

RESTRICTED

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THE SECOND WORLD WAR

1939-1945

ROYAL AIR FORCE

MONOGRAPH

FLYING TRAINING

VOLUME II

ORGANISATION

RESTRICTED

**Air Historical Branch (1)
Air Ministry**

PART I

BASIC TRAINING IN THE UNITED KINGDOM

FLYING TRAINING

VOLUME II

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CHAPTER 1

RECRUITING, SELECTION, RECEPTION AND INITIAL TRAINING

Developments in Selection and Classification

The system of recruiting young men for flying duties in the Royal Air Force was not, as the word may imply, a policy of press-ganging all and sundry, training them, and seating them in an aeroplane. It was a policy - a science in fact - of selecting, from the widest possible field, the most suitable personnel for the task.

In modern warfare time is the all important factor, and in a highly technical service calling for a high degree of skill from the personnel concerned, the length of time spent in training, though necessarily long, must be cut to the minimum. There were always sufficient numbers of volunteers for aircrew duties, and, given enough time most of these personnel could probably have been trained to operate in the air. In 1939, however, the Royal Air Force was not given enough time, nor for that matter enough money, to indulge in such luxuries. It was essential that only those personnel with the requisite medical and educational standards and who were imbued with a keen desire to fly and fight in the air were selected for training as aircrews. The task of the Inspectorate of Recruiting and the Directorate of Manning was therefore to tap all sources of manpower and to ensure that sufficient numbers of suitable personnel were available at all times to fill the courses at the flying training schools.

The recruiting field was extended to cover the whole British and Allied world, and the peace-time rule that only persons of unmixed European descent were eligible for Royal Air Force service was abolished. During the war there were few nations, colours, or creeds, which were not represented in the Royal Air Force. The keenness of overseas recruits to serve with the Royal Air Force was self-evident. Individual instances of the urge to serve could be quoted at length from the Anglo-American from Japan who did two hours dual flying in a Japanese flying school in order to strengthen his chances of

Note: Much of the information for this chapter was obtained from Air Ministry Pamphlet 190 - 'Grading - A Report on Pilot Selection in the Royal Air Force' and a statement by the Training Research Branch (Reference T.R/B dated 11 July 1945) called 'Principles of Assessment in Selection and Training for Large Scale Production of Aircrew'.

Joining the Royal Air Force, to the volunteer from Patagonia who travelled 800 miles by every known and unknown form of transport to reach his port of embarkation. The young volunteer from the Czech-Poldi Steel Works, Osaka, whose father was of Persian extraction born in Hong Kong and whose mother was of Danish-American-Japanese parentage was probably somewhat relieved at the lifting of the 'unmixed European descent' ban.

As the war progressed and the flow of recruits diminished measures were taken to raise the education standards of otherwise suitable personnel, prior to their entry into the Service. Later, however, when the training organisation had completed its task and the flow of new aircrew entrants was decreased, it was again necessary to review the selection machinery so that only the best candidate was chosen. It was also necessary to ensure that the best use was made of the available material, and more elaborate methods of selection and classification were employed.

It was the methods of selection and classification of aircrew candidates that saw radical changes as the war progressed, more possibly, than any other branch of the system of aircrew training. It should perhaps be explained that 'Selection' refers to the acceptance or rejection of the candidate for aircrew duties. 'Classification' was the next step whereby the accepted (or rather 'selected') candidate was allocated to a particular category in aircrew, e.g. pilot, air gunner, etc. In the early days of the war these two stages were carried out as one action by the Selection Boards. Later, however, more importance was attached to the classification of candidates and this step was divorced from the initial selection. The war saw a gradual change over from the old system of what might be termed 'survival selection' whereby a candidate was both selected and classified into a particular aircrew category solely on the result of the impression he made in a personal interview with a board of officers, to a scientific system

of 'quality selection'. This latter method, which was in operation at the end of the war, comprised an interview - not conducted by a board, but using a more analytical procedure whereby the results were scoreable on a rating scale basis - a series of psychological tests scientifically designed to measure the candidate's particular aptitude for each of the aircrew trades, and a flight test where the cadet was graded on his piloting ability. The final classification was made as a result of a combination of these three factors together with the requirements of the Service.

This latter objective system, besides ensuring that only the most suitable cadets went forward in the various categories thus reducing appreciably the wastage throughout all periods of training, also had the effect of widening the field of aircrew recruiting. Every candidate wishing to become a pilot and who was medically suitable was given the opportunity to demonstrate his ability, final classification being made by an impartial board solely on the results of the candidates demonstrated aptitudes and abilities.

It can scarcely be claimed that the improvements effected along these lines were made according to plan; they were mostly derived from the conditions and crises met with in the mass production system. The many difficulties, however, which were experienced in the procurement and 'processing' of aircrew personnel in large numbers had several compensating advantages, particularly in uncovering weaknesses in the system, and in stimulating thought on effecting means to meet them.

The main trends in the selection and classification procedure can be viewed in five stages, each stage marked with some significant advance in principle. Broadly the five stages were:-

- (a) The original system instituted on the outbreak of war with many boards, known as Aviation Candidates Selection Boards (A.C.S.B.s), geographically dispensed,

doing both selection and classification to category of candidates according to quotas required. The entire selection and classification was carried out by a board of officers, with few facilities for measuring the education levels and natural aptitudes of the candidates.

- (b) The 'P.N.B.' system, introduced in the spring of 1942, whereby slightly modified A.C.S.B.s continued selection for all categories of aircrew and classified all but the trades of pilot, navigator and air bomber. Personnel considered suitable for these latter trades were accepted under the broad trade of 'P.N.B.', the final classification being made by a 'Central Aircrew Classification Board' (A.C.C.B.) after the cadet had demonstrated his aptitude in a flight test and completed the 'Initial Training Wing' examinations.
- (c) A further simplification of the A.C.S.B.s to undertake acceptance for all categories in the broad trade of aircrew and only provisional (shadow) classification into categories, commenced in early 1944. A classification centre was established at the Air Crew Receiving Centre (A.C.R.C.) which carried out aptitude testing and official classification for all categories. The flight test of course continued to be the main instrument in the classification of pilot candidates.
- (d) Towards the end of 1944 a modified form of A.C.S.B. was incorporated with the classification unit at A.C.R.C. In conjunction the two agencies carried out both acceptance and classification of civilian candidates already previously accepted for aircrew by the A.C.S.B.s and deferred pending call-up for training. This reorganisation was the outcome of an urgent need to reduce this deferred service pool.

- (e) The final step was the formation of an Aviation Candidates Selection Centre in early 1945 where all candidates were accepted and classified, using the tests evolved during the war, in a centralised unit.

It is interesting to note that by the end of the war the circle of development was completed and once again selection and classification were carried out in one movement. The methods employed, however, were very different, and it will be seen (particularly as regards pilot trainees) that the emphasis moved gradually from the educational and intellectual standard of the candidate as a basis for selection and classification, to the measurement of natural aptitude of the candidate for the particular aircrew categories. The old system depended solely on the board's impression of the candidate and this not unnaturally was based mainly on an educational level. It was not until they began their flying training that cadets selected under this method had their suitability confirmed. This led to a heavy wastage rate in the training schools and large numbers of personnel had to be reselected after spending long periods of time training for a category for which they were entirely unsuitable. The evolution of the new methods finally reversed the process, and the first consideration was the candidate's aptitude for the particular aircrew trade, his educational background could if necessary be reinforced by a course of preliminary ground training provided his was otherwise suitable for the aircrew duty.

Situation Pre-War

In 1934 the Royal Air Force trained some 300 new pilots; by the end of 1941 the annual rate of output in the Empire was 22,000. In the same seven years the number of non-pilot aircrew trained rose from none in 1934 to 18,000 in 1941. In peace-time therefore the needs of the Royal Air Force in terms of personnel, and the problem of recruiting sufficient suitable personnel for flying duties was a simple one. Sufficient numbers of suitable personnel were always forthcoming (mainly through the short-service commission scheme) and the problem resolved itself merely into the selection and training of these personnel.

Apart from these direct entry personnel for full time service in the Royal Air Force (such as short service commissions, direct entry airmen, pilots and observers) large numbers of young men were recruited for the Royal Air Force Volunteer Reserve and, to a limited extent, the Auxiliary Air Force, and once again no major recruiting difficulties occurred.

Pre-entry training schemes (The Air Defence Cadet Corps, Air Sections of the Officers' Training Corps, and University Air Squadrons) also provided a channel through which suitable young men were encouraged to prepare themselves for, and to join, the Royal Air Force.

In addition to these Reservists and pre-entry training schemes, the Government gave support to the civil flying duties of Great Britain. In 1938 this support was more centralised - and more practical - and the Civil Air Guard was formed. This organisation, besides enabling people to fly at reduced rates, was intended to foster throughout the whole country a spirit of air-mindedness and to create general interest in aeronautical affairs. This in turn encouraged volunteers for the Royal Air Force.

The methods of selecting direct entry personnel for flying duties in the Royal Air Force were quite simple. Before the war the needs of the Service, in spite of the fact that since 1934 a rapid expansion had been taking place, were limited and clearly defined. There were only two categories of full-time aircrew personnel, pilots and observers and the latter had only been introduced in February 1939. The other aircrew trades (those of air gunner and wireless operator/air gunner) were filled by serving airmen with a basic ground trade and who carried out part-time flying duties. The trade of wireless operator/air gunner had been introduced as a full-time category a few months before the outbreak of war, though this scheme was not fully implemented when the war started.

Pilots were recruited under the short service commission scheme and observers under the 'direct entry observers' scheme. Candidates for these two trades were selected in the one particular trade by an Air Ministry Selection Board. There were no flying, scientific or psychological tests given to measure the candidate's suitability for flying duties; and the pupil's first introduction to flying was at an Elementary and Reserve Flying Training School (E. & R.F.T.S.), or in the case of observers, an Air Observer Navigation School (A.O.N.S.). Failures simply returned to civilian life. The courses of instruction were more leisurely planned than the war-time syllabi, thus enabling more time to be spent on training the more backward pupils.

Administrative and disciplinary training did not play a very important part in the training system; the only initial training and introduction to the Service procedure was carried on a course lasting a fortnight at the R.A.F. Depot, Uxbridge. Pupils carried out their first stage of training at civilian operated flying schools and retained their civilian status (E. & R.F.T.S. for pilots, A.O.N.S. for observers). From this course they proceeded to Uxbridge for the two weeks' course where they were kitted and given some disciplinary training. Pupils entering under the short service commission scheme were commissioned as acting pilot officers whilst other direct entry personnel were enlisted as airmen and promoted to sergeant at the end of their training. From Uxbridge all pupils proceeded to a Service flying school to complete their training (F.T.S. for pilots, A.O.S. for observers).

Formation of Aircrew Selection Boards

On the outbreak of war, steps were taken (as planned under the war training organisation) to accelerate the training process; course lengths were drastically curtailed, schools expanded and new units formed in order to ensure the smooth and rapid flow of candidates into the training organisation. The selection machinery was re-organised and eight aviation candidates selection boards were formed on 3 September 1939 to select and attest candidates for the

four aircrew categories of pilot, observer, wireless operator/air gunner, and air gunner. Medical boards (A.C.M.B.s) were also established at all the selection boards in order to carry out a thorough medical examination of all candidates. Personnel were recruited through combined recruiting centres which examined all personnel joining any branch of the armed forces and those expressing a desire to serve as aircrew were then forwarded to the R.A.F. aviation candidates selection boards via a receiving centre. These boards, each with a weekly capacity of 125 candidates, were located as follows:-

- No. 1 A.C.S.B. Uxbridge
- No. 2 A.C.S.B. Uxbridge
- No. 3 A.C.S.B. Uxbridge
- No. 4 A.C.S.B. Cardington
- No. 5 A.C.S.B. Padgate
- No. 6 A.C.S.B. Padgate
- No. 7 A.C.S.B. Cardington
- No. 8 A.C.S.B. Uxbridge

At the same time three receiving centres were established (No. 1 at Uxbridge, No. 2 at Cardington and No. 3 at Padgate) to receive volunteers and allocate them to the various boards. As the need for volunteers increased more boards and more centres were opened in all parts of the country and special arrangements were made to send travelling boards in the more remote districts. Broadly speaking there were two types of action in selection:-

- (a) Candidature: (for aircrew duty) which was simply a case of acceptance or rejection.
- (b) Classification: (for category) which was the allocation of each accepted candidate to an appropriate category.

These were judged in two ways; for individual suitability by personality, educational status, medical status, aptitudes, and preferences, and for collective requirements by quotas for each category.

The machinery established to carry out these essential tasks was simple. The A.C.S.B. did them all (with the exception of the medical examination which was carried out by the medical board). Candidates comprising the main flow for selection were interviewed in turn by a selection board of Service officers, consisting of a president and one or two subordinate members. The combined

judgment of the board decided the questions of acceptance and classification about each individual in his presence, with due regard to the quotas to be filled. These A.C.S.B.s worked relatively independently under Air Ministry instructions issued in general terms. No formal system of training existed for new personnel for boards, but board members were allowed to visit training and operational stations for information and the boards were inspected periodically by Air Ministry officers.

Establishment of the Deferred Service List

For the first few weeks of the war personnel selected commenced their service forthwith but on 27 September 1939 the deferred service scheme was introduced. ⁽¹⁾ There had been an immediate rush of volunteers to join the Royal Air Force, many more than could be immediately absorbed, and in order that these keen young men should not be lost, either to industry or to the other services, the deferred service scheme was drawn up so that candidates could be selected, attested and then placed on a period of deferred service pending their call-up for training.

The volunteer was given a travelling warrant to return to his home and it was explained that -

- (a) He might not be required immediately for service but on attestation he might be returned to civil life pending recall to service.
- (b) While remaining in civil life and until recall to service he would be on the reserve and no pay or emoluments would be issued.
- (c) He was under the obligation to report for service in accordance with a notice to that effect from the Officer i/c Records, and that arrangements would be made to give at least 10 days notice of that date on which he was required to report.
- (d) He was at liberty to follow his normal civil occupation until recalled to service.

(1) A.M. File S.57959.

This deferred service scheme became increasingly important as the war progressed and the manpower shortage became more and more acute. In August 1940 arrangements were made with the Ministry of Labour that suitable candidates whose occupation was of vital importance to the war effort should be released for aircrew duties; although in some of these cases the period of deferment was lengthened. The scheme ensured that whatever else happened the smooth flow of men of the right type into the training machine⁽¹⁾ would be uninterrupted.

The length of deferment varied at different stages of the war, owing to changes in the training schemes. In 1940 the period was rather less than six months, by 1942 it had risen to between six and nine months, and by mid 1943 it was over a year. It was soon found that a number of other advantages arose from this scheme of deferred service. For instance, although the minimum age for operations was 19, volunteers could be enlisted at 17 and placed on deferred service. In the case of air gunners, whose training was only of a few months duration, this meant that they would not be required to start their training until they had reached about 18½. Moreover, not all men recruited were available for immediate call-up, e.g. men specially required for munitions factories. In January 1944, for example, there were approximately 28,000 aircrew recruits on the deferred list, of whom some 17,500 were not available for immediate~~ly~~ call-up either through age or because of industrial requirements. Furthermore, it provided a useful reserve of candidates for training and ensured that the training machine was always working to a maximum capacity.

Recruiting in the Dominions

In spite of the rush of volunteers and the measures taken to accept as many as possible, the first-line squadrons were desperately

(1) A.M. File S.57959.

short of trained aircrew personnel. For the first two years of the war, in fact, while the training machine was in process of expanding, the demand outstripped the supply. Although courses were drastically curtailed, it still took many months to train a pilot and observer for operational duties. The reserve and auxiliary forces provided a substantial number of trained or partially trained personnel during the opening months of the war but few of the R.A.F.V.R. personnel were trained up to a standard enabling them to take their place immediately in the front line, the large majority being in various stages of their training. These personnel were absorbed into the expanded flying training schools, thus enabling a pool of suitable volunteers to be established. Nevertheless the shortage of experienced personnel persisted and steps had to be taken to widen the field of recruiting to the colonies and foreign countries where suitable personnel were likely to be available. As a result, during the course of the war, about 4,200 candidates from overseas, from every part of the world, joined the Royal Air Force.⁽¹⁾ In addition, personnel from the Dominions were recruited and trained under the Empire Air Training Scheme and served with their respective air forces. Similarly, personnel from enemy occupied countries joined their own air forces or allied sections of the Royal Air Force.

In the Dominions of Canada, Australia and New Zealand the vast Empire Air Training Scheme was launched which was designed to recruit a total of 32,300 candidates per year which, it was estimated, after allowing for training wastage, rejects, etc., would provide 28,300 basically trained aircrew per year for service with the Royal Air Force.

It was agreed (under the revised Riverdale agreement) that of this figure, all of which were trained in Canada, Australia or New Zealand, Canada would supply 51 per cent of the total output, Australia 37 per cent and New Zealand 9 per cent, the remaining 3 per cent being supplied from the United Kingdom and Newfoundland.

(1) A.M. File S.69081 . See Appendix 1.

Recruiting schemes were launched and operated by the respective Dominions concerned and the personnel were enlisted in the R.C.A.F. and R.A.A.F. or R.N.Z.A.F. As in the United Kingdom, in order to ensure a constant flow of recruits to fill the training schools, deferred service schemes were introduced.

In addition to the Empire Air Training Scheme, large numbers of personnel were recruited in the continent of Africa and trained in schools in South Africa and Southern Rhodesia. In South Rhodesia personnel from Kenya, Northern and Southern Rhodesia, South Africa, together with Greek and Yugo-slav personnel from the Middle East, were enlisted and trained for flying duties with the Royal Air Force.

In South Africa the position was somewhat different, personnel recruited for the South African Air Force did not have any liability to serve outside the Union, although they were encouraged to volunteer for overseas service with R.A.F. and S.A.A.F. squadrons, and large numbers served with distinction in the Middle Eastern theatres of war. South African personnel volunteering to serve in the Royal Air Force were recruited in South Africa and sent to Southern Rhodesia for training.

Recruitment of British, Allied and Foreign Personnel
from Overseas Sources

The immediate and whole-hearted response of sympathetic peoples from all parts of the world in the early days of the war, was a spontaneous demand to be allowed to take their share in the hazards of the war. On 28 September 1939 nationality restrictions were removed and overseas recruiting commenced.

By the summer of 1940 the Air Ministry Overseas Recruiting Scheme was launched. His Majesty's representatives in foreign countries and the Colonial Office reported that provided steps were taken to safeguard British commercial and industrial interests in the places concerned, encouragement would be welcomed for personnel

/ desirous

desirous of joining the Royal Air Force particularly those with previous flying experience. Arrangements were made, through the Colonial Office in the case of the colonies, protectorates and dependencies, and through the Foreign Office elsewhere, to select, medically examine and provide free passages to the United Kingdom (or other R.A.F. commands overseas) for all candidates for aircrew duties who were considered suitable by the local authorities (1) concerned.

At first, apart from experienced pilots, colonial volunteers were not encouraged, but in January 1941 colonial governors were notified that the Air Ministry were prepared to consider applications on an increased scale for all British subjects volunteering for aircrew duty in the R.A.F. particularly those recommended for pilot training. African colonies and dependencies were not included in the scheme as the Colonial Office considered it inadvisable to take any steps which would deplete African manpower. An application for R.A.F. service received from Africa was not, however, rejected at sight, it was (2) considered on its merits and referred to the Colonial Office.

In May 1941 the Air Ministry agreed to accept for the period to March 1942 a maximum of 430 colonial candidates (European 187, Non-European 243) for aircrew training in the United Kingdom. It was stipulated that the men must be selected and recommended by the local authorities. Aircrew volunteers living in up country districts were initially selected by the colonial magistrate or other official and medically examined by the nearest qualified doctor. If the colony was any distance from an R.A.F. command, volunteers went before an Aircrew Selection Board (A.C.S.B.) set up under the auspices of the governor of the colony and were examined in accordance with R.A.F. standards by a locally constituted medical board. Where there was a R.A.F. station within reasonable distance, the preliminary vetting only was carried out by colonial authorities. Brief telegraphic reports were sent through the Colonial Office to / the

(1) A.M. Files S.60600, S.69081, A.110421/40 and S.1895.

(2) A.M. File S.59082.

the Air Ministry on all candidates who were recommended and passed medically fit. Reasonable travelling expenses were refunded to candidates who were provisionally selected locally and required to proceed to another place in the colony for final selection. Free passage to the United Kingdom or to an overseas command was provided. During the later stages of the war there was some reduction in colonial recruitment for aircrews owing to reduced requirements, although recruitment for ground duties proceeded on a greatly increased scale.

The introduction of the Empire Air Training Scheme affected the colonial empire as such only indirectly. The scheme was designed to serve the needs of the Empire as a whole (including the United Kingdom) and not of the colonies in particular. Its establishment, however, did have a bearing on the utility of certain local training schemes set on foot by individual territories, most of which were discontinued during the latter stages of hostilities. Outside the Empire, America was the largest potential source of these personnel and in June 1940 arrangements were made whereby American and Canadian pilots wishing to serve with the R.A.F. could be recruited and medically examined at R.C.A.F. recruiting centres in Canada. If considered suitable they were instructed to proceed to Ottawa and reported to a selection centre in the United Kingdom Air Liaison Mission. If selected their travelling expenses were refunded and arrangements were made to transport these personnel to the United Kingdom. Successful applicants were commissioned as pilot officers in the Royal Air Force Volunteer Reserve. In this way limited numbers of pilots were recruited; these efforts however were not co-ordinated and often clashed with efforts made by other allied governments to secure trained American pilots.⁽¹⁾

In 1941, with the co-operation of the United States Government, a scheme of refresher courses were launched whereby American pilots with 80 or more hours flying experience were recruited and signed on nominally to serve with an imaginary flying concern known as

/ British

(1) A.M. File S.69081.

'British Aviation Limited' with the understanding that when they arrived in the United Kingdom they would be enlisted in the Royal Air Force. Personnel recruited under this scheme carried out a refresher flying course at a civilian operated school in the United States before proceeding to England via Canada. These courses, however, together with any flow of fully trained recruits, stopped upon America's entry into the war.

Steps were also taken to recruit suitable personnel for aircrew duties in other parts of the world (such as South America). Most of the personnel so recruited were British subjects residing in neutral countries. The arrangements for recruiting in this field differed from those in the colonies or in the United States in respect of local selection machinery. It was not thought advisable to set up in a foreign country any committee or board which might be regarded as part of a recruiting organisation. A volunteer was vetted, however, either by H.M. representative or the air attaché. If he resided in an up-country district he was required to obtain a letter of recommendation from a local resident of standing and to undergo medical examination by the nearest qualified doctor.

This method of selection which circumstances imposed had a definite disadvantage. Unless a volunteer was reported to have had adequate and recent flying experience - thereby establishing his suitability for pilot training - it was necessary to bring all aircrew candidates to the United Kingdom. The applicant usually expressed a preference for pilot duties, but as there was no confirmation of his suitability for such on the part of a local board, it was not considered safe to rely on the judgment of the British consul or to place the responsibility for final acceptance upon the air attaché as he was not, in fact, in a position to go beyond a general recommendation of fitness for aircrew training.

If local selection could have been relied upon in foreign countries, it would have been possible in some cases to arrange for candidates recommended as pilots to proceed direct to a

/ locality

locality nearer at hand than the United Kingdom to undergo their training.

Experienced pilots (other than British subjects) in whatever foreign country were accepted at once by H.M. representative or air attaché and assisted to proceed to the United Kingdom or the nearest R.A.F. command provided that they were medically fit and that they could prove their one time membership of an Air Force of an allied country or of a reputable commercial air line. Foreigners who were similarly qualified, but without previous air force or commercial air line service, and others who did not reach the full standards of skill, were encouraged to apply for R.A.F. service, but no disposal action was taken pending reference to the Air Ministry.

Another source of considerable numbers of aircrew personnel were the allied sections of the R.A.F. and the allied air forces. Large numbers of Poles, Czechs, French, Norwegian, Dutch and Belgian personnel made their way to the British Isles after the defeat of the allied armies on the continent in 1940. In May 1940, for instance, there were 350 Polish pilots in the United Kingdom. Steps were taken to concentrate these personnel into R.A.F. units and eventually to form allied air forces. By the end of 1941 the strength of the allied air forces, including ground personnel, was 14,476. In addition, there were 170 allied pilots serving in the R.A.F. and a year later the strength had increased to 18,672 personnel, made up as follows:-⁽¹⁾

Polish	9,524
Czech	1,348
Norwegian	1,938
Dutch	603
French	2,198
Belgian	436
Greek	2,500
Yugoslav	125

Steps were taken to recruit personnel for these allied air forces in other parts of the world. For instance, large numbers of Poles were recruited in Russia and the Middle East. Norwegians, Danes and French were recruited in Canada, Yugoslavs and Greeks were recruited in the Middle East and trained in Rhodesia. As the numbers increased it was possible to form special squadrons

/ manned

(1) E.R.P.222.

manned entirely by Allied personnel. By the end of 1942 there were 27 such squadrons serving with the R.A.F.

These various overseas schemes provided a substantial number of recruits for the R.A.F. It was impossible to assess accurately the total number of overseas recruits joining the R.A.F. because they were not allotted special Service numbers but were absorbed into the R.A.F. without distinction. It is known, however, that by May 1945 over 4,200 British, Allied or foreign nationals from overseas had made their way to the United Kingdom under the official scheme to join the R.A.F. and train for aircrew duties; ⁽¹⁾ many others had joined overseas either in Rhodesia or Canada. In addition, nearly 7,500 Allied personnel were serving in their own air forces co-operating with the R.A.F. :-

French	1,784
Dutch	490
Norwegian	587
Greek	34
Yugoslav	154
Polish	3,241
Belgian	475
Czech	714
Danish	17
Total:	<u>7,496</u>

There was also the Dominions personnel recruited under the training scheme in Canada, Australia, New Zealand, S. Africa and S. Rhodesia who totalled roughly 150,000.

/ Formation

(1) See Appendix 1.

Formation of Initial Training Wings and Receiving Wings

In tracing the history of overseas recruiting this narrative has progressed ahead of the chronicles of units. Parallel with the establishment of recruiting schemes was the need to set up machinery to deal with the reception and initial training of recruits.

It was obvious that, whilst the pre-war method of training was satisfactory - where leisurely training courses and squadron activities would permit adequate time being spent on all subjects whilst the cadet was at his F.T.S. and later on his squadron - this system would not stand up to the strain in the event of war. Squadrons would be too busy with their operational flying and training schools would have to direct their undivided attention to the flying training of their pupils. Some basic training in navigation, mathematics, airmanship and other subjects which the pupil would take at his flying school could be just as easily taught at a non-flying school, and it would have the added advantage of ensuring that all personnel proceeding to a flying school would have a common minimum standard of education. In addition, some sort of pool would be required to ensure that a smooth and steady flow of pupils passed into the flying schools. Moreover, with an obvious need to widen the field of selection of aircrew candidates, eventually it became necessary to raise the educational level of otherwise suitable raw material, a consideration which became increasingly important as the war progressed.

As the narrative unfolds it will be seen how the ground training organisation for aircrew personnel developed during the course of the war from the two weeks disciplinary training course at Uxbridge to a series of courses lasting, in some cases, up to six months or even longer. The three main developments in this organisation, under the control of No. 54 Group, were as follows:-

- (a) The Preliminary Aircrew Training Scheme (P.A.C.T.)
- (b) The Aircrew Reception Centre (A.C.R.C.)
- (c) The Initial Training Wings (I.T.W.).

These three did not develop in this order, in fact the I.T.W.s were the first to form, followed by the A.C.R.C., whilst the P.A.C.T. Scheme did not fully develop until 1943.

Shortly before the outbreak of war it was planned, under the War Training Organisation, to set up Initial Training Wings, giving a thorough grounding in discipline and elementary instruction in ground subjects for aircrew candidates. The course, which was to be the first stage in the career of aircrew pupils, was to last a month, after which personnel were to be selected for training as pilots, observers or air gunners. It was intended early in 1939 that two such schools, each with 350 pupils, should be formed within seven days of the outbreak of war.⁽¹⁾

Independently of the War Training Organisation, Brigadier Critchley, who had done preliminary training for the Canadian Corps in 1917 and the R.F.C. in 1918, approached the Secretary of State for Air in April 1939 with a scheme for putting 10,000 cadets under training for a period of 2-3 months to prepare them for absorption by pilot, observer or gunnery training schools. He proposed to do this training at Hastings and Bexhill area, using billets and

(1) S.D. 138.

public parks, and to employ the staff he had in 1918, many of whom were available.⁽¹⁾

At first sight the scheme appeared to be nothing but a lengthier and unnecessary duplication of the initial training schools. It was pointed out, however, that at the outbreak of war elementary and Service flying training schools would be fully occupied in bringing the partly trained reservists up to standard, and that it would be three to four months after the outbreak of war before the initial training schools could begin to deal with recruits. During this time good and suitable men would try to join the Royal Air Force and become discouraged by the delay and join other Services. At the end of August it was decided to establish flying personnel reception depots at holiday camps, universities and V.R. town centres, where recruits awaiting vacancies could be given preliminary ground instruction. They were to be additional to the initial training schools and were to be dispensed with when the flow of recruits had reached normality. A special group in Reserve Command was to be formed to deal with these flying personnel reception depots and Brigadier General Critchley was to be put in charge of it.⁽²⁾

The flying personnel reception depots which Brigadier General Critchley had proposed before the war became the concern of a new Group (No. 54) in Reserve Command on 4 September 1939. Reserve Command pointed out that there was no real difference between flying personnel reception depots and the initial training schools planned under the War Training Organisation, and the first one, which opened at Cambridge on 7 September, was called No. 1 I.T.S., until the name 'Initial Training Wing' was adopted on 15 September.

It was at first intended that there should be ten initial training wings, each with 1,000 pupils, but on 27 September the scheme was reduced to five I.T.W.s of 1,000 each (three being for pilots and observers and the other two for wireless operators/air gunner and air gunners). By November three more wings had been

/formed

(1) A.M. File S.51385.

(2) A.M. File S.51385.

formed:- No. 3 at St. Leonards on 18 September, No. 4 at Bexhill on 27 September and No. 5 at Hastings on 13 November - No. 2, planned for Torquay and another for Grange over Sands, had to be abandoned because of political opposition to requisitioning and billeting on the west coast. By that time the planned number was cut down to four, all of which were to train pilots and observers: wireless operators/air gunner and air gunners were called up to the Recruits Centre at Cardington and from there to wireless or air gunners' schools. In December the size of each I.T.W. was reduced from 1,000 to 800 and the number increased to five in order to keep the total capacity unchanged, although a month later the formation of the fifth I.T.W. was postponed until the flying training organisation had expanded enough to require it: even with only four I.T.W.s in use, there was a long waiting period at the I.T.W. before flying training began.

At first the I.T.W.s were intended to be holding pools at which men would learn the rudiments of Service routine life and be given physical preparation before they went on to flying training schools, but education officers to teach general educational subjects were established before the end of the year, each wing having 12 education officers.

The I.T.W.s handled a variety of pupils during the autumn of 1939. Pilots and direct entry observers who had been under training before the war were sent for the disciplinary course which was part of the peace-time sequence: V.R. pilots and observers were sent to await entry to flying training. War-time entries from civil life did not arrive until considerably later (the first direct entries for pilot training entered I.T.W.s in May 1940). At first training varied according to individual requirements, only the V.R. pupils doing the four-weeks syllabus laid down by the War Training Organisation. By November, however, it was clear that better preparation in mathematics and navigation was needed before the flying training stage, and on the 18th the basis of I.T.W. planning was changed to a ten weeks' training course - the first two weeks was for kitting, documentation, etc., followed by an

eight weeks' training syllabus. At the end of February Link Trainers were installed and visual instruction for pilots on the Link trainer⁽¹⁾ introduced.

In the early months of 1940 the I.T.W.s were crowded and the period for which pupils stayed in them was long because of the restricted intake to flying training. By February there were over 2,500 pupils in the I.T.W.s awaiting entry to the flying training schools - nearly six months supply - and it seemed possible that⁽²⁾ men might have to stay in I.T.W.s as long as 7-8 months. The flow through E.F.T.S.s and A.O.N.S.s could not be speeded up immediately and neither the number nor the capacity of S.F.T.S.s could be increased; flying practice units to hold elementary-trained pilots could not be improvised because aerodromes and instructors could not be found for them. A proposal that gliding should be included in the I.T.W. course, using the facilities of civilian gliding clubs, was considered but was rejected because gliding could not be justified as part of the training sequence. Eventually, by May 1940, the flow from I.T.W.s was quickened by starting advanced elementary courses, increasing E.F.T.S. capacity and shortening the E.F.T.S. and S.F.T.S. courses.

By July, after the German conquest of France had disrupted intakes by causing the I.T.W.s to move away from the south coast area (Nos. 3 and 5 moved from St. Leonards and Hastings to Torquay in June and No. 4 from Bexhill to Paignton in July) and when the demand for E.F.T.S. pupils was suddenly increased, the I.T.W. course was temporarily reduced to six weeks, and steps had to be taken to provide more capacity. As a first step it was decided to relieve the I.T.W.s of the responsibility for the kitting, documenting, inoculating of pupils, by forging a new link in the chain of training - the Receiving Wing. No. 1 R.W. formed at Babbacombe on 1 July (at the same time, to avoid confusion, No. 1 I.T.W. was renamed No. 2 I.T.W.) followed on 20 November by the formation of No. 9 at Stratford-on-Avon. The main function of these wings

(1) A.M. File S.51385.

(2) A.M. File S.60255.

was to act as a pool from which entries to initial training wings were drawn. Each wing dealt with 900 recruits (pilots and observers); they arrived direct from civil life and stayed three weeks before proceeding to an I.T.W. This enabled the I.T.W.s to concentrate on ground training and courses were again established at eight weeks. Instruction at the receiving wings consisted of disciplinary training and a general introduction to Service life, coupled with elementary work on certain technical subjects, such as mathematics, navigation, armament and signals, of basic importance in later flying training. The amount of elementary technical instruction tended to increase, in order to relieve the pressure at later stages of training, and the I.T.W. syllabus was revised in November 1940 to give more time to navigation, signals and armament. At the same time visual Link Trainer instruction, which had not proved of value, was dropped. This increased attention to technical subjects was not ⁱuniformly successful, chiefly because of the difficulty of obtaining experienced instructors particularly for signals and armament.

In addition to forming receiving wings, it was necessary to increase the number of I.T.W.s to deal with the accelerating flow of recruits and the total capacity was doubled (making it 6,400 pupils) by the end of the year with the formation of four new Wings - No. 6 I.T.W. opened at Aberystwyth on 1 August; No. 3 at Newquay on 1 October; No. 8 also at Newquay on 4 November; and No. 10 at Scarborough on 13 December.

A similar expansion occurred at the selection stage; six new A.C.S.B.s were formed during July (Nos. 9 and 10 at Cardington and Padgate respectively on the 8th and Nos. 11, 12, 13 and 14 all at Euston two weeks later), four more in August (No. 15 at Euston on 1st, No. 16 at Edinburgh and Nos. 17 and 18 both at Blackpool on 19th) followed by five more on 15 December (Nos. 19 and 20 at Cardington, No. 21 at Oxford, and Nos. 22 and 23 at Euston). Two of the

new Boards at Euston, Nos. 12 and 15, moved to Oxford on 27 October. Thus, by the end of the year there were 23 boards at seven different centres dealing with a total of 2,875 candidates per week:-

<u>A.C.S.B.</u>	<u>No. of Boards</u>	<u>Location</u>
Nos. 17, 18	2	Blackpool
Nos. 4, 7, 9, 19, 20	5	Cardington
Nos. 11, 13, 14, 22, 23	5	Euston
Nos. 1, 2, 3, 8	4	Uxbridge
Nos. 5, 6, 10	3	Padgate
Nos. 12, 15, 21	3	Oxford
No. 16	1	Edinburgh

Selection Tests

With the rapid growth of the selection machinery and increase in the number of recruiting centres it became necessary to ensure that the methods and standard of the various boards enjoyed reasonable uniformity. With this object in mind a series of tests, known as the Bartlett tests, was introduced at all A.C.S.B.s in June 1940. These comprised three separate tests, each of 10 minutes duration, given before the candidate was interviewed by the board president. The first two were intelligence tests, one comprising general intelligence and the other with a mathematical basis, and the third an observation test to measure the candidate's ability to observe accurately and swiftly. Thus when the candidate appeared before the board it was to assess only his personal qualities, namely those of courage, determination, alertness and keenness, initiative and responsibility; and this assessment was standardised by introducing a standard final assessment form to all boards.⁽¹⁾

A few months later it was decided that a co-ordination test known as the S.M.A.3 (Sensori Motor Apparatus No. 3), which had been used experimentally at No. 2 I.T.W. Cambridge since September 1940, was to be introduced at all selection boards as soon as sufficient numbers of the apparatus could be produced. Owing to production delays, however, it was not until the end of 1941 that the apparatus was actually installed at all A.C.S.B.s.⁽²⁾

The apparatus was used to test the candidate's ability to make co-ordinated movements with a hand operated column and a foot

(1) A.M. File S.64243.

(2) A.M. File S.71258.

operated rudder bar and, in conjunction with other tests, examinations and an interview, to enable the president of the board to allocate aircrew candidates to pilot and observer training. Essentially the apparatus consisted of a frosted glass screen (approximately 10" in diameter) through which a spot of light was visible. Passing through the centre of the screen were vertical and horizontal black lines, and at the centre a small square was etched. The movement of the spot was controlled in two independent ways: the vertical movement by means of a hand operated column moving backwards and forwards. (The column could also be moved sideways but this had no effect on the movement of the light). The horizontal movement left or right was controlled by a foot rudder bar. When the machine was operated, with the controls kept still, the spot of light moved in an irregular eccentric path over the screen. This was done by means of a rotating cam. The candidate after being seated in the apparatus which was in the shape of a fuselage with an adjustable seat, a control and rudder bar, a two position switch in the form of a conventional throttle control, and an instrument panel carrying the glass screen and one red and one white light positioned below the screen, was required by means of the two controls, to keep the spot of light as near to the centre of the screen throughout the test. At intervals throughout the test red and white lights were illuminated below the screen, and the candidate had to extinguish these by moving a hand switch either backwards or forwards according to the colour of the light shown. These lights formed distractions to the main task.

The test was of $1\frac{1}{2}$ minutes duration (the candidate was allowed to practise for a few minutes before taking the test) and the performance in the test was scored automatically by means of four recording dials which showed lateral and vertical deviations of the light from the centre showing inaccuracies of the foot control, hand controls, the total time during which the spot of light was outside the centre square during the course in the co-ordination of the controls, and the total time of response to the red and white lights.

The foregoing tests were established in order to assist in the selection of aircrew personnel, and to classify them as pilots, observers, wireless operators/air gunner or air gunners. In December 1940 a scheme of pre-selection tests was established at the I.T.W.s to assist in the assessment of potential pilots for bomber or fighter duties. These tests, which were of a psychological nature, were introduced experimentally and their findings were only provisional. The final decision regarding the pupils further flying training i.e. (1) single-engined or twin-engined, was made at the E.F.T.S.

Five tests were given which took about two hours each to complete and personnel were tested in batches of four for one hour on two different days. A special pre-selection team, consisting of a medical officer, a W.A.A.F. officer, a corporal and an airman, were attached to each I.T.W. to carry out these tests.

Investigations were made to discover the broad difference between fighter and bomber pilots. It was generally agreed that a good fighter pilot should possess a different temperamental constitution to that of a good bomber pilot. It was also agreed, however, that there were a considerable number of individuals, not belonging to an outstanding class on either side, who could just as well be either fighter or bomber pilots according to the requirements of the Service or their own personal choice. With these points in mind, and based upon the pupil's performance in the psychological tests, the pre-selection team classified all the prospective pilots into one of the following categories:-

- 'E' Men of outstanding qualifications who would make either bomber or fighter pilots.
- 'B' Men who would make good bomber pilots.
- 'F' Men who would make good fighter pilots.
- 'IB' Men of medium qualifications who would probably make bomber pilots.
- 'IF' Men of medium qualifications who would probably make fighter pilots.
- 'I' Men of medium qualifications with no special bent.
- 'N' Men of poor qualifications who would probably fail to become pilots.

The classifications 'fighter' and 'bomber' ('F' & 'B') were

limited to those showing in marked degree the qualities enumerated above for those categories of pilots, and the combined total was not to exceed more than 50 per cent of the numbers tested. The remainder were assessed as having general flying aptitude and were considered as suitable for training as either bomber or fighter pilots according to the requirements of the situation. This was a necessary feature of the scheme in order to preserve flexibility.

Pre-Entry Training

By the end of 1940, with the Selection Boards, Receiving Wings and I.T.W.s in full swing and an ever increasing flow of recruits passing through them, attention was turned to the necessity of establishing some form of co-ordinated pre-entry training which would not only attract recruits for the Royal Air Force but would prepare them for their eventual service in the R.A.F.

There were already three separate schemes which provided training and education in Service aviation matters, all of which were subsidised by the Air Ministry :-

- (a) The University Air Squadrons (U.A.S.).
- (b) The Air Defence Cadet Corps (A.D.C.C.), - boys 15 to 18
years of age.
- (c) The Air Contingents of the Officer Training Corps (O.T.C.),
- public and secondary school boys.

These three schemes, covering three different sections of the community, operated independently of each other and were not related directly with the R.A.F. Although many of their numbers did eventually join the R.A.F. there was no obligation for them to do so and training in these units was not designed to assist directly their Service careers.

The University Air Squadrons had been opened at Oxford and Cambridge in October 1925, followed ten years later by a third in London. These squadrons did not form part of the R.A.F. or its reserve and their members did not wear uniform. The original policy for these squadrons was not that they should form a definite channel of entry into the Royal Air Force, but that their members

/should

should go into their civil occupations with a good knowledge of aeronautical affairs and in this way arouse wide-spread enthusiasm and interest in aviation throughout the country.

This original idea was subsequently modified since many good potential officers were being lost to the Air Force. University members were therefore encouraged to join the R.A.F., the R.A.F.V.R. or the Auxiliary Air Force, and by 1939 most of the officers in the A.A. Class reserve were ex-members of the U.S.A.S.s.

The squadrons were recruited from members of the universities, but were not of a Service character even though they came under direct Air Ministry control, and had no liability for Air Force service. The squadrons were staffed by full-time officers and airmen supplied by the Air Force, who acted as instructors. The R.A.F. also supplied aircraft, equipment and the bulk of the necessary funds for the maintenance of each squadron, and provided facilities for flying training at nearby R.A.F. airfields. Flying membership of a squadron was limited. The chief obligations of membership were the performance of specified flying training, attendance at the courses of ground instruction, an annual period of training at an R.A.F. station and the payment of an annual subscription. Members who had attended at least one annual camp, completed 15 hours flying (including at least 3 hours solo) and passed an examination in ground training courses, were awarded a certificate of proficiency by the Air Ministry. This certificate carried with it several advantages for any member who was proposing to enter the Royal Air Force.

On the outbreak of war the squadrons were closed, but towards the end of 1940 the Air Ministry decided to re-open the original three and to establish squadrons in certain other universities and colleges. The original squadrons at London, Oxford and Cambridge were re-opened in October 1940 and twenty-one new squadrons were formed by the summer of 1941.⁽¹⁾ Six opened in January (at

/Aberdeen.

(1) A.M. File A.199866/40.

Aberdeen, Aberystwyth, Belfast, Edinburgh, Leeds and St. Andrews); ten more in February (at Bristol, Cardiff, Durham and Newcastle, Hull, Liverpool, Reading, Sheffield, Southampton and Swansea); one (at Manchester) in March; two more in April (at Glasgow and Nottingham); one (at Birmingham) in May; and finally one (at Exeter) in August.

The chief reason for re-starting these squadrons was to attract candidates of a good public school type into service with the Royal Air Force. The Army were already subsidising various courses at the universities and consequently were gaining the majority of these men. Each squadron was established with facilities for 100 members. Training consisted of ground instruction up to I.T.W. standard; no flying instruction was given although passenger flying was given at nearby Service aerodromes. Members joining (who were normal university students on a 12 months course or longer) were medically examined and selected by a board, conditions of service were similar to those existing pre-war with the addition of an agreement to serve in the R.A.F. as a pilot or observer, on successful completion of the course, which usually took about twelve months.

On joining the Service, U.A.S. candidates were exempted from passing through an I.T.W. course and, after a short stay at a reception centre where some disciplinary training was carried out, proceeded straight to E.F.T.S. On completing their flying training they were granted commissions in the Royal Air Force.

The Air Defence Cadet Corps (A.D.C.C.) came into being in the summer of 1938. The first steps to provide the youth of Great Britain with some organised preliminary training in aviation had been taken by the Air League of the British Empire in the previous year when junior members of the Air League were organised into squadrons and flights and encouraged to pursue their studies in aviation. A 'Young Pilots Fund' was also started which provided half the cost of obtaining pilots' 'A' licences for selected young men. It was

the success of these schemes that encouraged the formation of a body of uniformed, disciplined and instructed young men anxious to join the Royal Air Force or Civil Aviation as a career, and the Air Defence Cadet Corps was launched with official approval in early 1938. ⁽¹⁾

The first squadron was formed at Leicester in August 1938, and by the end of the year there were 50 squadrons situated in all parts of Great Britain. A squadron comprised 100-150 cadets (aged between 15 and 20) divided into four flights each of 25-36. The average yearly cost of running a squadron was £200-£300. A capitation grant of 3s. 6d. per cadet was made by the Air Ministry, the remainder of the costs being subscribed by the citizens and local authorities of the districts in which the squadrons were operating. The Royal Air Force provided equipment and facilities wherever possible. The training given included disciplinary training, games and physical training, and instruction in elementary principles of aero-engines and airframes, theory of flight, navigation, meteorology and signals. Summer camps were organised and gliding was also carried out.

By the outbreak of war 172 squadrons were in operation. The Corps continued to expand and in the summer of 1940 it offered to assist in training deferred service personnel awaiting entry into the Royal Air Force. On attestation, personnel were informed of the training facilities of the A.D.C.C. and advised to join the corps. This scheme was purely voluntary, the men were unpaid and the Royal Air Force had no jurisdiction over them. A few months later a scheme was initiated to provide training in morse for under-training wireless operators on deferred service. They were to be called up when they reached a standard of 16 words per minute.

At the same time that the A.D.C.C. was formed, the War Office initiated a scheme whereby certain Officers Training Corps contingents provided facilities for air training for certain of

(1) A.M. Files S.95241 and A.95241/40.

(1) their members. The scheme was limited to those O.T.C. units at universities, colleges and schools where a sufficient number of cadets holding Certificate 'A' could be spared without prejudicing the normal work of the contingent. The air sections consisted of cadets holding Certificate 'A' and the size of an average section was 20 cadets.

The air section of each contingent was affiliated to the nearest suitable R.A.F. unit and training, which was laid down by the Air Ministry, was similar to that carried out in the A.D.C.C. squadrons. No flying training was carried out, although passenger flying was carried out wherever possible, usually at R.A.F.V.R. centres. Arrangements were also made for one of the school staff to be granted a commission in the R.A.F.V.R. if this were possible. Financial arrangements were made by the War Office, and where necessary, recovered from air force funds. An annual grant was made of 26s. Od. for each efficient cadet over 16 years of age.

The Air Training Corps

Towards the end of 1940 it was realised that, in the interests of training as well as of recruitment, these schemes providing pre-entry training should be greatly extended and organised on a nation-wide basis and it was suggested that one organisation should be developed which would cover the whole field of pre-entry training by giving a good grounding in Service subjects to all prospective recruits. This would not only simplify the administrative system (the three schemes were dealt with by a diversity of branches in the Air Ministry); it would also make it possible to reduce the periods of training given in the Service. Moreover, from the recruitment point of view, the attractiveness of these schemes depended to a marked extent on the training facilities of the schemes.

The suggestion that a force to be known as the Air Training

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- (1) The first O.T.C. units were formed in 1908, with a view to providing facilities for students to undergo a standardised system of elementary training. They supplied candidates for commissions in the Special Reserve of Army Officers and the Territorial Army. (A.O.160/1908).

Corps should be formed was submitted to the War Cabinet in December 1940.⁽¹⁾ It was proposed that this corps should be organised partly in school units and partly in local units. It was to be a nation-wide organisation into which the 40 O.T.C. air sections, the 200 A.D.C.C. squadrons and the 23 existing or projected university air squadrons were to be merged, although the latter squadrons were to retain their identity and continue under existing organisations. It was to be at least ten times the size of the existing organisations.

This project was approved in principle on 19 December 1940, and the Air Training Corps was established on 1 February 1941; it comprised the university air squadrons and units organised at schools or on a local basis.⁽²⁾ A Commandant of the A.T.C. was appointed and a special branch (The Directorate of Pre-entry Training) was set up in the Air Ministry. Members of the A.T.C. appeared before a selection board and underwent a medical examination and were required to give an honourable undertaking to serve either in the Royal Air Force or the Fleet Air Arm.

The main object of the A.T.C. was to widen the field of selection for aircrew, mainly by educating those who otherwise could not have passed the educational test and partly by improving the physique of those who would otherwise have had difficulty in passing the medical examination. It was run on an entirely voluntary basis and training was carried out in the evenings and during the weekends; summer camps were also organised. The minimum age for enlistment was 15½. The uniform which was issued free was similar to that of the A.D.C.C. Cadet officers were granted honorary commissions in the R.A.F.V.R. and wore R.A.F. uniform when on duty.

Cadets who were potential candidates for aircrew duties carried out a syllabus of training approximating to that of the I.T.W.s. Proficiency certificates comparable to the Certificates 'A' and 'B' of the O.T.C. were introduced and it was originally intended

(1) WP.(40) 480.

(2) A.M.O. A81/41 and 308th Conclusion of War Cabinet.

that those holding proficiency certificates should by-pass the I.T.W. course. Subsequently, however, this was found unsatisfactory and all entrants had to undergo I.T.W. training, although cadets with proficiency certificates were allowed to take the final examinations (1) earlier in the course.

The Corps was subsidised by the Air Ministry and a capitation grant of £1 for each efficient cadet over 16, together with a further capitation grant of 10s. Od. for each cadet over 16 who qualified for an efficiency certificate, was made. In addition, a grant of 5s. Od. for each efficient cadet over 16 was paid into a headquarters fund administered in the interests of 'lame dog' units. A further capitation grant of 3s. 6d. per head was made in respect of boys under 16 who were formerly members of the A.D.C.C.

The success of the new Corps was soon apparent. On its formation the A.T.C. took over 20,000 cadets from the A.D.C.C. and O.T.C. air sections; within a few months the strength had risen to a total of 146,000 cadets. Twelve months later it reached what proved to be its peak strength with a total of more than 210,000 cadets. Soon similar organisations in Canada, Australia, New Zealand and South Africa were formed and many overseas sections of the A.T.C. were started in the colonies and dependencies.

Although the university air squadrons were brought into the A.T.C. they continued to operate as separate units. The only noticeable change in the U.A.S. system was the introduction of university short courses at some of the universities in March 1941. Under this scheme youths between the ages of $17\frac{3}{4}$ and $18\frac{1}{2}$ who possessed certain educational qualifications were selected and attested at an A.C.S.B., placed on deferred service, and sent to universities for a six month's period of training. These short-course candidates were full members of the universities and subject to university discipline. They received no Service pay, but all

(1) A.M. File S.67236.

expenses of tuition, board and lodging were paid by the Air Ministry. They had to go through a course of study in the university either in the arts or science group, but they were also members of the U.A.S. and went through a special course of training in R.A.F. subjects similar to that of the I.T.W. syllabus. Like the long course candidates, these pupils who qualified for an efficiency certificate were embodied in the R.A.F. and posted direct to flying training schools, thus saving three months of the normal sequence. The object of the scheme was to pass a larger number of potential R.A.F. officers through a university before their call-up; it was thought that the broadening effect of university life would prove beneficial when they joined the Service. The experience gained at the British flying training schools in the United States, which were operated on cadet-leadership lines training large numbers of ex-U.A.S. pupils, supported this assumption.

Ten universities undertook these short courses, five of which were in England (Cambridge, Durham, Manchester, Oxford and Southampton), four in Scotland (Aberdeen, Edinburgh, Glasgow and St. Andrews) and one in Northern Ireland (Belfast - subsequently known as Queens College). The remaining 13 universities continued with the full courses. Twelve months after their introduction, the short courses were discontinued at the three non-residential universities (Aberdeen, Glasgow and Manchester) as it was evident that the desired results could only be obtained at residential universities. These three universities retained their air squadrons and reverted to 'long course' training. (1)

Manpower Resources

The main reason underlying the formation of the A.T.C. was the need to encourage all suitable applicants to join the Royal Air Force. In the early months of the war, when the training organisation was in process of development, the flow of recruits was more than adequate to meet the demand, but by the summer of 1940, after

(1) A.M. File A.199866/41.

plans had been laid and as assessment of future requirements made, it was apparent that the number of potential candidates available to meet the requirements of the current year and the next two years (1940, 1941 and 1942) was, by the existing standards, far below requirements. Excluding the E.A.T.S. (the United Kingdom was expected to supply up to 10 per cent of those intakes) the total aircrew requirement was 96,000. The gross male population (excluding those already in the forces) in the aircrew age group (16-32) was about $4\frac{3}{4}$ millions. It was estimated that 233,000 would opt for aircrew duties, but of these nearly three quarters would be found unsuitable before reaching the A.C.S.B.s. A further 32,000 would be rejected by the A.C.S.B.s, leaving approximately 36,000⁽¹⁾ available for aircrew duties - less than half the total requirement.

A second survey, of December 1940, again reviewed the situation in⁽²⁾ the light of further expansion. This second review differed from the earlier one in one respect. Hitherto regard had been paid to the requirements for the whole range of aircrew, but it was now evident that the demand for air gunners and wireless operators/air gunner could be met since the supply was supplemented by candidates entered for ground duties who volunteered for aircrew duties during training. The requirements for the thirteen months under review (December 1940 - December 1941 inclusive) amounted to 40,500 pilots and 4,500 observers. Against this the number expected to become available was 26,800, which meant that there was a possible shortage of some 18,200 suitable candidates for pilot and observer duties.

As a result of these two surveys, a number of steps were taken to widen the recruiting field. In addition to the development of pre-entry training facilities, medical standards were revised, the age limit for the commencement of flying training reduced from 19 to $18\frac{1}{4}$, and arrangements made to waive the schedule of reserved occupations in favour of aircrew volunteers. The Army and Navy

(1) A.C. 11/40.

(2) A.C. 105/40.

were pressed to release aircrew volunteers for the air force, and all ranks of the R.A.F. were combed for aircrew trainees. Empire resources were further developed and the recruiting campaign in America intensified. Finally the allied forces arriving in Great Britain were scoured for suitable trainees.

Two more surveys of manpower resources were carried out in 1941. The first, in May, was chiefly to measure the effects of the remedial measures already adopted, and covered the 24 months between 1 January 1941 and 31 December 1942.⁽¹⁾ The total pilot and observer requirements was estimated at 42,300 by the end of 1941, rising to 97,300 by December 1942 against which the estimated availability was 61,300 and 84,200 respectively, i.e. an adequate supply was available for the current year, but it would fall short of the demand towards the end of 1942. It is interesting to note that in both years only half of these estimated supplies were expected to come from the National Service call-ups. Of the remainder, about 23,000 (in both years) were to be supplied from the deferred service list, the schedule of reserved occupations and transfers from the Army; the rest (9,000 in 1941 and 19,000 in 1942) were to be recruited from serving airmen and overseas territories.

In October, following the establishment of a large scale training organisation in the United States (involving a requirement of 43,000⁽²⁾ recruits by the end of 1942) a further survey was carried out. The pilot and observer requirement had now risen to 126,000 by the end of 1942 and, in spite of further remedial measures taken after the May review, there was still a prospective deficiency of 23,000 by December 1942. As a result, efforts were again made to increase publicity, enlarge the scope of the A.T.C., recruit more candidates from overseas and encourage transfers from the Army.

In the event, these measures, and the changes of policy which

(1) A.C. 31/41.

(2) A.C. 60/41.

restricted R.A.F. training in America after 1941, ensured an adequate supply of trainees and there was, in fact, never a shortage of pupils at any stage of training.

Formation of the Aircrew Reception Centre

As a result of the manpower surveys and the steps taken to ensure an adequate flow of recruits, intakes continued to increase as the overseas training organisation expanded, and by the spring of 1941 there were some 10,000 potential pilots awaiting entry into the training organisation. Three-quarters of these were on deferred service and the remainder employed temporarily on ground defence duties pending their posting for aircrew training. The period spent on deferred service was increasing alarmingly and it was difficult to reconcile public opinion to the fact that training expansion was proceeding as quickly as possible, especially as there was an intensive publicity drive for aircrew recruits. In order to reduce this delay - if only temporarily - a large centre was needed where large numbers of recruits could be called into service and then sifted so that the most promising went forward first into training. This was achieved by forming an Aircrew Reception Centre (A.C.R.C.) at Regents Park in London to replace the two existing receiving wings at Babbacombe and Stratford.

The new centre, which opened on 14 July 1941 with a capacity for a maximum of 5,100 cadets (with a weekly intake of 1,700) made several important changes in the training system. The initial effect was to reduce somewhat the lengths of time spent on deferred service, although this was only a short term measure. It continued the functions of the old receiving wings of kitting, documentation etc., but in addition a small education test was given to all candidates so that only those reaching a certain standard were sent forward to I.T.W. training, thus ensuring that they would readily assimilate the later training. This led to an improvement in the general standard of I.T.W. training and eventually enabled the I.T.W.s to specialise in their training. Those personnel failing in the test to come up to the minimum I.T.W.

entry standard were detained over and above the normal three weeks stay and given a short course of special instruction to bring them up to that standard and so continue their training. In addition to this sifting and selecting, the newly formed centre was also used to deal with cadets who had been rejected from pilot and observer training and who were to be reselected and trained in another aircrew category. Thus the unit had three distinct functions: reception, refresher and reselection. The new centre also undertook the training of U.A.S. cadets, who were not required to undergo I.T.W. training; they were given a four weeks' disciplinary course before passing on to a flying training school. (1)

The Growth of Selection Boards

The selection machinery continued to expand to keep pace with the growth of intakes into initial training, and during the first half of 1941 seven more A.C.S.B.s were opened: Nos. 24 and 25 at Edinburgh on 27 January; Nos. 26, 27 and 28 at Birmingham on 2 June; and No. 29 at Penarth and No. 30 at Padgate on 30 June. Several existing boards were moved during the early months of the year - Nos. 2 and 22 from Uxbridge and Euston respectively to Oxford on 3 February and Nos. 1, 3 and 8 A.C.S.B.s from Uxbridge to Weston-super-Mare on 1 April - so that by the end of June there were 30 boards located at nine centres, with a total weekly capacity of 3,750 candidates:-

<u>A.C.S.B.</u>	<u>No. of Boards</u>	<u>Location</u>
Nos. 4, 7, 9, 19, 20	5	Cardington
Nos. 2, 12, 15, 21, 22	5	Oxford
Nos. 11, 13, 14, 23	4	Euston
Nos. 1, 3, 8	3	Weston-super-Mare
Nos. 5, 6, 10, 30	4	Padgate
Nos. 16, 24, 25	3	Edinburgh
Nos. 26, 27, 28	3	Birmingham
Nos. 17, 18	2	Blackpool
No. 29	1	Penarth

This was the peak strength of the A.C.S.B.s and, apart from a few changes of location in the winter of 1942 and the summer of 1943, these 30 boards remained in being until the reduction of the training organisation was begun in mid 1944.

The Aircrew Disposal Wing

The expansion of the A.C.S.B.s in the first half of 1941 was

naturally followed by an increase in A.C.R.C. intakes, and in the autumn it became necessary to use the maximum capacity of the A.C.R.C. - a capacity for 5,100 cadets - for reception purposes. Consequently the remustering and refresher training duties formerly carried out there had to be removed, and a new centre, known as the Aircrew Disposal Wing, was formed within the framework of No. 54 Group, to carry out these duties.⁽¹⁾

The new wing formed at Brighton on 6 October 1941 and was located in accommodation previously requisitioned to accommodate two new Initial Training Wings (Nos. 15 and 16) but which were not wanted for that purpose at that time. The new wing had a capacity for 2,000 cadets and its functions, which were to deal with those personnel formerly dealt with in refresher and reselection sections of the A.C.R.C. It was divided into three squadrons: 'A' squadron, with a capacity⁽²⁾ for 600 cadets, dealt with personnel remustering from one aircrew trade to another; 'B' squadron, accommodating 400 cadets, ran a four weeks' disciplinary course for personnel who had completed I.T.W. or its equivalent but needed a refresher course before starting flying training (chiefly pilots remustered to observers at the end of I.T.W. training or U.A.S. candidates by-passing the I.T.W.); and 'C' squadron, with a capacity for 1,000 cadets, gave a three weeks' pre-I.T.W. course for those personnel failing the educational test at A.C.R.C.⁽³⁾ For a time certain other candidates, selected station cadets (personnel who had been called up and employed on ground duties in lieu of deferred service pending the commencement of their aircrew training) and A.T.C. cadets with proficiency certificates, also underwent the four weeks' 'B' squadron course instead of I.T.W. training, but after about 1,000 had been so trained (50 per cent of whom were A.T.C. personnel) these two schemes were discontinued.

The Aircrew Despatch Centre

A third new type of unit was formed in No. 54 Group during 1941; this was the Aircrew Despatch Centre which opened at

/ Heaton Park,

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- (1) S.D. 155/990/41.
 - (2) Cadets remustering to ground trades went to a Reception and Disposal unit at Blackpool.
 - (3) A.M. File S.74899.

Heaton Park, Manchester on 21 August. Its function was to prepare and assemble drafts of aircrew cadets proceeding overseas for their flying training and it had accommodation for 2,000 cadets. Most of its intakes were drawn from the I.T.W.s and went to Canada, America, Southern Rhodesia or South Africa for flying training, but a few came direct from A.C.R.C. and underwent I.T.W. training whilst ⁽¹⁾ en route to South Africa or Southern Rhodesia.

In September the responsibility for final selection of cadets as pilots or observers and the assessment of pilots for fighters or bombers was transferred from the I.T.W.s to the A.C.R.C.s, and it was this step which made it possible for the I.T.W.s to specialise in the training of aircrew trades. By this time the number of I.T.W.s had increased from eight in December 1940 to fifteen. Nos. 1 and 9 Receiving Wings were converted into I.T.W.s on the formation of the A.C.R.C., and five new wings had been opened; No. 11 at Scarborough on 15 March; No. 12 at St. Andrews on 12 May; No. 13 at Torquay on 1 June and Nos. 14 and 17 at Hastings and Scarborough respectively on 23 September. No. 14, which moved to Bridlington four months after its formation, was opened as an air gunners I.T.W. with a capacity for 1,200 cadets on a six weeks' course. All the remainder trained 800 at a time on an eight weeks' course, Nos. 3, 4, 5 and 13 training observers and the others pilots.

Investigation of Selection Methods

Towards the end of 1941 the seed sown in the early months of the war was bearing fruit in the shape of an ever increasing output of pilots, observers, wireless operators/air gunner and air gunners. By this time, in fact, the shortage of trained aircrew had been overcome and it was now possible to relax the pressure a little by extending courses and improving the standard of training. For the first two years of the war everything had been sacrificed to obtain the maximum output; courses had been

(1) A.M. File S.73621.

drastically reduced and the standard of training cut to the minimum. On the recruiting side the accent had largely been on the recruitment of experienced or suitably qualified personnel who would need the minimum of training. By 1942 it was possible for A.M.T. to introduce his 'New Deal' which aimed at improving considerably the standard of training by allowing more time and providing more flying experience in both the basic and operational stages of training. Even in the initial stage more time was to be allowed and in February 1942 I.T.W. courses for pilots and observers were extended by four weeks, making them 12 weeks in all.

By this time it was realised that it was not merely the length of training which needed to be extended if standards were to be improved; a more careful method of ensuring that the right type of candidate was sent for the right type of training was necessary.

Up to this time the procedure for selecting and classifying aircrew candidates had remained basically unchanged since September 1939. Three 'new fangled' psychological tests had been introduced, the 'Bartlett' Observation and Intelligence tests, the S.M.A.3. co-ordination test, and the pre-selection tests, but not without opposition. The old Service prejudice against mystic scientific devices died hard and even on their introduction these tests did not play an executive part in the selection process; the 'impression' method, depending almost entirely on the board's personal view of the candidate was the final and deciding factor in aircrew selection and classification. (1)

The pre-selection tests carried out at the A.C.R.C. were, in fact, dropped in February 1942 and the possibility of using any scientific means of selecting bomber and fighter pilots was given up, selection for these categories being left to the flying training schools.

The Bartlett and S.M.A.3 tests at the A.C.S.B.s, however, were soon shown to be proving their worth, but it was apparent that these should be supplemented by a more tangible method of selection.

(1) A.M. Files S.64243 and A.130847/40.

The whole question of selection and classification was closely examined in December 1941 when a training research branch was formed within A.M.T.'s department. One of the tasks of this new branch concerned the selection of candidates in order to secure the proper type of trainee for aircrew duties. The first stage of the research was to ascertain what finally became of those who presented themselves for aircrew at the A.C.S.B.s. The histories of over 1,000 names out of a total of 20,000 who came before the A.C.S.B.s between June and December 1940 were analysed and their status two years later was noted. Analysis showed that 48 per cent were rejected by the A.C.S.B.s and that only 25 per cent had become operational at the end of two years training. It was also found that 7 per cent (that is 15 per cent of those accepted) were still under training after two years. This was due largely to initial misclassification which resulted in reselection and starting training again in a new category. Taking the pilot trainees only, 58 per cent passed as pilots, 36 per cent were rejected and 6 per cent still under training. ⁽¹⁾ The bulk of the rejects (22 per cent) occurred at the E.F.T.S. stage, and more than half of these had subsequently qualified for other aircrew duties. It was evident therefore that most of the wastage was due to initial misclassification.

In the case of observers and wireless operators also, it was found that wastage was due largely to faulty selection; observer failures occurred mainly through insufficient education and wireless operators through lack of morse aptitude. These analyses showed the waste of training effort which occurred through attempting to select individuals for different categories of aircrew simply as the result of a short interview by a board of officers.

Further analysis started in 1941 on the relation between the speed with which individuals were able to go solo at E.F.T.S. and the ability they showed during subsequent stages of their training. A record was made of 2,892 pilot trainees of whom 24 per cent failed to reach the solo stage at all. An analysis was made of those who reached that stage with the following results:-

~~(1) See Table 2.~~

(1) See Appendix 2.

<u>Category</u>	<u>Percentages of cases</u>	<u>Hours dual before going solo</u>
Very fast	11	5 - 8
Fast	35	9 - 10
Medium	45	11 - 14
Slow	9	over 14

Of the very fast 52 per cent were assessed as superior at E.F.T.S. and only 3 per cent as inferior, while of the slow only 6 per cent were assessed as superior and 35 per cent as inferior. Similar facts stood out at the S.F.T.S. and the O.T.U. Of the very fast 70 per cent reached operations and 30 per cent did not; of the slow only 43 per cent reached operations and those were poor in quality compared with the 70 per cent of the very fast group. The fast and medium pilots from the E.F.T.S. occupied an intermediate place between the very fast and the slow. In fact, the number of hours dual which pilots required before their first solo showed a close and consistent relationship to their subsequent performance in flying training right up to and including their O.T.U. stage; in other words, pilots who went solo quickly paid higher dividends to the Service both in quantity and quality than those who sent solo slowly. It was found that the quick starter on solo also did his ground training better than the slow starter; the reason probably being that the former was confident that he would not fail in flying.

While these investigations were being made, and the training course lengthened, a third event occurred which indirectly contributed towards the revision of the selection procedure. This was the one-pilot policy, which was introduced for all heavy and medium bomber aircraft in February 1942.⁽¹⁾ Fewer pilots were now needed but, since they all were to be employed as captains of aircraft, a higher standard of training was needed which, in turn, meant that a more stringent selection procedure was necessary. Furthermore, the other aircrew categories were revised: the trade of observer was abolished and the duties split between two new categories, navigator and air bomber, the former being sub-divided into five classes according to the type of aircraft they were going to fly. Another new category, the flight engineer, was

(1) A.M.O. A786/42.

also introduced who took over some of the duties previously performed by the second pilot of medium and heavy bomber aircraft; at the same time two variations on these main categories were recognised for employment on flying boats, the wireless operator mechanic/air gunner and the flight mechanic/air gunner. Thus there were twelve different aircrew categories in place of the four at the outbreak of war:-

Pilot
Navigator
Navigator/Wireless
Navigator/Bomber
Navigator/Bomber/Wireless
Navigator/Radio
Air Bomber
Wireless Operator/Air Gunner
Wireless Operator Mechanic/Air Gunner
Flight Mechanic/Air Gunner
Air Gunner
Flight Engineer

There was yet another event which influenced selection and classification procedure; this was the transfer of basic training schools overseas which, after 1941, meant that nearly all pilots and observers (or navigators and air bombers as they were shortly called) were sent abroad for their training. It was soon apparent that it was wasteful both in time and shipping space if large numbers of cadets were sent overseas only to fail their courses, and in November 1941 some of the E.F.T.S., whose capacity was not filled once the overseas schools started training, were used to give a short flying test to ensure that prospective pilot trainees possessed the necessary aptitude for such training. Cadets underwent a three weeks' course of instruction which included 15 hours flying on Tiger Moths; if there was no reason to believe that they were unsuited for pilot training (air sickness, lack of co-ordination, etc.) they were sent abroad for training, otherwise they were reselected as observers.

It was a combination of these four factors - the New Deal, which demanded better training; the training research investigation, which revealed the inadequacy of the existing selection procedure; the one-pilot policy, which widened the aircrew field but narrowed the requirements of pilots; and the transfer of

basic training overseas, which made it essential to send only the most promising cadets overseas, which eventually led to a complete revision of the existing selection procedure.

The P.N.B. Scheme

As a result, on 4 May 1942, an entirely new method of aircrew selection and classification was introduced.⁽¹⁾ Under the new scheme volunteers for pilot, navigator or air bomber duties who were accepted by the A.C.S.B.s entered training as an undifferentiated group of aircrew known as 'P.N.B.' Candidates for the non-'P.N.B.' categories, i.e. wireless operators/air gunner, flight engineers, and air gunners continued to be selected and trained as before.

The I.T.W.s were no longer specialists (with the exception of the air gunner I.T.W. at Bridlington); all fourteen wings undertook the training of the common category of 'P.N.B.' cadets. A week before the final examinations, cadets received a final lecture covering all P.N.B. trades and were required to fill in a pro-forma stating in order of priority the trades they preferred. At the end of the I.T.W. course all P.N.B. personnel, with the exception of those not expressing a first preference for pilot training and those whose medical category showed them unfit for pilot training (who continued to go direct to the A.C.D.C.) were posted to an E.F.T.S. for the flying grade course, and thence to the A.C.D.C.

Subsequent allocation within the P.N.B. category was based on performance at the I.T.W.s and on a flying aptitude test. An aircrew classification board was set up at No. 54 Group Headquarters and was the responsible authority on the final classification of aircrew within the P.N.B. group. Cadets were selected for the pilot category in strict order of merit according to their performance in the flying test and the quotas required at the particular time. Cadets not selected for pilot, and those cadets who had not attended a grading course, were classified in one of the

(1) A.M. File S.82828.

navigator or air bomber categories according to their preference, medical category, abilities (as shown at the A.C.S.B., A.C.R.C. and I.T.W.) and Service requirements. Cadets who did not reach the necessary standard in the I.T.W. examinations were automatically failed in the P.N.B. category and were sent to the A.C.R.W. at Brighton for re-selection into one of the non-P.N.B. trades. (1)

~~The new system thus introduced a new stage which is illustrated in Appendix 3.~~

The selection machinery was also revised and several new stages were inserted which can best be explained by a brief resume of the entire system of selection and classification. The first stage was the A.C.S.B. which, as has already been explained, selected candidates into either 'P.N.B.' or one of the remaining non P.N.B. categories. The functions of each trade and the methods of selection were explained to cadets by means of a pamphlet issued at the A.C.S.B. The duties of the medical boards, which were attached to the A.C.S.B.s, were not affected a great deal by the new scheme, except that the aircrew trades were divided into five groups for medical categorisation and Service documents were endorsed in medical terms (such as A.1.B, A.3.B.) and not annotated in terms of trades (such as fit pilot, fit Observer) as hitherto:-

- | | |
|--|-----------------|
| (i) Pilot | A.1.B. |
| (ii) Air Gunner)
Air Bomber) | A.3.B. |
| (iii) Navigator/Bomber)
Navigator/Bomber/Wireless)
Wireless Operator Mechanic/Air Gunner)
Flight Mechanic/Air Gunner) | A.3.B. |
| (iv) Navigator)
Navigator/Wireless)
Wireless Operator/Air Gunner)
Flight Engineer) | A.3.B. (Vision) |
| (v) Navigator/Radio | A.3.B. (Radio) |

Except in the case of pilots who required special eye qualifications, these classifications were made in order of priority of medical standards. For example, personnel fit for trades (ii) automatically fit for classes (iii), (iv) and (v). Similarly, a Navigator/Radio was the lowest class and was fit for that class only. Class (ii) differed from class (iii) only in certain height and weight restrictions. 'A.1.B., A.3.B. (Turret)' indicated fitness for all aircrew trades. These medical categories were supplemented by a night vision capacity rate (indicated on the medical document as NVC), which was measured by means of a test carried out at the A.C.R.C.

(1) See Appendix 3.

The procedure as to calling up for the P.N.B. scheme remained unaltered. No. 54 Group, on Air Ministry instructions, notified the Records Office of the numbers of cadets required at A.C.R.C. so that call-up papers could be issued. Four weeks' notice was usually given. On call-up, all P.N.B. personnel reported to the A.C.R.C. where they were kitted, inoculated, tested for night visual capacity/

capacity and given some basic ground training. The stay was normally three weeks; during the first week a lecture on the P.N.B. Classification system was given together with a brief description of all aircrew trades. A short test in mathematics and signals was given and those not considered up to I.T.W. entry standard were sent to the Aircrew Disposal Centre (renamed Aircrew Reselection and Training Centre in September 1942) for a three weeks' course in mathematics and signals before proceeding to I.T.W. At the end of the I.T.W. course the pro-forma stating the cadet's preference was forward to No. 54 Group. Personnel medically suitable and expressing a preference for pilot training were posted to an E.F.T.S. for a grading test, and the remainder posted direct to A.C.D.C. Those failing the I.T.W. examination (after a resit) were posted to the A.C.D.C. at Brighton for reselection.

At the E.F.T.S. candidates were graded strictly in terms of their flying aptitude. The course was of three weeks' duration and 12 hours flying was carried out, after which cadets were posted to the A.C.D.C. The best available measure of flying aptitude was found to be the actual flying skill shown after a fixed amount of flying instruction, so after 7 hours instruction and again after 11 hours instruction cadets were given a standard test flight by a testing officer. The cadet's actual performance in the air in a series of 10 defined manoeuvres was systematically observed and assessed according to a standard method. The function of the Grading School was not to select pilots nor to eliminate 'unsuitable' cadets; it was simply to grade, i.e. to measure the quality of performance of all who were sent. This meant making a systematic measurement of aptitude on the basis of a standard 'work sample' of flying performance. A training report was completed for all cadets entering grading courses and on completion of the course the cadet's report was forwarded to No. 54 Group.

At No. 54 Group all training documents from A.C.S.B.s., A.C.R.C., I.T.W. and Grading Courses, were assembled and forwarded to the Aircrew Classification Board for final classification. Cadets were not seen by this board; classification was accomplished by

/ dealing

dealing with the factual information and assessments supplied to the A.C.C.B. regarding the cadets preferences and their aptitude as indicated by the records of their performance in grading schools or in initial training schools. This method was obviously a great improvement on the old 'queue' system of selection. When a selection board dealt conclusively with individuals one by one there was little opportunity for comparing candidates in detail according to merit. This new system, which might be termed a 'block' system, whereby a sizeable group were available for a longer period so that information on relevant points could first be measured and assembled for a block of candidates, enabled a more efficient comparison, and accurate classification was possible for the sample of individuals concerned.

The board was notified monthly of the requirements in all trades, although it was not normally required to classify as pilots less than 40 per cent or more than 60 per cent of the total candidates for any one week. Moreover, the board was not authorised to classify a cadet outside the P.N.B. group. Final classifications were made into six categories:-

Pilots. Required for all types of aircraft.

Navigators. Required for heavy and medium bombers. The duties entailed long flights by day and night necessitating a high standard of ability.

Navigator/Wireless. Required for Coastal Command long-range fighters. Had to be capable of undertaking wireless operator training, but the navigation tasks were less exacting than those of the 'straight' navigators.

Navigator/Bomber and Navigator/Bomber/Wireless. Required for light and certain categories of medium bomber aircraft. These generally operated by day, and therefore did not carry the responsibility of the 'straight' navigator owing to the smaller size of the aircraft.

Navigator/Radio. A lower standard of navigator was accepted in this category.

Air Bomber. The selection of this category was determined largely by the individual's preference and partly by the discretion of the board, owing to the fact that at this time (mid 1942) there was no reliable aptitude tests for air bombing.

All cadets on the termination of their grading course, or in the case of those opting for one of the Navigator/Bomber categories on the termination of their I.T.W. course, were posted to the A.C.D.C. to await the results of their classification by the A.C.C.B. After notification of their selected category and being given a lecture and pamphlet on their future training and operational careers, they awaited posting to their next stage of training; those proceeding overseas were kitted and assembled for the voyage.

This new system of grading all candidates for pilot duties had two underlying points of principle. First, from the standpoint of the cadet, all who wished to be pilots were dealt with on merit and had a fair and equal opportunity under standard conditions to show what they could do in the air. Secondly, from the standpoint of the Service, the procedure and results were as differential and reliable as possible and the field for pilot recruitment was considerably widened.

The Value of Grading

The effect of this 'quality' selection method had been made evident by analysis of wastage at the E.F.T.S. and S.F.T.S. stages in training.⁽¹⁾ Furthermore the fallacy that potential pilot trainees could be selected by the 'impression' of some experienced officer (or board of officers) regarding the candidate's appearance, bearing, manner, and background was conclusively disproved. There is no doubt that useful information about a cadet, particularly as regards his suitability in general as a member of an aircrew, can be obtained by a trained interviewer, but no reliable indication of flying aptitude can be obtained by the 'impression' method.

This theory was proved in late 1942, when it appeared at one stage that there might be insufficient grading capacity to meet overseas pilot training commitments. Accordingly it was necessary to pre-select a limited number of special drafts (of roughly 100 cadets) to be sent directly overseas for pilot training without

(1) A.M. Pamphlet No. 96.

passing through a grading test. The I.T.W.s were asked to make a careful survey of all their cadets who were about to be graduated and to select only those who, in their opinion, gave the best promise of successful training as pilots. This task was carefully and conscientiously carried out by officers who had ample opportunity to get to know the cadets (the I.T.W. course was of 12 weeks' duration).

One draft selected in this way was not dispatched overseas owing to a change in the shipping situation. These 102 cadets, specially selected from nine I.T.W.s were consequently graded in the normal way along with cadets who had not been thus pre-selected. It ~~will be seen~~ ^{was found} that there was practically no difference between the two groups in their flying performance as measured by the flight test at either 7 hours or 11 hours. Furthermore, ~~it will be seen that~~ there was no difference in the proportion of each group who failed to go solo, nor in the speed to solo of those who did qualify. Indeed, the Classification Board, on the basis of the available evidence concerning the demonstrated flying aptitude of these cadets (and without knowledge of this special group), actually classified as pilots a somewhat smaller proportion of the 'selected' cadets than of those 'unselected'.

Thus it seems evident that experienced officers even when they have a full opportunity of getting to know the cadets in question are unable to predict subsequent flying ability by the impression method with any better than chance success. In the test case the I.T.W.s would have done just as well if they had picked the good prospects with a pin or alphabetically, as they did by giving the most careful consideration to personality, background and other seeming evidence of pre-flight selection.

Grading, on the other hand, was proved to have reduced the wastage rates in the subsequent flying training stages, and the cadets performance at the grading school was in direct proportion to his chances of successfully completing his flying training as a

/ pilot

pilot. Through 1940-41 the wastage rate for the E.F.T.S.s in the United Kingdom were at the 30 per cent level, and in early 1942 when the bulk of the elementary flying training was transferred overseas the wastage rate level rose to 38 per cent. After the introduction of grading in 1942, the E.F.T.S. wastage rates (for all areas) dropped to 14 per cent, i.e. less than half its former size. Similarly, in the S.F.T.S.s the wastage rate before the introduction of grading had been 16 per cent of the intake; in 1943 this was down to 11 per cent. In the post S.F.T.S. stages also, although the wastage in any case was normally smaller than in the basic stage, grading had contributed towards the reduction of wastage (from 3 per cent in 1942 to $1\frac{1}{2}$ per cent in 1943-44). Another interesting factor in the grading system was that those cadets who showed the most promise at Grading Schools had a remarkably small failure rate in their later stages of training; similarly, the lower the cadet's aptitude at Grading, the higher was the wastage rate.

A further analysis of flying hours showed that even if all the hours devoted to grading were counted as wastage, and allowing for 50 per cent of those tested going from the grading school to S.F.T.S., the total amount of flying required under the P.N.B. scheme to produce a certain number of pilots was less than would have been required under the old method to produce the same output. This was due mainly to the large numbers of rejects at the E.F.T.S. stage under the old scheme. It followed that the greater the number of pupils passed through the grading schools in proportion to the numbers required for the E.F.T.S. (in other words, the higher the degree to which preliminary grading could be carried), the more efficient would be the training organisation throughout the subsequent stages and the higher the average of those joining operational squadrons.

Modifications to Recruiting and Initial Training Organisation

While the P.N.B. scheme was being introduced, a number of minor modifications were made to the recruiting and initial training machinery. First was the formation of the Aircrew Camp at Ludlow on 27 April 1942. This Camp, which was to be constructed by aircrew cadets, supervised by local works officers, was planned as an alternative location for the I.T.W.s in the Devon and

/ Cornwall

Cornwall area (Nos. 1, 3, 4, 5, 7, 8 and 13 I.T.W.s) which would have to be moved in the event of invasion.⁽¹⁾ The use of cadets instead of civilian labour had several advantages: it saved money, it enabled cadets to be called up earlier; and it served as a toughening up course.⁽²⁾

The camp was ultimately to hold a total of 12,000 personnel, situated in three tented camps holding 4,000 each, but until such time as it might be needed for evacuation purposes, the idea was gradually conceived that the camp could be used as a training camp for aircrew cadets in order to develop physical standards before they proceeded to I.T.W. Consequently the population of the camp was fixed at 3,000 cadets (i.e. 25 per cent of the total capacity required in an emergency) and the length of stay three weeks.

The plan worked very well in the summer of 1942. The cadets, most of whom were town-bred boys with very limited experience outside their civilian occupation, were posted to the Aircrew Camp, after passing through A.C.R.C., where they were prepared for I.T.W. training and for subsequent Service life. The training syllabus was mainly of an outdoor nature and was aimed at constructing the camp and at the same time developing physical standards of the cadets. It included disciplinary training, field craft and defence duties, training in unarmed combat, swimming and physical training and hardening-up manual work such as the construction and improvement of the camp, and building roads, ablutions, latrines and drains under the supervision of works engineers. A certain amount of training instruction in mathematics and navigation was also provided. On the completion of the course the cadets proceeded to I.T.W. The camp was not considered an essential part of the training organisation and was never included in Air Ministry policy as such. It was, in effect, a 'cushion' between the A.C.R.C. and I.T.W. and cadets only went there if they could not be immediately⁽³⁾ absorbed into the I.T.W.s. Both the capacity and course length were variable.

(1) Other No. 54 Group units in Coastal areas were also to be moved but these were all to go into ready made accommodation.

(2) A.M. Files CS.8729 and S.79415.

(3) A.M. File S.69023.

The Director General of Medical Services disagreed with this policy of putting cadets so soon after entry into a drastic hardening course, and on 12 December 1942, since huttet accommodation was extremely limited and winter conditions would not allow any beneficial training to be carried out under the existing tented arrangements, the camp was temporarily closed.

The second modification concerned I.T.W. training. Following Russia's entry into the war, large numbers of Polish airmen made their way to England to join the Polish Air Force. Originally these personnel were trained at No.1 Polish Flying Training School which had operated at Hucknall since January 1941, and selection, initial training and flying training were all done at the one station. In June, however, the school was reorganised on R.A.F. lines. No. 25 E.F.T.S. and No. 16 S.F.T.S. replaced the old school at Hucknall and an aircrew training centre established which performed the duties of an A.C.R.C. For the initial training it was arranged that Polish cadets should pass through a Royal Air Force I.T.W. and one squadron of No.12 I.T.W., St. Andrews, was turned over for this commitment. Just over twelve months later, on 21 July 1942, the Polish squadron of No. 12 I.T.W. was transferred to Brighton where it became the Polish I.T.W. and a new R.A.F. squadron formed at No. 12 I.T.W. so that its capacity remained at 800. The capacity of the new wing was increased from 200 pupils to 300 and the course length extended from 12 weeks to 14, to allow the Poles more time to learn English regulations, drill, etc.⁽¹⁾

The question of providing I.T.W. training for wireless operators/air gunner and flight engineers was also considered in 1942. In November 1941, in fact, steps had been taken to provide a pseudo I.T.W. course for wireless operators/air gunner by forming aircrew wings at the two signals schools (at Madley and Yatesbury) with the object of converting wireless operators (ground) to wireless operators (air). The course, which lasted 8 weeks, was similar to an air gunners I.T.W. course, except that it included 10 hours flying and it was given to cadets who had completed their signals course and were awaiting entry into an air gunners school.⁽²⁾

(1) A.M. File S.75031.

(2) A.M. File S.85264.

In January 1943 it was decided to adopt a straight through training policy for wireless operators/air gunner (W. Ops/A.G.). The old system was most unsatisfactory in that it led to many delays and long periods of waiting ensued. Two I.T.W.s were therefore formed: Nos. 18 and 19, both at Bridgnorth on (1) 4 January and 20 March respectively. Each wing dealt with 1,080 pupils at a time on an 8 weeks' course with weekly intakes of 135. In place of training pupils first as ground wireless operators and converting them to W. Ops/A.G., pupils were recruited for the W. Ops/A.G. duties. They were called up to A.C.R.C. along with other categories of aircrew and underwent I.T.W. training before commencing their wireless course. The new system cut down the length of training by nearly 6 months:-

<u>Procedure prior to 1943</u>		<u>Procedure introduced in 1943</u>	
Signals Recruits Centre	- 15 weeks	A.C.R.C. (Regents Park)	- 3 weeks
Signals School (Madley or Yatesbury)	- 14 weeks	I.T.W. (Bridgnorth)	- 8 weeks
Ground Operating	- 36 weeks	Radio School (Madley or Yatesbury)	- 20-24 weeks
Air Crew Wings (Madley or Yatesbury)	- 8 weeks	Air Gunners School	- 8-12 weeks
Air Gunners School	- 8 weeks		

As far back as March 1942 it had been agreed that an I.T.W. course for flight engineers was desirable, but because of urgent demands for these personnel, in the summer of 1942, owing to the rapid expansion of the Heavy Bomber Force, it was not practicable to introduce this training. The original flight engineers were drawn from ground trades within the R.A.F. and so initial training was not vital anyway; but later, in October 1942, when direct entry flight engineers were recruited, it was essential that they should pass through an I.T.W. course.

The course length was to be 6 weeks and a capacity for 600 cadets was deemed necessary. Accommodation for these personnel was available at Bridlington, where No.14 I.T.W. was already in operation for air gunners' training, and in January 1943

(1) LM. 3354/D. of O.

No.14 I.T.W. was re-established with a combined capacity of 1,800 cadets:-

- 1,200 Air Gunners - Course length six weeks.
400 to proceed to Canada for E.A.G.S. 800 to E.A.G.S. training at Bridlington.
- 600 Flight Engineers - Course length six weeks.
All to proceed to St. Athan for flight engineer training.

At the same time it was arranged that both air gunners and flight engineers should pass through the A.C.R.C. before starting their initial training, instead of passing through recruits centres in the same way as ground personnel.

Another modification concerned the Aircrew Disposal Wing at Brighton, which on 1 September 1942 was renamed the Aircrew Training and Reselection Centre. This change did not affect the duties formerly carried out there, the four weeks disciplinary course, the three weeks pre-A.C.R.C. course and the reselection squadron, but two other units, the Polish I.T.W. and the Aircrew Refresher School (which had been opened at Brighton on 13 April 1942 for the purpose of giving disciplinary training to aircrew personnel) also formed part of the new centre. (1)

The A.C.S.B. organisation remained largely unchanged during 1942, with a total weekly intake of 3,750 candidates. Nos. 17 and 18 A.C.S.B.s moved from Blackpool to Doncaster on 1 December and Nos. 1 and 8 A.C.S.B.s from Weston-super-Mare to Doncaster, and No. 3 from Weston-super-Mare to Oxford six days later, which meant that by the end of the year there were eight centres comprising the following boards:-

<u>A.C.S.B.</u>	<u>No. of Boards</u>	<u>Location</u>
Nos. 4, 7, 9, 19, 20	5	Cardington
Nos. 2, 12, 15, 21, 22	5	Oxford
Nos. 3, 11, 13, 14, 23	5	Euston
Nos. 1, 8, 17, 18	4	Doncaster
Nos. 5, 6, 10, 30	4	Padgate
Nos. 16, 24, 25	3	Edinburgh
Nos. 26, 27, 28	3	Birmingham
No. 29	1	Penarth

No. 7 A.C.S.B. moved to Birmingham and Nos. 5 & 6 to Doncaster on 28 August 1944.

/The Pre-Aircrew

(1) A.M. File S.74899.

The Pre-Aircrew Training Scheme

As the war progressed and the demand for recruits increased there was a marked tendency for the medical and education standards of intakes to decrease. Before the war, candidates for aircrew duties were required to be in possession of a school certificate or to have reached an equivalent educational standard, but under war conditions it soon became impossible to enforce this requirement if the necessary number of aircrew personnel was to be secured, and an increasing number of entrants who had little or no more than elementary education, but who were in all other respects suitable as pilots, observers and air gunners, who came before the selection boards, were accepted for training. At the same time courses became more exacting as the complexity of modern aircraft, equipment, and methods of warfare increased. In many cases the failure of entrants to complete their courses successfully was not due to absence of innate mental capacity but to a lack of training on broad lines which longer education had provided for their predecessors. It was found, for example, that many cadets had only a rudimentary knowledge of mathematics and none of general science.

The deferred service scheme enabled cadets awaiting call-up to obtain a certain amount of preliminary training and, shortly after the outbreak of war, a scheme was introduced whereby local education authorities provided part-time instruction chiefly in elementary mathematics for volunteers suitable for aircrew duties but who were regarded as being educationally deficient. The scheme gave valuable help to several thousand potential aircrew cadets, but in many cases could not bridge the gap between the educational standard of the individuals and that which had been found necessary for P.N.B. candidates.

The first approach to this problem of training personnel below the requisite I.T.W. entrance standard was made in June 1941, when with the opening of the Aircrew Reception Centre a short educational test was given to all entrants and those who failed to reach a certain standard were retained and given special training. This was later carried out at Brighton.

The A.T.C. also provided valuable assistance in pre-Service training and at the beginning of 1942 all candidates were informed on attestation that they would be required to attend A.T.C. lectures. Because of the relatively short time involved they were, in effect, honorary members and were not issued with uniforms.

These measures, however, did not solve the problem and by the autumn of 1942 it was clear that a more comprehensive scheme of ground educational training was necessary. A review carried out during a period of three months in the summer of 1942 showed that roughly one-third of the personnel selected as pilots and navigators had received little more than elementary education, and this did not enable pupils to gain the full benefit from their subsequent courses of instruction.⁽¹⁾ This was borne out by the findings of a committee under the chairmanship of the Under Secretary of State for Air held on 19 December 1942, which discovered that wastage at the I.T.W.s had doubled⁽²⁾ (from 5 per cent to 10 per cent during the previous 12 months). The schemes dealing with educationally deficient aircrew candidates were both numerically inadequate and incomprehensive from the educational point of view.⁽³⁾

(1) A.C. 86 (42).

(2) A.C. 89 (42).

(3) A.M. File S.88530.

From enquiries made by the Board of Education it was ascertained that capacity could be made available for the bulk of the P.N.B. aircrew who had not proceeded beyond the elementary standard of education, amounting to some 15,000 - 20,000 personnel per annum. As a result of subsequent discussion with the Board of Education and the Scottish Education Department, arrangements were made through local education authorities for full-time educational courses of six months duration to be held in colleges and schools in England, Scotland and Wales.

This scheme, known as The Preliminary Aircrew Training (P.A.C.T.) Scheme, was introduced in the early part of 1943. A six months full-time educational course was given to selected personnel in schools and colleges throughout the country. The target population was 26 centres each with a capacity of 200 - a total of 5,200 pupils, although the actual capacity secured amounted to just under 3,500 pupils in 21 centres. This was the maximum amount of suitable accommodation which local authorities were able to provide from resources existing at that time.

The problem was partly one of providing the cadets with basic information, mostly of a mathematical or scientific character required in order to cope with the subsequent R.A.F. training. A much more important need, however, was to form or revive habits of study and to develop an attitude of inquiry and self reliance in the solution of problems. A curriculum of six educational subjects was devised: Mathematics, General Science, Mechanical Drawing, Geography, English and Modern History. In addition, cadets received instruction in the History of Flying and the R.A.F., in general Service information and in physical training.

A P.A.C.T. Wing was established at the A.C.R.C. Regents Park on 18 February with a capacity for 600 cadets to deal with reception, kitting, inoculation and final selection of personnel for P.A.C.T. courses, followed by the formation of P.A.C.T. centres in various parts of the country under the auspices of the local educational authorities. A centre was affiliated to a convenient R.A.F. unit for administration purposes and included one or more schools according to the geographical distribution and the number of cadets to be accommodated. The first centre opened at Edinburgh on 8 March 1943⁽¹⁾ and, by the end of the year, 21 centres were in operation.

On 26 November the Technical College at Dagenham (under No. 11 Centre) was disbanded and a fortnight later two small organisational changes were made: the Technical College at Wakefield (part of No. 16 Centre) was transferred to No. 9, and that at St. Helens (part of No. 10 Centre) was transferred to No. 19 Centre.

The introduction of this scheme rendered redundant the Pre-I.T.W. course of the Aircrew Training and Reselection Centre, Brighton, and as the Reselection Wing was moved to Eastchurch to form part of a combined reselection centre it was decided to close the centre at Brighton. This was done on 8 August 1943, and the remaining course at Brighton, the four weeks' disciplinary course for U.A.S. personnel, was transferred to the A.C.R.C.

(1) See Appendix 4.

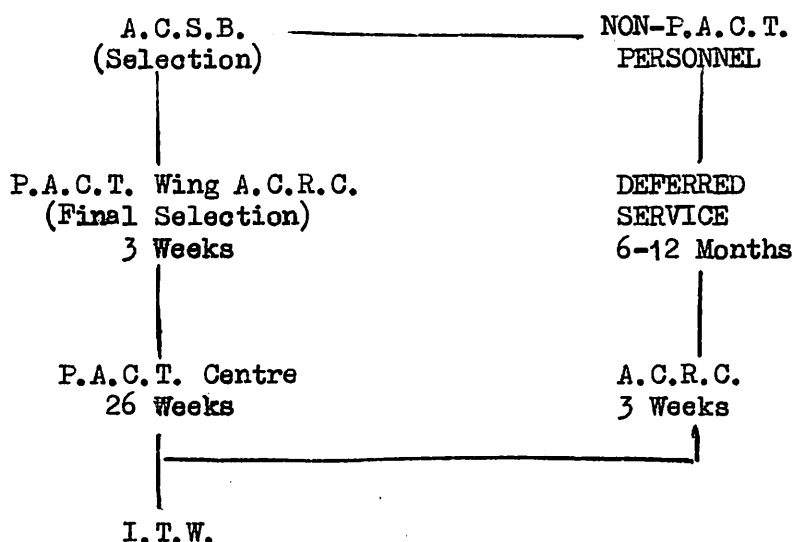
The P.A.C.T. scheme was originally confined to direct entrants of P.N.B. aircrew. Serving airmen who volunteered for aircrew duties were excluded from the scheme as they could not easily be spared from the work they were already doing, and other aircrew categories were excluded through shortage of accommodation. In April 1944, however, with a reduction of Service requirements, it was possible to widen the scope of the scheme to include all cadets who were accepted for aircrew training irrespective of their provisional category given at the A.C.S.B.s.⁽¹⁾

Cadets selected for P.A.C.T. were placed on deferred service when attested, but were recalled roughly six months earlier than they would otherwise have been so that they were not delayed in entering the normal training sequence. The minimum age for recall was reduced from $18\frac{1}{4}$ to $17\frac{3}{4}$ for P.A.C.T. pupils.

Methods of selecting cadets for the P.A.C.T. courses were developed with much care to ensure that those personnel posted to the course needed it. Normally a cadet holding a school certificate, or an A.T.C. proficiency certificate (aircrew), was not required to take the P.A.C.T. course unless he so wished. The first sifting was done at an Aviation Candidates Selection Board where personnel were interviewed and given various tests (including tests in General Knowledge, Mathematics, Intelligence and English). The qualifications and educational histories of all candidates passed by the A.C.S.B.s were examined at the Air Ministry with a view to deciding which of them should take a P.A.C.T. course, and final selection was made at the Aircrew Receiving Centre (P.A.C.T. Wing) by means of a further educational test and interview. Those provisionally selected who were deemed at A.C.R.C. not to need a P.A.C.T. course proceeded direct to I.T.W., unless they

(1) A.M. File S.88530.

were under 18 $\frac{1}{4}$, in which case arrangements were made to post them to a selected R.A.F. station where they took a special course in preparation for their subsequent aircrew training. Throughout their P.A.C.T. cadets held the rank of A.C.2. Their sequence of training was as follows:-



Personnel selected for P.A.C.T. were, after enlistment into the R.A.F., posted to the P.A.C.T. Wing at Regents Park where they were kitted, inoculated etc. and underwent educational tests. From there they proceeded to P.A.C.T. Centres to undergo the training courses. They remained on the strength of A.C.R.C. Regents Park but were attached to the nearest R.A.F. station for pay, medical and equipment services. Accommodation was obtained mainly by private civilian billeting, although hostels and R.A.F. stations were used where convenient. Messing also took various forms; British Restaurants, College Authorities, Y.M.C.A. and R.A.F. Stations and private contractors.

The primary object of the course was to provide a broad mental training, and not to supply the minimum information in various subjects required by cadets in their subsequent R.A.F. training. The teachings were related to the cadet's future needs but no attempts were made to anticipate any part of their subsequent

/ training

training. It was obviously unwise for instance to undertake instruction in navigation as, apart from the secret nature of Service navigation (thus leading to varying ideas by civilian instructors), this subject would be fully covered in the later stages of training. The syllabus was wide and not too rigidly defined, and no formal passing-out examinations were held, although later, in order that cadets should have some incentive to work for, local examinations were held; these examinations did not 'pass' or 'fail' the cadets, they simply graded their work. The syllabus was divided into six main subjects: Mathematics, General Science, Mechanical Drawing, Geography, Modern History and English. The time required to cover a subject was decided rather by the mode of treatment than by the number of topics enumerated in the syllabus. The aim was to form good mental habits and to give satisfying understanding rather than a 'get through' the whole of the items at all costs. In addition to these subjects, and the Service instruction, lectures were arranged by local authorities and visiting lecturers.

Revised Manpower Allocation

In September 1942 the manpower demands of the three Services and of industry instead of being an unrestricted scramble were co-ordinated and related to the general supply position. A co-ordinating committee was formed with Sir John Anderson, Lord President of the Council, in charge, which recommended to the Cabinet the number which each Service was entitled to take.

Owing to a prospective manpower shortage in 1943, the War Cabinet in December 1942, decided to cut the R.A.F. manpower demand for 1943 of 470,000 by 225,000, which meant that the aircrew intake would be cut from 125,000 to roughly 60,000. The situation was reviewed again in June 1943 and the allocation of personnel to the R.A.F. to the end of 1943 was 100,000, against a demand of 146,000.

The effect of these, and the subsequent manpower cuts during 1944, led to a gradual reduction in the numbers of aircrew intakes.

The manpower allocation for 1944 was 50,000 men and 20,000 women, against estimated requirements of 107,000 men and women, and so drastic measures had to be taken to meet the deficiency. There were three courses from which to choose:-

- (a) The expansion programme could carry on as planned, keeping the training organisation going on the assumption that the war with Germany would continue indefinitely. This would leave a large deficiency (37,000) by the end of 1944.
- (b) The expansion programme could be cut, so as to reduce the deficiency without reducing the training organisation.
- (c) The expansion programme could continue as planned until the end of August 1945, at the same time reducing the training organisation so that by that date the numbers of aircrew completing their training would be no more than required for the Japanese War.

After much discussion this last course was adopted, and steps were taken to reduce the training organisation. It was also agreed that on the termination of the European War, 17,000 trained pilots should be transferred to the Fleet Air Arm.

As a result of these cuts, I.T.W. capacity requirements amounted to 13,639 compared with the existing capacity of 15,460. This figure was made up as follows:-

P.N.B.	-	9,000	
Air Gunner	-	1,300	
Flight Engineer/Air Gunner	-	750	(860 by June 1943)
Flight Mechanic (E)/Air Gunner	-	64	
Wireless Operator Mechanic/Air Gunner	-	85	
Wireless Operator/Air Gunner	-	2,140	(2,440 by June 1943)
Poles	-	<u>300</u>	
		13,639	

These requirements necessitated a reduction in the P.N.B. capacity and an increase in the air gunner capacity. The P.N.B. capacity was 11,200 (made up of 14 I.T.W.s each holding 800) - thus two I.T.W.s could safely be closed. The capacity for the air gunner trades at the time was three I.T.W.s with a total capacity of 3,960 (made up of 600 flight engineers/air gunner, 1,200 'straight' air gunners and 2,160 wireless operators/air gunner). The new requirement (of 4,339) necessitated the formation of one I.T.W. exclusively for flight engineer training and a further I.T.W. (making three in all) for the training of wireless operators/air gunner.

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Revision of I.T.W. Organisation

Before all these changes could be implemented, I.T.W. requirements were revised (as a result of the June cuts) and in July the new requirement was estimated to be 17,380 (10,900 pilots/navigators/air bombers, 2,900 wireless operators/air gunner, 1,900 air gunners, 1,380 flight engineers and 300 Poles). (1) It was also decided to form a special I.T.W. to train French personnel, with a capacity for 800 cadets. At the same time it was decided to standardise the size of all I.T.W.s, each with a capacity for 800 pupils, which meant that five more I.T.W.s (including the French I.T.W.) would be required, making 23 in all. (2)

As a result of these decisions the following reorganisation took place:-

- (a) No. 3 I.T.W. Torquay, which had been closed on 29 May under the May reduction, was reopened on 14 September.
- (b) No. 5 I.T.W. Torquay, which had been due to close under the previous reorganisation but had not actually done so, was retained for P.N.B. trainees, but its capacity was reduced to 600.
- (c) No. 13 I.T.W. Torquay reduced to 600 pupils on 29 May.
- (d) No. 15 I.T.W. formed at Bridlington on 23 September with a capacity for 800 A.G.s.
- (e) The capacity of Nos. 18 and 19 I.T.W.s Bridlington, was reduced from 1080 to 800 on 24 May.
- (f) No. 16 I.T.W. formed at Whitley Bay on 1 October, capacity 800 W. Ops/A.G. and A.G.s.
- (g) No. 20 I.T.W. formed at Bridlington on 29 May, capacity 800 W. Ops/A.G. It moved to Usworth on 7 November.
- (h) No. 21 I.T.W. formed at Torquay on 29 May and moved to Usworth on 15 September and to Bridlington on 7 November, capacity 800 F.E.s.
- (i) The capacity of No. 14 I.T.W. Bridlington was reduced from 1,800 to 800 by 15 September.
- (j) No. 23 (French) I.T.W. formed at Filey Town on 1 October, capacity 800.

The fifth new unit, No. 22 I.T.W., was planned to open at Scarborough but opposition to the requisitioning of property postponed its formation and subsequent changes in requirements rendered it unnecessary. (3)

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- (1) A.M. File S.82330.
 - (2) LM.2223/D. of O.
 - (3) A.M. File S.91312.

On 1 May 1943 the aircrew camp at Ludlow was re-opened to carry⁽¹⁾ out the same purpose of training during the coming summer months; but as it was not possible to supply cadets from the A.C.R.C. it was decided to feed the camp with cadets from the A.C.D.C. Cadets on completion of their grading courses reported to the A.C.D.C. in the usual way and, after a few days during which time they had received their final aircrew classification, cadets, mainly navigator and bomber trades, were attached to Ludlow. The capacity was 2,500 and the duration of stay depended entirely on the A.C.D.C. requirements; it did not, in practice, amount to more than six weeks. The syllabus of training and camp construction remained unchanged.

The conception of this camp was excellent and there was no doubt that the time spent in the healthy activity at Ludlow instead of stagnation at Heaton Park was beneficial to the cadets. Unfortunately the cadets who were arriving at Heaton Park in the summer of 1943 were cadets who had commenced their I.T.W. training some six months earlier and consequently most of them had already passed through the Aircrew Camp the previous year as pre-I.T.W. cadets. They were therefore not very pleased to find themselves back at Ludlow again.

In the summer of 1943 the question arose as to whether or not Ludlow should be retained as a training camp for aircrew at some stage prior to the A.C.D.C. The conclusion was that as Ludlow was of limited use only, owing to the majority of the accommodation being tented, and therefore could not be used to any advantage during the winter, it should not be used for aircrew training. There had been a proposal to utilise Ludlow as a permanent overflow for the A.C.D.C. Heaton Park, but as this would involve the construction of permanent buildings at Ludlow, which was more difficult than building at Heaton Park or elsewhere, the proposal was not adopted.

On 1 October 1943 the camp was again closed for the winter months, though it was retained as an emergency home for units which might have had to be moved from the south coast. It was never subsequently used by the R.A.F. however and was turn over for⁽²⁾ use by the Army in the spring of 1944.

(1) IM 574/D. of O.

(2) A.M. File S.79415.

The I.T.W. organisation by the end of 1943 was as follows:-

<u>I.T.W.</u>	<u>Location</u>	<u>Capacity</u>	<u>Course Length</u> (Weeks)
No. 1	Babbacombe	800 P.N.B.	12
No. 2	Cambridge	800 P.N.B.	12
No. 3	Torquay	800 P.N.B.	12
No. 4	Paignton	800 P.N.B.	12
No. 5	Torquay	600 P.N.B.	12
No. 6	Aberystwyth	800 P.N.B.	12
No. 7	Newquay	800 P.N.B.	12
No. 8	Newquay	800 P.N.B.	12
No. 9	Stratford-on-Avon	800 P.N.B.	12
No.10	Scarborough	800 P.N.B.	12
No.11	Scarborough	800 P.N.B.	12
No.12	St. Andrews	800 P.N.B.	12
No.13	Torquay	600 P.N.B.	12
No.14	Bridlington	800 A.G.	6
No.15	Bridlington	800 A.G.	6
No.16	Whitley Bay	(500 WOP/A.G. 300 A.G.	8 6
No.17	Scarborough	800 P.N.B.	12
No.18	Bridgnorth	800 WO/A.G.	8
No.19	Bridgnorth	800 WO/A.G.	8
No.20	Bridlington	800 (WO/A.G. WOM/A.G.	8
No.21	Usworth	800 F.E./A.G.	6
No.23 (French)	Filey	(400 P.N.B. 400 WO/A.G.	12 8
Polish	Brighton	300 Poles	14
Total		10,800 P.N.B. 2,900 WO/A.G. & WOM/A.G. 1,900 A.G. 800 F.E./A.G. 800 French 300 Poles	
Grand Total		17,500 all trades	

In March 1944, Nos.14 and 15 I.T.W.s were renumbered as Nos. 18 and 19 respectively, while 18 and 19 were renumbered 14 and 15.

Over-production of N.B. categories

By mid 1943, although the P.N.B. scheme was proving a great success in the reduction of wastage in pilot training, one serious drawback was ventilated. This was the over-production of classified N. and B cadets. When the P.N.B. scheme was introduced total requirements were in the broad requirements of 50 per cent pilot and 50 per cent navigator and air bomber categories. It was assumed that 10 per cent of

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the I.T.W. output was either not eligible or nor desirous for grading, therefore the number of pilots required from grading represented 55 per cent of the graded personnel. In practice this proved an appropriate proportion in quality and F.T.S. wastage was considerably reduced. The estimated N.B. requirement, however, never materialised, chiefly owing to the R.C.A.F. increasing the output of navigators and air bombers.⁽¹⁾ This was further aggravated by the increased requirements for pilots. In order to reduce the N.B. surplus, the classification of pilots was raised to 75 per cent in May 1943 of the grading output. This, however, was an undesirable position as it was found that the increase of the percentage of pilot classification led to an increase in the wastage rates at later stages in training.

Another difficulty which arose as a result of the introduction of the P.N.B. scheme, was that there was a lack of flexibility. The A.C.S.B.s provided too many P.N.B. cadets and insufficient numbers of cadets for the air gunner and flight engineer trades. The expansion of the bomber force called for more non-P.N.B. categories with the result that the period spent on deferred service by non-P.N.B. personnel was shortening and recruiting difficulties were increasing, whilst the P.N.B. candidates were spending a longer period of time in deferred service. The fact that the non-P.N.B. categories did not have an opportunity to demonstrate their pilot aptitude also meant that valuable pilot material was being wasted.

New Proposals for Selection and Classification

In the summer of 1943 vigorous steps were taken to overcome these difficulties. It was realised that the whole system of aircrew selection and classification would have to be overhauled and drastically reorganised if these serious deficiencies in the system were to be overcome.⁽²⁾ On 6 June 1943, the Director of

(1) A.M. File S.82828.

(2) A.M. File S.82828.

Flying Training submitted a scheme whereby all aircrew candidates presenting themselves at the Aviation Candidates' Selection Boards, if accepted would merely be selected in the broad category of aircrew. This would not only allow all the available material to be examined systematically to ensure that only the most suitable personnel proceeded on pilot training but would enlarge the field of pilot candidates. By means of specially designed aptitude tests, it would also be possible to ensure that all other aircrew categories would be filled by the personnel showing the most promise in that particular category. It was pointed out that over 25 per cent of the aircrew personnel graduating at this time (June 1943) were qualified in a category other than the one in which they had been initially selected. This represented a great loss in time and training capacity as in nearly all cases the individuals were rejected having completed a substantial part of their training and their subsequent reselection meant their commencing the training in the new category at the beginning again.

The new scheme envisaged an aircrew receiving centre where, as before, cadets would proceed on call-up to be kitted, documented, etc., the stay being three weeks duration. From there all candidates would proceed to a Classification Centre (to be located in place of some of the existing I.T.W.s) where they would spend four weeks carrying out a common I.T.W. course. This common basic Service training for all categories of aircrew would be a great advantage over the old scheme. It was recognised that this step was desirable in order to foster a team spirit in aircrew personnel, as hitherto at no stage of their training prior to their Heavy Conversion Unit (or O.T.U.) were the different categories brought together and given a sense of their common objective. At this classification centre candidates would, by means of a series of aptitude tests and, for pilots, a grading flight test, be classified into the six basic aircrew trades (i.e. pilot, navigator, air bomber, wireless operator/air gunner, air gunner and flight-engineer). They would then proceed to a specialised ground training school (also located in the place of the old remaining I.T.W.s) where they

would combine the elementary specialised training in navigation, signals, armament, etc. with the balance of the I.T.W. syllabus. These schools would vary in course length according to the categories trained. From here the cadets would pass on into the normal machinery of the training scheme. On 6 August 1943 the Air Members for Training and Personnel approved the revised scheme in principle although the final details had yet to be worked out. They suggested that a committee be appointed to investigate these proposals for a change in policy and submit the detailed recommendations for final approval.

The Committee was formed and had its first meeting on 20 September 1943, three further meetings were held (on 27 September, 4 October and 8 October respectively) to discuss all details including the change over method to be employed so that there would be no interruption of the training pipe line during the change over period, and, as a result of these four meetings, a final report was issued which fully supported the new scheme.

Introduction of Shadow Selection

Whilst the new scheme was under discussion the procedure of selection at the A.C.S.B.s was revised as the first step towards the implementation of the scheme. The new scheme envisaged all aircrew candidates being selected in the broad category of aircrew, but for the time being at any rate this was impracticable owing to the adverse effect it would have on recruiting. On and after 19 August 1943, however, although the procedure was not radically altered and candidates continued to be accepted for P.N.B., wireless operator, air gunner or flight engineer duties, it was explained to the cadets that the particular category for which they were recommended at the A.C.S.B. was provisional only and that in spite of their personal preference, and the recommendation of the board, tests taken at an early stage of training might show that they were more suitable for some other type of airman training, and that the varying periods of deferment should be brought to a common period for all deferred airmen as soon as possible.

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Whilst it was acknowledged that the proposed system of classification of aircrew candidates was a definite improvement on the old system, there was considerable opposition to the scheme from the Air Officer Commanding-in-Chief Flying Training Command and the Air Member for Personnel.⁽¹⁾ Flying Training Command's main objections were on the grounds that a series of unproven scientific tests were not reliable enough to replace the old well-tried system of selection by experienced officers by interviews. The following cases were cited as examples of how the psychological tests were not infallible:-

- (a) A Royal Air Force officer who underwent certain tests at Regents Park (A.C.R.C.) He did so badly that doubts were expressed as to whether he could go forward for pilot training. Perhaps it was fortunate for him that his classification in the University Air Squadron had been 'outstanding'. Subsequently at every stage of his training as a pilot he received an assessment of either 'exceptional' or 'above average'. He was selected as an instructor in the U.S. Army Air Corps and received very high reports from them and was assessed 'above average' at his A.F.U.
- (b) An Army officer who had been Adjutant of two battalions of his Regiment and had been recommended by his Commanding Officer for the Staff College. When he underwent the so-called 'scientific tests' for the Army earlier in the war, he was recommended as being suitable for employment as 'a sanitary orderly or batman'.

In defence of the psychological tests it was pointed out that all the proposed tests were not merely a group of experimental tests; they were tried and found to be useful in the measurement of particular aptitudes. They did not claim to be infallible, but they did claim to be instrumental in selecting only the most promising material to be sent forward to Grading.

Criticism from the A.M.P. came only in so far as it affected the recruiting programme and he maintained it was essential to continue with the Shadow Selection Scheme. A meeting held by the A.M.T. on 11 November 1943 discussed these points and, after the scheme had withstood the onslaught from Flying Training Command and A.M.P., it was agreed to go ahead with the scheme.

(1) A.M. File S.82828.

The Revised Classification Scheme

The revised scheme, largely on the lines proposed by D. ^{F.T.}~~DE~~,
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was launched on 1 April 1944. The selection procedure remained unaltered, however, and the shadow selection methods were used at the A.C.S.B.s. The 30 existing A.C.S.B.s continued to accept candidates for P.N.B. (Pilot, Navigator and Air Bomber), Wireless Operator (Air), Air Gunner or Flight Engineer duties, but it was explained to the candidates that the particular aircrew category for which they were recommended at the A.C.S.B. was to be regarded as provisional only. The primary responsibility of the A.C.S.B.s remained that of ensuring that candidates were in general suitable for aircrew training. At the A.C.S.B.s time and facilities did not allow comprehensive measurement of aptitude, and the needs of the Service for each category were not precisely known at this stage. Thus, while classification in aircrew had to be provisional only, A.C.S.B.s retained the responsibility of deciding whether the candidate possessed the character, keenness, courage and temperament required in all categories of aircrew.

Several moves had taken place during 1943, but these were unconnected with the new scheme. Nos. 15 and 22 A.C.S.B.s moved from Oxford to Euston on 18 January, and Nos. 2, 12 and 21 all moved from Oxford on 19 June to Doncaster, Penarth and Birmingham respectively. Thus, by the beginning of April 1944 there were 30 Boards at seven centres:-

<u>A.C.S.B.</u>	<u>No. of Boards</u>	<u>Location</u>
Nos. 3, 11, 13, 14, 15, 22, 23	7	Euston
Nos. 4, 7, 9, 19, 20	5	Cardington
Nos. 1, 2, 8, 17, 18	5	Doncaster
Nos. 5, 6, 10, 30	4	Padgate
Nos. 21, 26, 27, 28	4	Birmingham
Nos. 16, 24, 25	3	Edinburgh
Nos. 12, 29	2	Penarth

As before, aircrew candidates, in the first instance, reported to an A.C.R.C., but the course was extended to six weeks during which time they were given basic training in general Service subjects and were kitted, medically examined, inoculated and vaccinated.

During the first and second weeks they received, through the medium of lectures, pamphlets and talks with their flight commander

(1) See Appendix 5.

a full explanation of the programme to be followed during their stay at the A.C.R.C.

During the third week of the cadet's stay at an A.C.R.C. he was given a series of aircrew aptitude tests:-

- (a) General (intelligence, education ability, etc.)
- (b) Mathematics
- (c) Mechanical comprehension
- (d) Instrument comprehension
- (e) Observation
- (f) Co-ordination
- (g) Auditory Morse Code

These tests were completed by the individual cadet in two consecutive days. All cadets were given all the tests and the results of the individual cadets expressed in such a way as to show his aptitude for training in each of the six basic aircrew categories of pilot, navigator, air bomber, wireless operator, flight engineer and air gunner. These results were forwarded to a central classification section at No. 54 Group where assignment of cadets to categories was made.

After these tests and for the remainder of his stay at the A.C.R.C. the cadet received basic training in drill, discipline, R.A.F. law, administration and organisation, mathematics, signals, and in the use of weapons. Organised games, physical training, and swimming were also carried out.

During the last week at A.C.R.C. cadets were informed of their categorisation, and on finishing the A.C.R.C. course, those cadets showing the most pilot aptitude proceeded to an E.F.T.S. where they carried out a flight test, and from there those selected for pilot training proceeded to a pilots' I.T.W., the remainder and those not passing through the E.F.T.S. proceeded to an I.T.W., appropriate to their particular trade.

The reception facilities therefore had to be considerably extended. The doubling of the course length meant that accommodation was required for 8,000 cadets, and this could only be provided by opening a second A.C.R.C. It had been proposed that the A.C.R.C. London should be closed and two new centres opened in the accommodation vacated by the I.T.W.s in Scarborough and Torquay, but,

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owing to the invasion of the continent at this time, all accommodation on the south coast was needed by the Army and consequently continued use was made of the London A.C.R.C., the second centre opening at Scarborough. Under this reorganisation, which took place on 1 April, the A.C.R.C. London was numbered No. 3 A.C.R.C. and the new centre at Scarborough No. 6 A.C.R.C. Each centre was divided into Reception and Classification Wings:-

<u>A.C.R.C.</u>	<u>Location</u>	<u>R.C.W.</u>	<u>Capacity</u>
No. 3	Regents Park	No. 30	1,250
		No. 31	1,250
		No. 32	1,250
		No. 33	1,250
		No. 34	600
			<u>5,600</u>
No. 6	Scarborough	No. 35	1,200
		No. 36	1,200
			<u>2,400</u>

Pilot candidates were attached to grading schools for approximately four weeks during which time they carried out 12 hours flying and were tested. Before proceeding to grading schools all cadets were told of their selection to take a flight test and at the same time were given a second category to which they were classified if they were not chosen for pilot training. On finishing the flying tests, the cadets proceeded on two weeks leave whilst their reports and test results were forwarded to No. 54 Group for classification. Cadets were notified of their classification and instructed to report to an I.T.W.; those selected for pilot training proceeding to Pilot I.T.W.s, other cadets were posted to I.T.W.s appropriate to their second category.

Further Changes in I.T.W. Organisation

The I.T.W.s underwent vast changes under the revised classification scheme. They specialised in types of cadets trained, and courses were altered in length to deal with the specialised training. The grading test now preceded the I.T.W. course, thus all cadets were classified before arrival at I.T.W. Much of the training in these I.T.W.s remained common to all wings, but the emphasis in this training could, at the same time, be made appropriate to the particular category of aircrew concerned. Even so an overall reduction was effected and requisitioned properties were relinquished at Cambridge, Aberystwyth, Stratford-on-Avon, St. Andrews, Whitley Bay and Usworth, while accommodation in / the

the Torquay-Paignton-Babbacombe area, which was to have been one of the new A.C.R.C.s was loaned to the Army for accommodation of personnel engaged in the liberation of Europe.

Under the new scheme I.T.W. training for pilots was centralised at Newquay; Bridgnorth was used for the training of navigators, air bombers and air gunners; Bridlington for wireless operators; and flight engineers were trained at Cranage. All the existing I.T.W.s were closed during the spring of 1944 (No. 16 on 1 February; Nos. 3, 4, 5 and 13 on 1 March; Nos. 10, 11 and 17 on 1 April; Nos. 12, 14, 15, 18, 19 and 21 on 21 April; Nos. 6, 7 and 8 on 1 May; No. 2 on 17 May and No. 9 on 25 May) and were replaced by the following:-

<u>I.T.W.</u>	<u>Formed - 1944</u>	<u>Capacity</u>	<u>Course Length - Weeks</u>
No. 40 - Newquay	10 May	1,150 Pilots	8
No. 50 - Bridgnorth	1 June	825 Navigators) 425 Air Bombers)	8
No. 70 - Bridlington	21 April	1,800 Wireless Operators (Air)	6
No. 80 - Bridgnorth	21 April	1,200 Air Gunners	6
No. 81 - Bridgnorth	21 April	1,000 Air Gunners	6
No. 82 - Bridgnorth	21 April	1,800 Air Gunners	6
No. 90 - Cranage	10 May	1,100 Flight Engineers	6

The capacity vacated at Scarborough was utilised to form No. 6 A.C.R.C.; and with the exception of those places already mentioned above, the old locations of the I.T.W.s were used for the new wings. Owing to the temporary nature of the large air gunner training commitment (4,000 - reducing to 2,500 in June 1944) one of the air gunner I.T.W.s (No. 82 I.T.W.) was formed merely on a temporary basis, and was disbanded in June, thus enabling the combined navigator/air bomber I.T.W. which was not needed until June 1944, to form in its place. The air gunner capacity requirement of 2,500 was met by reshuffling the two remaining air gunner wings. In July 1944, however, the Air Gunner requirement was again reduced thus allowing No. 81 I.T.W., which had temporarily

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expanded by 300 personnel, to resume its former size. This uncertainty of the air gunner training requirements was due largely to fluctuating crew requirements of air gunners for the V.L.R. Force (Liberators, Lancasters and Halifaxes to be used in the Pacific theatre of war). The Polish I.T.W., which had moved from Brighton to Croughton on 31 May 1944, continued training under the old system (with 300 pupils on a 14 weeks' course). No. 23 I.T.W., training 800 French pupils at a time on a 12 weeks' course, also continued unchanged.

The new scheme came into effect on 1 April 1944, when the first intakes entered the new A.C.R.C.; the first intakes to the new I.T.W.s were six weeks later. The I.T.W. course for pilots, navigators and air bombers was of eight weeks' duration, and courses for the remaining trades of air gunner, flight engineer and wireless operator were six weeks. On completion of the I.T.W. course, cadets proceeded on their training courses as before. That is, those proceeding overseas went to the A.C.D.C., whilst those training in the United Kingdom proceeded directly to their next training school.

Cadets who, for any reason, were at A.C.R.C. considered unclassifiable were posted to the Reselection Wing of the Combined Reselection Centre, Eastchurch. This Reselection Wing which was formerly located at Brighton, moved to Eastchurch on 1 May 1943, where it was combined with the suspended Aircrew Section from the Personnel Depot, Blackpool, to form the new centre. Those failing to reach the required standard at I.T.W.s were also forwarded to the C.R.C. Eastchurch. In cases where a reselection board considered that a cadet who was suspended at A.C.R.C. or I.T.W. was still temperamentally suitable for aircrew duties, the cadet was forwarded to A.C.R.C., where he proceeded to a special wing and was interviewed by the advisory officer who, together with the officer i/o classification, decided the future category of the cadet.

/ Suspension

Suspension of P.N.B. Entries

When the new classification scheme was launched there were wide variations existing in the periods spent on deferred service by the different categories of potential aircrew personnel. The P.N.B. categories spent roughly twelve months on deferred service whilst the non-P.N.B. categories of air gunner, flight engineer and wireless operator were only a few weeks on deferred service. Although under the new scheme the aim was to have a common period of deferment for all categories, this was made difficult by the fact that those personnel enlisted before the introduction of the Shadow Selection Scheme of August 1943 enlisted on the understanding that they would be trained in a certain defined category (either P.N.B., A.G., W.Op./A.G. or F.E.) and therefore difficulties would arise with the P.N.B. cadets who would be classified into a non-P.N.B. trade at A.C.R.C.⁽¹⁾ One particularly awkward point was the diversion of recruits from the P.N.B. category in which they were paid at a rate of 7s. 3d. per day whilst under training to the air gunner category whose corresponding rate of pay was 3s. 0d. per day.

With the reduction of the training organisation due to favourable developments in the war and the consequent reduction and revision of requirement in the numbers now entering the training pipe line, the position became further aggravated. As a result of the revised requirements, P.N.B. trade requirements were virtually suspended since there were enough in the pool of P.N.B. personnel held at the A.C.D.C. Heaton Park, to meet immediate requirements; entries into the non-P.N.B. trade, however, continued. This meant that the deferred service period for P.N.B. personnel was likely to extend to 18 months or more.

In the National interest it was not practicable to have large numbers of fit young men on inactive service at a time when there were so many claims on the available supply of manpower, so it was ruled

(1) A.M. File S.82828.

that the new system of classification should also be applied to those cadets who were enlisted by August 1943.⁽¹⁾ It was applied to all such cadets not finally classified as P.N. or B. (i.e. all those who had not yet taken a grading course and classified by the A.C.C.B.) whether on deferred service or under training at an A.C.R.C., I.T.W. or A.C.D.C., or undertaking a P.A.C.T. course. 50 per cent of those undertaking a P.A.C.T. course or on deferred service were classified non-P.N.B. under the revised scheme, thus considerably reducing the deferred service period. They were given the option of declining classification on the new basis and those who declined were released for service with the Army or Navy, or the Ministry of Labour. All cadets enlisted before 19 August 1943 were required to complete a pro forma stating that they were willing (or unwilling) to serve in any capacity of aircrew. In actual fact less than 3 per cent of these personnel opted for their discharge from the Royal Air Force. Owing to the former pledge given to U.A.S. cadets when they were attested for P.N.B. categories, these personnel were not normally classified outside the P.N.B. trades.

University Air Squadron and Air Training Corps Personnel

Under the new scheme University Air Squadron candidates in possession of a proficiency certificate reported for duty with the R.A.F. at one of the A.C.R.C.s for the full six weeks' course. Because they had already completed an equivalent to the P.N.B., I.T.W. syllabus, special emphasis was given to General Service Training. U.A.S. cadets took all the standard tests and those selected for pilot training underwent the grading test in the usual way. Those not classified as pilots, however, were only available for the navigator and air bomber categories. These U.A.S. personnel did not proceed to I.T.W.s after classification but were posted direct to the following stage of training.

Air Training Corps cadets holding proficiency certificates were called to the A.C.R.C. in the normal way and underwent the aptitude tests. They were classified and posted to I.T.W. in the

(1) A.M. File S.99180 and A.C. 15/44.

same way as the other direct entry cadets. At the I.T.W., however, they were given the opportunity to take the final examination at an earlier stage in the course, thus, if successful, accelerating their training.

Soon after the introduction of the revised scheme, the future of the U.A.S. courses and the A.T.C. organisation came up for consideration. By this time it had become obvious that the services rendered by the A.T.C. were such that the possibility of their continuing as a permanent feature of the R.A.F. organisation could not be ignored. The A.T.C. Standing Committee which had been charged with the task of examining the future of this Corps had recommended that the post-war A.T.C. should comprise candidates both for aircrew and ground duties and should be related in size to the intake requirements of the R.A.F. and its reserves, though it should leave due scope for entry to the Service from other sources. This was accepted, but there was some doubt about its future status. Should it be regarded as an auxiliary to the R.A.F. or was it properly to be regarded as the Air part of the Youth Organisation? The Cabinet attitude on this point was that while the A.T.C., in common with the Army and Navy Pre-service Organisations, was an integral part of the Youth Services, the Ministry of Education did not contemplate linking pre-service training in any way with compulsory part-time training, and were satisfied that control of cadet organisations, including the A.T.C., should remain with parent departments. ⁽¹⁾

A history of this nature would not be complete without some indication of the value of this cadet movement. A census taken in each of the years 1943, 1944 and 1945, analysing the aircrew candidates accepted by Aviation Candidates Selection and Medical Boards and comparing the overall percentage of acceptances for aircrew training and the percentage of acceptances for

(1) M.11(44) dated 31 October 1944.

(1)

ex-A.T.C. cadets, clearly shows the value of the Air Training Corps.

In 1943 a total of 72,800 candidates were accepted by the A.C.S.B.s as potential members of aircrew, roughly 18,000 of these personnel were serving airmen remustered to aircrew duties, leaving a total of some 54,800 direct entry personnel.

The total number of candidates appearing before the A.C.S.B.s during 1942 was 105,000, of which 37,000 had served in, or were members of, the Air Training Corps. The total number of candidates accepted for aircrew who had not served in the A.T.C. was 30,800, that is, less than half of the applicants. The number of A.T.C. cadets accepted, however, amounted to 24,400 candidates, or roughly, two-thirds of the A.T.C. candidates. The numbers of candidates rejected on medical grounds were approximately the same in both cases - just over 12 per cent - thus demonstrating the lower educational failure rate for A.T.C. personnel.

Although the university courses had also proved their worth, their status was also revised. Five squadrons (at Cardiff, Exeter, Hull, Reading and Sheffield) had already been closed in August 1943 through lack of candidates but, in spite of this, pupils from universities still had to wait between 6 and 10 months

(1)

	TOTAL ACCEPTED FOR AIRCREW		PERCENTAGE ACCEPTED				PERCENTAGE REJECTED			
	ALL ENTRIES PERSONNEL (including A.T.C. Cadets)	A.T.C. CADETS	P.N.B. CATEGORIES		NON-P.N.B. TRADES		EDUCATIONAL		MEDICAL	
			Overall (including A.T.C.)	A.T.C. CADETS	Overall (including A.T.C.)	A.T.C. CADETS	Overall (including A.T.C.)	A.T.C. CADETS	Overall (including A.T.C.)	A.T.C. CADETS
1943	54,800	24,400	18.4	32.0	33.8	34.0	35.4	21.7	12.4	12.3
1944	22,000	12,200	10.0	18.1	33.9	36.7	44.0	32.3	12.1	12.9
1945 (1 Jan. to 31 Aug.)	885	763	9.5	15.6	3.2	5.2	83.1	72.8	4.2	6.4

before the commencement of their training, and it could be reasonably be assured that these personnel would not be qualified in time to be engaged operationally in the war.⁽¹⁾ It was obviously uneconomical to provide university training for personnel who were not interested in making the Royal Air Force their career; on the other hand, at this stage of the war, it was quite impossible to lay down the post-war requirements of the Air Force. This meant that candidates could not be given definite assurance regarding their future prospects in the R.A.F. It was, however, necessary to maintain a flow of suitable candidates for permanent commissions in the R.A.F. in order to ensure a proper age distribution. In October 1944, therefore, the scheme was revised. The intake of cadets was considerably reduced and selection was limited to candidates who were genuinely interested in service in the post-war air force and, providing they were prima facie suitable for the grant of permanent commissions and assessed as suitable for training as pilots. The course length was extended from the existing period of 23 weeks (with 10 days break) to one academic year, i.e. October to June. University instruction was given during the three university terms (each eight weeks) and air squadron instruction given in the Christmas and Easter vacations with flying instruction in the long vacation. Courses continued to be either of a semi-technical character or a general arts course and⁽²⁾ their cost borne by the Air Ministry.

(1) A.M. File S.103602.

(2) A.C. 53 (44).

The Abandonment of the Pre-Aircrew Training (P.A.C.T.) Scheme

The reduction of aircrew requirements in 1944 also brought to an end the Pre-Aircrew Training Scheme. The supply of volunteers was exceeding the demand and numbers on deferred service began to increase. The fairest and most beneficial way of reducing aircrew acceptance was to raise the medical and educational standards, and this meant that the P.A.C.T. scheme, which had been introduced with the sole object of making up any educational standards in aircrew candidates, was now redundant. The decision to discontinue the scheme was taken in September 1944 and no further intakes were accepted after that time. Centres were closed as courses terminated and the scheme finally finished on 9 February 1945. A number of changes in the P.A.C.T. organisation had taken place before September; on 1 January four centres were closed and their schools and colleges transferred to other centres (No. 12 became a satellite of No. 1; No. 4 was split between Nos. 3 and 5; No. 18 became a satellite of No. 8; and No. 21 became a satellite of No. 13); on 16 June Ealing Technical College under No. 13 centre was closed; on 1 July the schools at Worcester broke away from No. 14 Centre to become No. 23 P.A.C.T. Centre; and No. 20 Centre disbanded on 14 July, followed a week later by the closure of No. 15. These changes, however, were caused chiefly by accommodation difficulties, enemy bombing or congestion at the college and were not intended to reduce the size of the scheme. After the decision to close the scheme was taken, the centres were disbanded.⁽¹⁾

(1) See Appendix 6.

From observations made at the various stages of training, it was agreed that the aim of the P.A.C.T. scheme, to raise the educational standard of aircrew candidates who would have otherwise been unacceptable, was achieved. It's success was due largely to the close co-operation of Service personnel with the principals and educational staffs of the colleges, schools and institutes. During the life of the scheme the total number of intakes amounted to some 9,904 cadets, of which 9,676 were posted to I.T.W.s, which meant that the wastage was less than $2\frac{1}{2}$ per cent.

The Cessation of Recruiting

By June 1944 the size of the deferred service list, ⁽¹⁾ which was growing longer as the measures to reduce intakes into training took effect, was causing serious concern, especially as the Army were clamouring for recruits now that it was fighting on the continent. It was inevitable, therefore, that some of the R.A.F. surplus should be transferred to the Army, and in June 1944 the Minister of Labour decided that 10,000 men on the R.A.F. deferred service list should be transferred and as many others as possible released from industry. The deferred service list was to be reduced to not more than 5,000. Although the need for this decision could not be denied, it was realised that the transfer of keen, specially selected personnel, trained in their own time with the help of voluntary instruction and public bodies who had given unstinting of their efforts in the

(1) See Appendix 7.

belief that in fitting young men for aircrew they were performing an urgent public service, would be an extremely unpopular move, but this had to be accepted as one of the consequences of war.

An analysis of the aircrew deferred list made at the beginning of July 1944 showed that out of a total of 34,000, some 19,000 were not immediately available for recall because they were specially deferred by the Ministry of Labour, under age, or for some other special reason. It was estimated that by December 15,000 of these 19,000 not readily available would be available; thus giving a total of 30,000 out of the 34,000. In order that the most suitable men were retained for aircrew duties, arrangements were made to call up these men for a few days and have them tested and classified with the object of keeping the most suitable and making the remainder available for the Army and the Ministry of Labour, and by the end of the year 10,000 men had been made available for the Army and a further 5,900 for industry from the deferred list.

This reboarding of civilian deferred P.N.B. candidates arose as an urgent problem and the selection machinery had to be adjusted in order to select those who were to remain in the Royal Air Force. This situation therefore gave opportunity to experiment or modify the procedure for acceptance at A.C.S.B.s and on combining the interview procedure with the A.C.R.C. scheme

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for aptitude testing and centralised classification. All personnel were called up to A.C.R.C. for four or five days, when they carried out the full battery of aptitude tests normally carried out at A.C.R.C. In addition, they were each interviewed personally by an experienced interviewing officer. A medical examination was also carried out and then, dependent on the results of these three factors - medical suitability, the interview and the cadet's aptitude - the final selection was made. Those who were to be retained in the Royal Air Force continued on their deferred service until called up to commence their initial training. Those discharged from the Royal Air Force also returned home and were then at the disposal of the Ministry of Labour. This reboarding process easily solved the practical problem of the Service and at the same time enabled significant advances to be made in the selection procedure.

The reduction in recruiting meant that many selection boards and centres could be disbanded and others amalgamated. The capacity of these selection boards was reduced from a weekly total capacity of 3,750 candidates at the beginning of the year to six boards with a total capacity of 750 candidates by January 1945. Details of the closures are as follows:-

<u>A.C.S.B.</u>	<u>Disbanded</u>
No. 9 - Cardington) No.19 - Cardington) No.20 - Cardington) No.15 - Euston) No.21 - Birmingham)	18 April 1944
No. 2 - Doncaster	25 May 1944
No.26 - Birmingham) No. 4 - Cardington) No.24 - Edinburgh) No.23 - Euston) No.10 - Padgate) No.30 - Padgate) No.12 - Penarth) No.18 - Doncaster)	28 August 1944
No.29 - Penarth	25 September 1944
No.25 - Edinburgh) No. 8 - Doncaster) No.17 - Euston) No.22 - Euston) No.14 - Euston)	1 November 1944
No. 7 - Birmingham) No.27 - Birmingham) No.28 - Birmingham) No.16 - Edinburgh)	29 January 1945

This left only Nos. 1, 5 and 6 A.C.S.B.s at Doncaster, and Nos. 3, 11 and 13 at Euston.

Revised Selection Procedure

In February 1945, a sub-committee appointed to review the selection procedure for applicants for aircrew duties submitted a report recommending the formation of a combined centre for the functioning of initial selection, educational and aptitude testing, and final classification procedure. (1)

The proposed scheme envisaged the existing A.C.S.B.s, the classification section of No. 3 A.C.R.C., and aptitude testing section of No. 7 A.C.R.C. being combined into one centre to be known as the Aircrew Selection Centre (A.C.S.C.). The new centre was to be organised to deal with an intake of 100 candidates per day (i.e. 600 per week) each intake would remain at the centre for 5 or 6 days. The scheme called for three main sets of information on the candidates - educational suitability ratings, aptitude indices, and interview ratings. Final acceptance or rejection would be by a Service board. This final board would meet when all the reports were available and then decide on selection and classification.

At this time there was also a proposal to combine the A.C.R.C. and I.T.W. training, and it was necessary to co-ordinate these two schemes to ensure that no additional personnel and accommodation was required. It was therefore impossible to approve the new selection proposals until the combined A.C.R.C./I.T.W. scheme had been agreed. In March 1945, the scheme for a combined A.C.R.C./I.T.W. was approved whereby new schools known as Initial Training Schools (2) were established.

The revised selection procedure was therefore agreed in principle. Henlow was suggested as a site for the

/ new

(1) A.M. File A.767848/45.

(2) A.M. File A.767848/45.

new centre, but this was not considered a suitable location owing to the flying activities carried out there, the noise of which would interfere with the aptitude testing section. Bridgnorth was finally selected and on 16 June 1945, the Classification and Aptitude Sections of No. 7 A.C.R.C. Torquay were moved to Bridgnorth. These two units known as the Aircrew Selection Centre (A.C.S.C.) had a weekly maximum capacity of 620 cadets, of which 60 were Fleet Air Arm personnel. The A.C.S.B.s however continued to function, but as the end of the European war had drastically reduced aircrew intakes, these boards accepted very few direct entry aircrew.

Nos. 1 and 5 A.C.S.B.s at Doncaster were disbanded on 15 June and No. 6 was transferred to Euston. Thus Euston, with four boards and a capacity for 500 recruits a week, dealt with all entries. The main activities were confined to the selection of glider pilots on behalf of the Army and aircrew personnel on behalf of the air forces of the allies. The newly formed A.C.S.C. therefore did not carry out initial selection, but tested and classified personnel from the university courses, the deferred list, and Fleet Air Arm personnel.

In September 1945, all direct entries for aircrew duties were suspended.⁽¹⁾ A new policy was formulated whereby all aircrew trainees were drawn from the ranks of serving airmen. This meant that all direct entry volunteers were required to serve first in a ground trade before being called forward to commence their

(1) See Appendix 8.

aircrew training, possibly up to a period of two years. The revised scheme, proposed some six months before, assumed that cadets would enter aircrew training soon after taking their aptitude tests, but this ground employment would nullify to an extent the findings of the aptitude tests; thus when the final classification came to be made the aptitude tests would be of little or no value. It was therefore decided that civilian applicants for aircrew training would, on the understanding that they were first to be required for a period of ground employment, be assessed and interviewed by an A.C.S.B. Successful applicants were accepted for ground employment in any trade open to recruiting for which they were considered suitable, and they were included in due chronological order in the roster of serving airmen awaiting aircrew training. Approximately one month before his aircrew training was due to commence the airman was called before the A.C.S.C. (later renamed the Air Crew Classification Centre (A.C.C.C.) and was required to undertake aptitude tests to confirm his suitability for training and for allocation to the aircrew category for which he was most suited. After successfully completing their aircrew training, these personnel were required to undertake a period of regular and reserve service, probably three years regular service followed by four years on the reserve.

Reduction of I.T.W.s

The reduction of intakes had its effect at the I.T.W. stage, and in August course lengths were extended to 12 weeks at the pilot, navigator and air bomber I.T.W.s and to eight weeks at the remainder. At the same time the capacity at four of the six wings was reduced

(No. 40 to 850, No. 70 to 1,200; No. 81 to 600 and No. 90 to 900). In October all intakes for I.T.W. training except for a few cadets for air gunner training were frozen; all I.T.W. training was concentrated at Bridgnorth and a nucleus set up there to deal with 1,150 cadets of all categories, and the remaining I.T.W.s closed:-

<u>I.T.W.</u>	<u>Disbanded - 1944</u>
No. 81 - Air Gunners	4 October
No. 90 - Flight Engineers	28 October
No. 70 - Wireless Operator	21 October
No. 40 - Pilots	27 November
No. 80 - Air Gunners	27 November

On 25 December 1944, as a result of the large accumulation of cadets in I.T.W.s, the capacity of Bridgnorth was reduced to 200 cadets on a six weeks' course together with a reception wing of 900. The I.T.W.s⁽¹⁾ for French and Polish personnel continued to function independently.

The A.C.R.C. organisation was also reduced - from a total capacity of 8,000 in August to 4,600 by October and to 1,210 by December. Nos. 30 and 34 R.C.W.s moved from Regents Park to Torquay and No. 3 A.C.R.C. disbanded on 2 September; No. 36 R.C.W. of No. 6 A.C.R.C. was disbanded on 30 October and No. 6 itself was disbanded on 25 December. By the end of the year A.C.R.C. capacity was as follows:-

No. 30 R.C.W. Bridgnorth (moved from Torquay)	- 700 cadets
No. 7 A.C.R.C. Torquay	- 510 cadets

The A.C.D.C. at Heaton Park was retained but became a holding pool for A.C.R.C. pupils awaiting I.T.W. training.

(1) The French I.T.W. at Filey moved to Starry Down on 27 November 1944.

Stormy?

In March 1945 the proposal to combine the A.C.R.C. and I.T.W. courses was agreed in principle. The combined course, which was to be of 10 weeks duration and would be followed by a four weeks grading course, was to be known as an Initial Training School. The requirements for Stage II were estimated at a total of 2,600 A.C.R.C. and 4,020 I.T.W.: the proposed combined course would reduce the capacity to approximately 4,500.⁽¹⁾ With the end of the war in May, however, and the uncertainty of the future size of the post-war training organisation, this question was held in abeyance and the basic ground training set up at the end of the war⁽²⁾ was as follows:-

Classification Section (Torquay No. 7 A.C.R.C.)	- 510
No.30 R.C. Wing, Bridgnorth (known as the A.C.S.C.)	- 900
No.50 I.T.W. Bridgnorth	- 200

(1) A.M. File S.104747.

(2) A.M. File A.767849/45.

CHAPTER 2

BASIC TRAINING OF PILOTS

The Training Organisation in 1934

The character of pilot training in the R.A.F. was initially set by the requirements of the 1914-18 war. These requirements were: complete mastery of the aircraft so that it could be fully and competently used in combat; the ability to shoot and air pilotage or the ability to find one's way about, even at night or in bad weather, over fairly short distances. These, it should be observed, are characteristic requirements for one or two seater aircraft of short range.

Two other factors entered into R.A.F. pilot training. One was the conception of what may, perhaps, be called the 'universal pilot' - a man who could fly, with equal competence, all Service types. The other was specialisation by pilots on certain technical duties. 'It is not sufficient to make the air force officer a chauffeur and nothing more.' (Lord Trenchard)

Thus in 1934, the aeroplane was virtually a one man machine. The pilot was responsible not only for the piloting of the aircraft but also for navigation and sometimes bombing and gunnery. The only other air crew personnel were air gunners who carried out only part-time duties and were selected and trained by the squadrons themselves from their ground tradesmen⁽¹⁾. The R.A.F. trained approximately 300 pilots per year prior to 1935, and although in those days it was largely occupied with training, the R.A.F. had only a bare minimum of schools. The ab initio training was carried out either at the R.A.F. College at Cranwell, or at a Flying Training School (F.T.S.), but these schools were expected to do little more than give the pupils a brief introduction to the military aspect of flying, which was given later in squadrons. Thus the F.T.S.s and the R.A.F. College merely turned out pilots with the bare ability to fly an aeroplane; all the individual Service training had to be done in operational units. This system tended to produce individual training schemes which virtually turned every unit into a miniature training establishment.

(1) In the 1914-18 war, air gunners were known as air observers, but the title was dropped at the end of the war, and ground tradesmen carrying out gunnery duties were called air gunners.

Flying Training Schools taught pupils ab initio on a ten months' course: flying was done entirely on single-engined aircraft, twin engine training at schools having been abandoned in 1931 because so heavy an aircraft as the Vimy, if used immediately after elementary instruction on an Avro, often produced pilots who were not sound on aircraft with light, accurate and even controls. Pilot navigation (or air pilotage) was taught; armament instruction was theoretical, and ground training was concerned with basic all-round knowledge.

The Flying Training Schools were No. 3 at Grantham, No. 5 at Sealand, and No. 4 at Abu Sueir in Egypt: No. 2 at Digby was closed in December 1933. There was also the training base at Leuchars, which taught officers from the Navy and Army, and dealt with the special requirements of carrier-borne aircraft. Each school turned out some eighty pilots a year. In addition, the Royal Air Force College at Cranwell trained small numbers of cadets in practical flying on a two years course.

The pilots proceeded direct to squadrons from the F.T.S. except those selected for specialist courses, and although the individual proficiency achieved by pilots under this system was high, it was slowly attained: it was a year or more after leaving the flying training school before a man became a fully competent military pilot. The corporate efficiency of squadrons was correspondingly low: each was diluted with pilots who were still learning the fundamentals of their work.

In addition to these F.T.S.s there were various specialist schools in operation giving instruction in navigation and conversion courses for pilots destined for Army and Naval Co-operation Squadrons. Further navigation training (except for flying boat pilots) was given in squadrons by pilots who had taken a course at the School of Air Pilotage at Andover. Practical armament training was also a matter for squadrons: annual visits were made to the Armament Training Camps

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for practical experience. Conversion to the squadron's type of aircraft, and the teaching of night flying, were also matters for the squadron: each flight of a twin engine squadron was supposed to have a flying instructor trained at the Central Flying School.

The amount of individual training added to the Flying Training School's foundation varied according to the type of squadron. Fighters and short range day bombers, for instance, needed considerably less than flying boats or night bombers. Flying boat pilots had to learn the handling of their type of chart-board aircraft, navigation, and the captaincy of a crew; night bomber pilots had to have much the same knowledge; while pilots of short-range day aircraft had no need for twin-engine flying, night flying or long distance navigation. The individual training done by a squadron had to be dealt with, to a large extent at least, before the squadron's corporate training as a fighting unit could begin.

In general, the types of aircraft in Service use made comparatively light demands on pilots; no squadrons were armed with monoplanes; elaborate cockpit drills were still in the future; there was little Service need for instrument and bad weather flying; night flying and long distance navigation were needed only by five bomber squadrons and twenty-four flying boats. The quality of recruits presented few problems: the numbers required were small, and pilots could be chosen with care either from civil life or from serving airmen. Specialist matters such as armament and navigation were regarded as particular aspects of a pilot's general equipment, and the specialist officers concerned with them were junior and only advisory to the main trend of policy on ^{both} ~~other~~ operational requirements and training.

(1)

This then was the training organisation in 1934.

A comfortable axiom that Britain 'was not likely to be involved in a major war within ten years' meant that there was no set date by which squadrons had to be fully ready for war, and no urgent time limit within which individual pilots must reach an operational standard of proficiency.

(1) The R.A.F. Training Organisation in 1934 was as follows:-

Ab Initio Training (10 month's course)

No. 3 F.T.S. Grantham	}	Short Service Commission personnel and airmen pilots
No. 4 F.T.S. Abu Sueir		
No. 5 F.T.S. Sealand		

R.A.F. College, Cranwell - Cadets and University entrants

Training Base, Leuchars - Attached Army and Naval officers

Specialist Training

School of Army Co-operation, Old Sarum
School of Naval Co-operation, Lee-on-Solent
Air Pilotage School, Andover (13 weeks' course)
Flying Boat Training Squadron, Calshot (29 weeks' course)
Navigation School, Calshot (7 months' course)
Coast Defence Training Unit, Gosport

Instructors Training

Central Flying School, Upavon

Reserve Training

4 Civil Schools - Hatfield, Filton, Hamble, Brough

The more training done in squadrons the less was the cost of the Air Force: if operational units did the work of schools there was no need to pay for schools as well as a 'first line'. Moreover, (1) the squadrons were kept usefully and profitably employed.

The price of this economy was paid in unreadiness and time: unreadiness because each squadron had pilots at various stages of military competence, and time because it had to deal with the training both of its pilots as individuals (without the specialised equipment of a school) and of itself as a fighting unit. Another aspect of the economy of squadron training was that experienced men were both teachers of young pilots and mainstays in war.

Reorganisation of Training

When in 1934, expansion began with the introduction of Scheme 'A', pilot training came under review. The existing system of pilot training was unsatisfactory in several ways: firstly, the pilots were below the requisite standards of the squadrons on leaving their F.T.S.; secondly, consequent upon this, the squadrons had to spend a good deal of their time in training their new pilots and were not therefore fully operational; and lastly, the existing training scheme bore no resemblance to that which would be required in War.

In July 1934, Air Marshal Sir John Higgins (Chairman of Armstrong Whitworth Aircraft Ltd. and A.V. Roe & Co. Ltd.) put to Air Marshal Bowhill (Air Member for Personnel) a suggestion that Air Service Training (a company with which he was associated) should undertake preliminary training and pre-selection of pilots before they entered Service

(1) This tendency to transfer the responsibility for training on to squadrons had reached its peak in 1927. In order to increase the output of pilots without enlarging the training organisation, 15 regular squadrons were selected to carry out ab initio training of pilots.

(1)
Flying Training Schools. A similar suggestion had been investigated and turned down about ten years before, and the first reaction to Sir John Higgins' proposal was unfavourable: training at civil schools (for Air Service Training could not be a single chosen instrument) might not satisfy Service requirements, any corollary shortening of the F.T.S. course would be undesirable because F.T.S. training was already below squadrons' requirements, and it was likely that the use of civil schools would mean extra cost.

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In October 1934, however, Air Commodore Tedder (Director of Training) brought the possibility of using civil schools into his review of the peace and war training systems, and incorporated their use in proposals for complete reorientation of the training system. (2) This review had two main aims, firstly establishing a training system in peace time which should not require radical alteration in war time, and secondly, reorganising the existing system so as to relieve squadrons of basic individual training and so allow them to give attention to collective flight and squadron training.

(1) A.M. File S.34816.

(2) The civil schools were already carrying out ab initio training for entrants into the reserve and this substantially covered the first stage of training at the Service F.T.S.s. The civil schools' course lasted approximately 70 days and provided 50 hours flying on an elementary type. The F.T.S. course lasted a year in three stages:-

- (a) Flying training on an elementary type.
- (b) Flying training on a Service type.
- (c) Service training in air warfare.

The proposal was that ab initio flying training should be done at civilian flying schools and applied flying on Service types at the existing flying training schools. ⁽¹⁾ In the first instance the new entry would go to a civil flying school for an ab initio flying course corresponding to the courses which were given to the Class 'A' Reserve; the object of this course was to train them in flying up to a standard at which they would be ready to begin training on Service types of aircraft. This course gave 50 hours flying including cross-country and instrument flying and 70 days was the proposed duration of the course.

On successful completion of the civil school course the pupils would then be posted to the R.A.F. Depot, Uxbridge, where they would be given disciplinary and administrative training and, in the case of short service commission personnel, commissioned and fitted with uniforms.

From Uxbridge pupils would proceed to an F.T.S. for a period of 10 months' training. This was split up into two terms of five months each, the first term dealing with flying training on Service type aircraft and the other directed to applied flying. At this second school pilots would be taught navigation, instrument flying, night flying, air gunnery and bombing.

In this form the new scheme seemed to have several disadvantages. It increased the total period of training before a pilot reached his squadron, and so not only reduced the length of his Service career in the squadron but also meant that slightly more pilots would have to be trained. Another difficulty was the status of personnel, both Short Service commission pupils and airmen pilots, whilst at the civil schools. The financial increase was also heavy, and the extra annual cost was estimated at approximately £110,000.

(1) A.M. File S.34816.

These disadvantages were fully discussed by the Director of Training and S.7. and slight modifications were made. The civil course was to be reduced to eight weeks and the F.T.S. course reduced to nine months, two terms each of $4\frac{1}{2}$ months, which meant that the total training period was kept down to a year. This removed objections of shorter service in squadrons and to a certain extent decreased the cost.

The problem of the status of personnel whilst at civil schools was overcome by not commissioning short service personnel until completion of the course.⁽¹⁾ The risk that people might take the course at the civil school and then not wish to join the R.A.F. was overcome by requiring personnel to sign an honourable undertaking that they intended to serve as pilots in the R.A.F. on completion of their training.

The additional cost would be offset by the efficiency and value of the new system of training and particularly of its high war reserve value. The advantages of the new scheme which was approved on 7 January 1935 can be summarised as follows:-⁽²⁾

- (a) It allowed for longer periods during the second and third stages of training (i.e. the F.T.S. stage).
- (b) It permitted a reduction of one Service F.T.S. in the permanent requirement of the R.A.F. after the then existing period of rapid expansion had passed.
- (c) It facilitated the change over from peace to war since the civil schools would be experienced in undertaking flying training.

On 28 June 1935 the Treasury approved the reorganisation and agreed to the Air Ministry adopting a total of 13 civil schools as a working basis.⁽³⁾ This meant that nine new civil schools were opened during the following 12 months.

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- (1) It had been suggested that, in order to have some hold over these personnel, they should be commissioned before taking the civil course. The C.A.S., however, was opposed to this on the grounds that men should not have the status of regular officers before they had experienced Service training and discipline.
 - (2) A.M. File S.34816.
 - (3) A.M. File S.34561.

Expansion Schemes 'A' and 'C'

Expansion began in February 1934 with a scheme to bring the Home Defence Squadrons up from 42 to 52 squadrons. Expansion Scheme 'A' which followed was approved in July 1934. This called for 1,000 additional pilots (over and above the normal flow of replacements) to be trained in the four years 1935 - 39, and involved the formation of two new F.T.S.s to bring the total number of schools up to six.⁽¹⁾ The training base at Leuchars was renamed No. 1 F.T.S. but continued with its specialised work. In January 1935 the number of pilots required was found to have been underestimated. Since it would have been difficult to open a new school at short notice because instructors⁽²⁾ and aircraft could not be provided quickly, it was decided to increase the number of pupils per course from 40 to 48 at all schools except Sealand (bad weather and congestion made an increase there inadvisable). These larger courses commenced in the early summer of 1935.

Expansion Scheme 'C' which planned a considerably larger and quicker increase was approved in May 1935. Its target was a Metropolitan Air Force of 123 squadrons, and a total of 1,512 first line aircraft by April 1937. This meant another 2,000 pilots had to be provided in rather less than two years. To achieve this programme a total of eleven flying training schools was required and five new schools were opened between October 1935 and March 1936.⁽³⁾

(1) By August 1935 the following schools were in existence:-

		<u>Capacity</u>	<u>Effective Date</u>
No. 1 F.T.S. Leuchars	renamed 1 April 1935	80	-
No. 2 F.T.S. Digby	re-formed 1 October 1934	96	17 May 1935
No. 3 F.T.S. Grantham		96	28 April 1935
No. 4 F.T.S. Abu Sueir		96	1 July 1935
No. 5 F.T.S. Sealand		80	-
No. 6 F.T.S. Netheravon	re-formed 1 April 1935	96	17 May 1935

(2) In order to meet the demands of Scheme 'A' for flying instructors, 10 per cent of the front line had to be withdrawn to man the F.T.S.s. Scheme 'C' meant over 40 per cent would have to be withdrawn. The sequence of training remained unchanged.

(3) The following new schools were opened under Expansion Scheme 'C':-

	<u>Formed</u>
No. 7 F.T.S. Peterborough	2 December 1935
No. 8 F.T.S. Montrose	1 January 1936
No. 9 F.T.S. Thornaby	2 March 1936
No. 10 F.T.S. Ternhill	15 December 1935
No. 11 F.T.S. Wittering	1 October 1935

These expansion schemes had an inverse effect on the front line. In order to provide instructors, pilots had to be withdrawn from the squadrons. If the sequence and length of training were left unchanged, 40 per cent of the front line would have been needed to act as instructors for the new pilots. This would have had serious effects on the squadrons, not only on their readiness for war, but also on the amount of post-F.T.S. school training which, at that time, was an essential part of the pilots' training. By the time Scheme 'C' was put into effect, however, the vast reorganisation in the system of training Service pilots which had taken place, relieved the position to a certain extent. Even so, shortage of instructors, together with the shortage of training aircraft, did restrict the number of pilots trained to the barest minimum. Their training syllabus too, was limited by these considerations. (1)

Introduction of New Training System

The new system of training started in August 1935 at the four civil schools, (2) and the nine new civil schools were opened by early 1936. (3) This enabled the F.T.S.s to concentrate on military flying training and they were equipped with Service types of aircraft (Hart, Audax and Fury), the elementary aircraft being retained only for instrument flying. (4) The five new F.T.S.s formed under

- (1) Under the new training scheme, the ideal length of the pilots' training course was estimated at 13 - 14 months. This was cut to a year, and later to nine months.
- (2) The four existing schools commenced training regular R.A.F. personnel in August 1935.

	<u>Aircraft</u>
Hatfield	Tiger Moth
Filton	Tiger Moth
Hamble	Tiger Moth
Brough	Blackburn B.2

- (3) The new schools opened as follows:-

	<u>Date Opened</u>	<u>Aircraft</u>
Hanworth	10 June 1935	Blackburn B.2
Sywell	10 June 1935	Tiger Moth
White Waltham	18 November 1935	Tiger Moth
Desford	25 November 1935	Tiger Moth
Reading	25 November 1935	Tiger Moth
Ansty	6 January 1936	Tiger Moth
Yatesbury	6 January 1936	Tiger Moth
Perth	27 January 1936	Tiger Moth
Prestwick	17 February 1936	Tiger Moth

- (4) The new aircraft establishment at F.T.S.s was 62 Service and 3 elementary aircraft.

Expansion Scheme 'C' started off on this new system as they opened; and (1)
the old schools changed over as they were re-equipped with Service aircraft.
No. 1 F.T.S. Leuchars remained on the old ab initio system.

When the reorganized system of training was introduced the F.T.S.s were divided into the Flying Training (renamed intermediate training in 1937) and the Advanced Training Squadrons; pupils spent one term of 13 weeks (15 in winter) and did about 50 hours flying, in each. A new course was accepted every three months; the size of the course remained as before i.e. 48 pupils. The 13 civil schools supplied the pupils for the 10 F.T.S.s; the civil schools were affiliated to F.T.S.s for the purposes of liaison and continuity in the instruction of pupils.

The course for regular personnel at the civil schools lasted normally for eight weeks, though it was extended in the winter to ten weeks to allow for bad weather. During this period the pupils carried out a minimum of 25 hours' dual and 25 hours' solo flying. Throughout the course those pilots who were candidates for short service commissions were purely civilians although they (2)
were paid by the Air Ministry. The serving airmen wore plain clothes and were given allowances and lived out under their own arrangements. On completion of this civil flying course the pupil pilots were sent to the R.A.F. Depot, Uxbridge, for two weeks' disciplinary training before proceeding to their F.T.S.

(1) The schools changed over to the new scheme on the following dates:-

No. 2 F.T.S. Digby	-	4 May 1936
No. 3 F.T.S. Grantham	-	16 March 1936
No. 4 F.T.S. Abu Sueir	-	20 April 1936
No. 5 F.T.S. Sealand	-	2 October 1935
No. 6 F.T.S. Netheravon	-	25 May 1936

(2) The short service commission scheme is discussed in detail in Chapter 25 (Reserve Training).

The aim of the first stage of the F.T.S. was to bring the pupils up to a standard when 'handling the aircraft was a means to an end, rather than an end in itself'. Navigation training covered map reading and elementary dead reckoning; and was practised on 200 mile cross county flights; some instrument flying was also carried out. The Advanced Training Squadron was largely devoted to armament training; cine-camera guns and the camera obscura were used, and the work culminated in a month's attachment to an armament training camp. In addition the F.T.S. course covered photography, reconnaissance and formation flying. New features such as night flying and twin-engined training at the flying training schools were quickly introduced in the months following the reorganisation.

(1)
By the summer of 1936 there were 13 elementary and reserve flying training

(1) The pilot position by 1 July 1936 was as follows:-

Regular Air Force

Qualified Pilots

Permanent Officers	-	1,676
Short and Medium Service Commission personnel	-	781
Attached or seconded from other Services	-	171
Airmen pilots	-	592
<u>Total</u>	-	<u>3,220</u>

Under Training as Pilots

Cranwell Cadets	-	135
Short and Medium Service personnel - direct entries	-	718
Seconded and attached from other Services	-	37
Airmen pilots	-	108
<u>Total</u>	-	<u>998</u>

Reserve Forces

Qualified Pilots

Class 'A' and 'AA'	-	888
Class 'C'	-	348
Class 'E'	-	54
Class 'F'	-	403
<u>Total</u>	-	<u>1,693</u>

Auxiliary Air Force and Special Reserve

A.A.F.	- Qualified Pilots	-	142
Special Reserve	(- Qualified Pilots	-	34
	(- Under instruction	-	16

<u>GRAND TOTAL</u>	Qualified pilots	-	5,089
	Under training	-	1,014

schools (as the civil schools were called) feeding 10 F.T.S.s. Part of the F.T.S. syllabus now included a month's visit to an armament training camp.

The new system, unfortunately, still did not turn out pilots up to first line standard. The training was certainly better than the old system; indeed as far as it went it was excellent, but it did not go far enough to fit the pilots for first line work. The reasons for this were many and varied:-

- (a) One reason was financial restraint. This kept the training period down to a year.
- (b) Expansion Scheme 'C' called for so many aircraft and instructors that it was necessary to cut down the length of training still further.⁽¹⁾ The idea that expansion was only a short term measure also supported the reduction in training time, since it was thought that to open more than the bare number of schools was extravagant.
- (c) The shortcomings of the scheme were accentuated by the increased complexity of the new types of aircraft with which the squadrons were being armed.

Further Measures to Improve Training

Soon after the new system of training was introduced, other steps were taken to improve the training of pilots. Night flying was given a more prominent part in the system of training, and later in 1936, twin-engined training was re-introduced into the F.T.S.s. The following three years saw a rapid expansion of the training machine. Courses were reduced in length and capacities at the schools increased in order to meet the various expansion schemes. The annual output of a F.T.S. had risen from 80 in 1934 to 140 two years later. Between April 1935 and May 1938 4,500 pilots were trained. This shows an annual average of 1,500, compared with 300 per year in 1934.

Thoughts were also turned to the possibility of establishing more F.T.S.s overseas, but nothing was achieved and No. 4 F.T.S. Abu Sueir continued to be the only overseas training school.

(1) When the flying training period was limited to a year, and then cut down to nine months, it was the F.T.S. that suffered. The proper duration was 10 months, but in late 1935 it was fixed at six.

Night Flying

Before 1934 night flying was one of the cinderellas of training. It was neglected by the flying training schools, its teaching was left to squadrons, and there was no co-ordinated system laid down in the C.F.S. training of instructors. The problem of improving night training was considered and discussed, and in August 1935 it was laid down as a policy that:-

- (a) Flying is an art in itself, which can be either taught or practised under conditions of daylight, cloud or darkness. The application of this art is taught or practised as Service training in the form of day bombing, night reconnaissance, the use of clouds for cover, etc., etc. It is clear that night flying falls, as regards instruction, under the category of the art of flying under conditions of darkness and should, therefore, be taught as part of the instruction in flying and not as Service training.
- (b) Night flying instruction should be given, as is day and instrument flying, during the Flying Training School course. The application of night flying to Service training, e.g. night navigation and reconnaissance, if taught at the Schools, should occur during the second term.
- (c) The Central Flying School, as the establishment responsible for formulating the methods of flying training, should issue the 'patter' for night flying instruction.

There was considerable delay, however, in providing night flying equipment for flying training schools, and it was not until the middle of 1936 that they began night flying training. The aim was limited: it was recognised that the time available during the course would not permit enough practice to produce experienced night flying pilots, and so the purpose of F.T.S. night training was defined as 'ensuring that every Service pilot had flown at night, keeping instructors in night flying practice, and destroying the theory that night flying required some special technique and skill'.⁽¹⁾ The syllabus aim was six hours' flying at night, all on circuits and landings except for one out and back flight of 20 miles.

(1) A.P. 1388 (3rd Edition).

Twin-Engine Training

In April 1934 Air Marshal Brooke-Popham asked for some special provision to be made for training night bomber pilots. He maintained that the preliminary training on twin-engined aircraft and in night flying, which had to be carried out on the squadrons, was really only basic flying training. He pointed out that the requirements of night bombers were comparable with those of flying boats, for which it had been found necessary to set up a special training unit, and suggested four ways of providing the necessary training:-

- (a) Putting a Service squadron exclusively on training.
- (b) Recreating an advanced training school to specialise⁽¹⁾ in night and twin-engined flying.
- (c) Creating a special ab initio school.
- (d) Creating training nuclei which could expand in war either to schools or to Service squadrons.

His conclusion was, 'it is inevitable that night flying and multi-engine flying must ultimately be in the curriculum of the Flying Training Schools'.

This night bomber problem was held in abeyance for nearly a year, and even when the new system of training was introduced it went only a little way⁽²⁾ towards meeting the difficulties. It did include some night flying but no twin-engined flying was carried out at the F.T.S. In June 1935, the Director of Training examined the whole problem and came to the conclusion that training on twin-engined aircraft at flying training schools would be useful only if suitable light twin-engined trainers could be produced, and if the F.T.S. course were of the length originally designed (i.e. nine months). So far as the F.T.S.s were concerned in the immediate future, twin-engined training was ruled out by lack of suitable aircraft. The only other way of providing twin-engined training outside the squadrons was a special school.

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- (1) On 15 March 1933 an Advanced Training Squadron was formed at No. 2 F.T.S. Digby to provide twin-engine training - this, however, ceased to function on 25 July 1933.
 - (2) Night flying was introduced in to the ab initio training of pilots in 1935. It was carried out on Moths and Tutors.

This school could either deal merely with twin-engine conversion, in which case three weeks would be long enough, or take three months and tackle the problem fully. The short course was dismissed as not having enough value to justify a special school, and the three months course could not be managed with the numbers and dates set by the expansion programme. It was therefore agreed by the C.A.S. in July 1935 that no special twin-engine training would be possible during the expansion period and that squadrons would have to go on giving basic preliminary training. The ultimate solution of a special school for twin-engine training was left to a more distant future when the pressure of expansion would be relaxed.

Two months later it was proposed to ease the transition from school to squadron by giving advanced training on twin-engined aircraft at the F.T.S. This was the only improvement possible under the existing conditions. There was no intention of relieving the squadrons of any major burden, and only conversion to twin-engine flying would be carried out. The training given would remain substantially the same as with single-engined aircraft. After some dissention, this scheme was finally agreed by the C.A.S. The next difficulty was aircraft; obsolete twin-engined aircraft (such as the Virginia) were quite unsuitable for training, and with so many various types of multi-engined aircraft in service it was quite impossible to give each school specimens of every type. What was needed was a twin-engined trainer which, in general characteristics, was reasonably representative of the various twin-engined Service aircraft. There was no need for this aircraft to be a Service type, and the main requirement was speed in production. The aircraft question finally resolved itself into whether Ansons, or modified Envoyes, could be produced earlier in the number needed. Air Marshal Newall investigated and found that Ansons could be made more quickly.⁽¹⁾ The C.A.S. then approved their use at F.T.S.s.

Twin-engined training was eventually introduced at F.T.S.s in

(1) It was recognised that the Anson was not as good a training machine as the Envoy: it had no flaps, its performance was inferior, and it was not so suitable for training in night or blind flying. Envoyes, however, could not be produced quickly enough.

late 1936 'in order to meet the growing demand for twin-engine pilots and to relieve Service squadrons of the responsibility for providing twin-engine conversion training'.

One third of the pupils of each course (those destined for heavy bomber, general reconnaissance, and flying boat squadrons) were to be trained on twin-engined aircraft. It was laid down:-

'In the first instance it is essential to provide all pupils, irrespective of what types they are to fly later, with single engine training. Pilots destined for twin-engine aircraft will therefore be required to fly single-engine aircraft during the first six weeks of their term at the Flying Training School, when it is hoped that they will complete 25 hours dual and solo flying. Thereafter, their training in the first and second terms will be carried out on twin engine aircraft.'

The first schools to be equipped with Ansons were No. 3, Grantham and No. 6, Netheravon, in November 1936. No. 9, Thornaby, was equipped in December. The aircraft establishments were altered to 69 aircraft at each school, 12 single-engined aircraft being withdrawn and 16 Ansons added.

A further difficulty came with the introduction of twin-engine training. The policy of requiring pupils to fly Harts during their first six weeks at F.T.S. meant that the first term tended to degenerate into a conversion course to two Service types, with navigation, instrument, and night flying receiving less attention. ⁽¹⁾ In November 1936 No. 23 Group proposed that twin-engine pupils should be trained throughout on Ansons, but the proposal was turned down and the policy of starting on single-engined aircraft reaffirmed by the Air Ministry.

The proposal was put forward again in July 1937, aggravation of the already difficult problem of getting all pupils off solo at night being given as the chief reason. The scheme was tried experimentally, found successful, and approved by the Air Ministry in November 1937. Four more Ansons were allotted to the schools concerned (Nos. 6, 9 and 3) and four Harts withdrawn.

(1) A.M. File 325263/34.

Navigation Training

Up to 1935 long distance navigation was required only by flying boat and night bomber squadrons, and to a lesser degree to torpedo bomber squadrons and coast defence units. In all cases navigation was still the pilot's concern.⁽¹⁾ Flying boat pilots were trained in navigation as part of the 29 week flying boat course at Calshot. Torpedo-bomber and coast defence pilots were trained in their units at Donibristle and Gosport. Night bomber pilots were trained on the squadrons by air pilotage officers (renamed 'squadron navigation officers' in 1935) who had passed a 13 week course at the Air Pilotage School, Andover. Specialist 'N' officers were trained by a seven months' course at Calshot.

In January 1936 the Air Pilotage school at Andover and the navigation course at Calshot were combined to form the School of Air Navigation.⁽²⁾

Its functions were:-

- (a) Courses in navigation, reconnaissance and ship recognition for pilots operating over the sea. These courses, later named G.R. courses, lasted 16 weeks. There were 6 courses per year each of 25 pupils.

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- (1) During the 1914-1918 war the pilot had been responsible for navigation and the principle that he should continue to be so died hard. Up to 1934 all other aircrew duties were carried out by air gunners selected and trained by units and employed on part time work. None were trained in navigation. In 1934 the trade of air observer was re-introduced. These men were merely trained on a two months' bombing and gunnery course and it was still assumed that navigation would be done by the pilot. In 1937 one month's navigation training was added to the A.O.S. course for those observers destined for medium bombers. (Even then the observer only assisted the pilot. In larger aircraft two pilots were carried, one doing the navigation).
 - (2) This reorganisation took place as a result of a decision to form 'coast reconnaissance' squadrons equipped with landplanes. It was realised that these squadrons could not operate efficiently without adequate training for the pilot in navigation and reconnaissance. The ideal scheme, that of training all pilots up to the standard of the flying boat pilots, was unattained owing to the pressure of expansion under Scheme 'C'.

/ (b)

- (b) Courses for Squadron Navigation officers. These were of 12 weeks duration, and there were 3 courses each of 12 pupils per year.
- (c) Specialist 'N' courses, of seven months' duration with eight pupils.
- (d) In addition there were occasional two week refresher courses.

The net outcome of this reorganisation was small. Although maritime pilots had a thorough course in navigation, the training of the rest of the Service remained very much where it had been since 1918.

In April 1936 the crewing of aircraft was laid down by the C.A.S. ⁽¹⁾ as one pilot and one observer (and wireless operators and air gunners where necessary) for bomber and two-seater fighter aircraft, and one pilot and one navigator (who was a pilot) for G.R. aircraft. The introduction of newer types of aircraft (i.e. Blenheim, Whitley, Hampden, Battle, Wellesley) made it increasingly difficult for the pilot both to fly and navigate the aircraft. Consequently the crewing of aircraft was revised in 1937. Whenever possible, bombers were given two pilots and special provision was made with regard to navigation for those bombers which could not carry two pilots (i.e. Blenheim, Wellesley and Battle). ⁽²⁾ This two-pilot policy created a further demand for navigation trained pilots and squadron navigation officers. To meet the added requirement the F.T.S. course was kept at six months and the 'S.N.' training capacity at the School of Air Navigation, Manston was increased from 12 pupils on a 13 week course to 22 pupils on a 10 week course. The latter expedient was not, however, enough and it was necessary to find some other means of producing these 'S.N.' officers.

Navigation Training at Civil Schools

Eventually it was decided to train pilots at two civil schools on a three

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- (1) A.M. File S.40289.
 - (2) For the medium bombers which could not carry two pilots, observers were specially trained. The course at the Air Observers' School North Coates was extended from two to three months and navigation training 'similar to that given to pilots at the F.T.S.' was added to the syllabus.

(1)
months' course in navigation. The first course, of 47 pilots, began at the Imperial School of Air Navigation, London, in April 1937, and the second, of 20 pilots, at Air Service Training Ltd., Hamble, in July 1937. These courses included no practical work on flying. In January 1938 another batch of 67 pupils were sent to the schools for training.

The need for giving pilots more navigation training than the F.T.S. course included was agreed in 1937. There was to be a separate navigation course following a pilot's F.T.S. training. It was to last 10 weeks and produce the 'S.N.' standard to which only squadron navigation officers had originally been trained. In addition, half the pilots destined for large long-range aircraft were to have a four weeks' course in astronomical navigation. The numbers to be dealt with were formidable. Plans were made for giving 1,500 pilots navigation training in 1938 and 1939, and the capacity of the School of Air Navigation was increased by transferring the navigation and reconnaissance training of pilots for G.R. squadrons to a new School of General Reconnaissance at Thorney Island in April 1938. Even so, Manston could not handle all the training. Six civil schools (2) were to be used for the remainder, working to the Manston syllabus and including air exercises in their instruction. The astronomical navigation courses were to be held at Manston.

This scheme was to start in April 1938, when the School of Air Navigation began dealing with the larger courses. Two civil schools (3) began working to the Manston syllabus in May, and the other four civil schools were to start during the summer. In April, however, the lack of trained observers was seen to be serious, and it was necessary for these four schools to revert to the original intention of observer training. (4) The rate at which pilots could be trained in navigation was therefore limited to some 900 a year, and only bomber

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- (1) Some pilots had taken courses at civil schools at their own expense and had obtained Second Class Navigators' licences. This led to temporary acceptance, by A.M.O. 1/36, of the licence as a qualification for squadron navigator officers.
- (2) Including four which had been approached originally to do observer training.
- (3) Air Service Training, Hamble, and the Imperial School of Air Navigation (which moved to Shoreham and changed its name to Martin's School of Air Navigation).
- (4) A.M. File 765961/28.

pilots were given the training. With the exception of one school the six schools were located at existing E.F.T.S.s. (1)

Revision of Navigation Policy: Effect on Pilot training

In May 1938 a radical change was made in navigation policy. It was thought that training pilots in navigation by means of a 10-week course would be impracticable in war, and that the most that could be done would be to teach basic D.R. navigation so that pilots could supervise the navigation after some experience as second pilot. Accordingly, a conference on Training and Establishment of Air Observers in War decided that in war-time the observer should be responsible for the navigation of aircraft. (2)

This decision meant that a fundamental change of policy, from pilot responsibility for navigation to observer responsibility, would occur at the outbreak of war. It had as a corollary the need for adding observers to peace-time crews and training them in peace-time; otherwise there would be almost complete reliance on the Volunteer Reserve for observers and navigation in war. Observers were accordingly added to the peace-time establishments of all bomber and G.R. aircraft, and the requirement for observer training went up sharply.

Thus, by the middle of 1938 a very rapid and considerable development had taken place in the policy of providing for navigation. Late in 1937 pilots (except those who went to Manston or the civil schools for 'S.M.' or equivalent courses) and observers were given only four weeks' training in basic D.R. (3) their further training being left to squadron navigation officers. After May 1938 all pilots and observers were to be trained by 10-week courses up to 'S.M.' standard, and some pilots were to be trained in astronomical navigation as well. Moreover, all bombers and G.R. aircraft were to carry an observer as well as the pilot or pilots.

In February 1939 Wing Commander Mackworth (O.R.3) pointed out that this seemed to involve a disproportionately large amount of teaching and flying to ensure that aircraft were safely navigated. (4) Three men were being fully

(1) Navigation Training of Pilots

No. 3 E.F.T.S. - Hamble	w.e.f. 1938
Martin's Navigation Ltd., Shoreham -	7 May

Navigation Training of Observers

No. 7 E.F.T.S. Desford	- 9 August
No. 9 E.F.T.S. Ansty	- 17 August
No. 10 E.F.T.S. Yatesbury	- 7 September
No. 12 E.F.T.S. Prestwick	- 9 August

(2) A.M. File S.40289.

(3) At the F.T.S. (pilots) or at North Coates (observers).

(4) A.M. File S.47667.

/ trained

trained for every large aircraft, and two for every smaller bomber. To cut down the amount of training effort thus devoted to navigation he proposed that navigation should become the observer's responsibility in peace as well as in war, and that pilots should be given only sufficient training to enable them to get across country or bring the aircraft back in emergency. The observer would be given a 10-week course to 'S.N.' standard, plus an astronomical navigation course in the case of long range aircraft; the pilot a 6-week course; squadron commanders the 10-week and astronomical navigation courses; and G.R. pilots the School of G.R. course.

Air Chief Marshal Ludlow Hewitt objected strongly to the idea of making the observer responsible for navigation, arguing that the captain should be both competent and responsible, and should then delegate navigation to the observer; if the observers were made responsible the pilot would wash his hands of navigation. ⁽¹⁾ Air Vice-Marshal Sholto Douglas, however, saw no difficulty in the captain being less fully competent than the observer, provided a pilot's basic grounding was good enough to enable him to appreciate the problems of navigation.

The policy of observer responsibility for navigation was introduced in May 1939. It was acknowledged that the previous aim of training all pilots and observers on 10-week courses had never been realised in practice. In future all pilots were to be given basic training, beginning at the F.T.S. and continuing with a six-week course at a navigation school. Observers were to be trained to the highest standard required, and were therefore to be given the 10-week course (for which 12 weeks were allowed at civil schools) and the four-week astronomical navigation course if it was needed. Pilots were to be capable of supervising navigation, and of bringing back the aircraft in emergency. Squadron leaders were to have a six weeks' course in advanced navigation so that they could give adequate supervision to squadron training. To ensure that pilots were trained to the required standard the F.T.S. syllabus

(1) A.M. File S.47667.

was rewritten so that it, and together with the proposed six weeks' course at the navigation school⁽¹⁾ could cover the same ground as the 10-week course.

It was recognised that the School of Air Navigation, Manston gave better training than the civil schools, and therefore, observers should be trained there. The capacity of the schools and the numbers concerned, however, made this awkward to put into practice, and it was decided to keep pilot training at Manston and to continue observer training at the civil schools.

Maintenance Organisation

Throughout the expansion period Flying Training schools were working under heavy pressure. Instructors had to deal with maintenance, which was done in the flights, administration and ground instruction as well as flying instruction. In spite of the fact that everyone did a bit of everything, flying Training schools worked satisfactorily, but only because the organisation was extravagant.

It was clear that this system, which was working with difficulty in peace, would break down under war-time pressure; and in June 1936 Air Commodore Tedder⁽²⁾ wrote a paper on the subject. He compared the flight system of maintenance with civil operating, and found the Service system uneconomical, though direct comparison was not possible.

'Service economics in war and civil economics in peace are very much akin, because the object is in each case to ensure efficient working with the strictest regard to economy, while preserving the ability to expand.'

Air Commodore Tedder applied these principles to a flying training school, and deduced that there should be a functional organisation by which technical maintenance was delegated in its entirety to one group containing all the technical maintenance personnel, under an officer-in-charge of maintenance: in war there would be need for strict economy in these men because of competition between industry and the Services. Similarly, there should be an administrative organisation, to relieve the instructional staff and maintenance personnel of all administrative work. The flying training school should thus have three distinct divisions:- an office, a garage and a school

(1) These courses, however, had not commenced by September 1939 and under the revised wartime training system navigation was omitted from the pilot's syllabus.

(2) A.M. File S.38529.

The flight system of maintenance ended in May 1937, when maintenance was centralised for each squadron (i.e. Intermediate and Advanced) under a squadron engineer officer.

Progress by the End of 1937

Thus we see that the years 1936 and 1937 were years of considerable activity and reorganisation. The air force was starting to expand and the expansion was dependent on the efficiency and capacity of the training schools. At the same time a new factor was being introduced. Squadrons were being re-equipped with faster and heavier aircraft and the monoplane was replacing the biplane, and this meant that the gap between the trainer and the operational aircraft widened considerably. Originally the aircraft of the F.T.S.s were themselves Service types (Harts, Audax etc.), but with the introduction in November 1936 of twin-engined trainers, the schools were equipped for the first time with special training aircraft. Plans were also made to build a special single-engined monoplane trainer (the Don).⁽¹⁾ There was, however, considerable delay in the production of advanced trainer aircraft and by the outbreak of war most schools were still equipped with biplanes. Nevertheless training was improved; more night flying and navigation training was introduced, and a distinction between the training of fighter and bomber pilots was instituted in 1935 and the syllabus altered accordingly.

During 1937 some of the stations used by flying training schools were required for operational units as expansion developed. No. 9 F.T.S. moved from Thornaby to Hullavington in July, No. 3 F.T.S. from Grantham to South Cerney in August, and No. 2 F.T.S. from Digby to Brize Norton in September.

Expansion Scheme 'L'

In May 1938 Expansion Scheme 'L' was approved. Since 1935 the annual output of pilots from the schools had been about 1,500. To provide the pilots for Scheme 'L' by April 1940 a rate of 2,500 was needed in 1939. Eight more F.T.S.s, over and above the eleven already at work, were needed to provide the pilots for Scheme 'L' by the date set, April 1940.⁽²⁾ To man these eight

(1) This aircraft, however, proved a failure and Masters and Harvards were eventually used.

(2) Of the eight F.T.S.s only three were planned to be a permanent peace-time requirement; the other five were wanted only for a one-year spurt in 1939.

schools some 300 officers and 4,000 airmen were required and practically all would have to be drawn from squadrons in the first line.

Squadrons were already considerably diluted with inexperienced men, and to take away a large number of experienced pilots and skilled maintenance staff for employment in flying training schools was likely to wreck their efficiency. Air Vice-Marshal Sholto Douglas wrote, 'as a result of intensive efforts during the past two years the squadrons are just beginning to attain some sort of standard of operational efficiency. I feel that we should do everything in our power to maintain and improve that standard'. Air Vice-Marshal Peirse was 'seriously concerned about the effect on the first line squadrons'.

The comparatively small nucleus of experienced pilots was, in fact, wanted for three distinct purposes: as the backbone of squadrons' war readiness, for training new pilots as squadrons worked up, and as instructors in schools. The nucleus was not enough to serve all three purposes fully, and so the number of extra flying training schools to be opened was cut down to four.⁽¹⁾ A suggestion by Air Commodore Leckie that some pilots straight from F.T.S. should be trained and employed as instructors was not considered likely to make a substantial reduction in the number of experienced men wanted. The suggestion was acted on, however, with the result that an appreciable, though not catastrophic, lowering of the standard of F.T.S. instruction was observed.⁽²⁾

Four flying training schools instead of eight would cause a deficiency of 720 pilots in April 1940. It had, however, been planned to offset the shortage of reserves to some extent by providing spare pilots in squadrons, and the deficiency of 720 meant only that these spare pilots would be lacking in April 1940.⁽³⁾ The deficiency would be overtaken in the following September. The reduction to four additional schools was approved in

(1) A.M. File S.44537.

(2) A.M. File S.51631.

(3) A.M. File S.44537.

(1)
 April 1938. To feed these four extra schools, new civil schools had to be utilised and additional regular courses were allocated to seven of the civil schools towards the end of 1938. (2)
 All but three of these schools were already carrying out training for regular air force personnel; these remaining three were previously carrying out reserve training only.

The length of course at the F.T.S.s remained unchanged at six months: the mounting demand for pilots and inability to open more than the minimum of additional schools made the originally-planned nine months' duration more remote than ever. (3)
 The 'reorganised' system was, however, generally considered to be successful, to have raised the standard at which pilots left schools, and to have relieved squadrons of responsibility for much individual training: and it was confirmed as the permanent system of pilot

(1)	<u>F.T.S.</u>	<u>Location</u>	<u>Opened 1939</u>
	No. 12	Grantham	1 December
	No. 13	Drem	17 March
	No. 14	Kinloss	1 April
	No. 15	Lossiemouth	1 May

During the period various other moves and changes took place:-

No. 11 F.T.S. moved from Wittering to Shawbury in May 1938, and No. 6 from Netheravon to Little Rissington in August 1938. No. 1 F.T.S. changed from ab initio training to the reorganised system of Intermediate and Advanced Training Squadrons, and began to draw its pupils from elementary civil schools, in May 1938. Its output continued to go to the Fleet Air Arm, and it moved from Leuchars to Netheravon in August 1938. In May 1939 No. 7 F.T.S. Peterborough also began to train for the Fleet Air Arm, its twin-engined aircraft being replaced by single-engined aircraft during the summer of that year.

(2) Additional regular courses were allocated as follows:-

<u>E. & R. F.T.S.</u>	<u>Location</u>	<u>Commenced 1939</u>	
No. 7	Desford	13 March	
No. 9	Ansty	6 February	
No. 11	Perth	13 March	
No. 12	Prestwick	6 October	
No. 19	Gatwick	6 October	} Formerly carried out reserve train- ing only.
No. 22	Cambridge	27 March	
No. 30	Derby	27 March	

(3) A.M. File S.34816.

training in June 1938. (1)

Nevertheless, it was necessary for Air Chief Marshal Newall to write in May 1938:- (2)

"(i) There is no doubt that the standard of training attained by pilots where they join Service units is higher now than it has ever been before, but at the same time there has been a great increase in the complexity of the modern bomber aircraft and also in the responsibility of the captain of the aircraft having regard to the size of the crew and the cost of the aircraft. The improvement in the standard of training although very considerable has not kept pace with the increased demands on the fully trained pilot. There is therefore a gap which we must fill between the time the pilot leaves his F.T.S. and the time when he is fit to assume the responsibilities of captain of an aircraft. In addition there is the consideration that during the period immediately following the arrival of a pilot at a Service unit, he is in what we have called "the accident-prone zone", and it is therefore desirable that he should be trained on to flying the big expensive types by an interim stage rather than by flying them immediately after leaving the F.T.S.

In my opinion there should be an interim stage after leaving the F.T.S. when a pilot should concentrate on getting in air hours. He would not go up with a full crew and would fly the lighter type of modern aircraft. The ideal is to give him air hours on an aircraft with all modern characteristics, such as retractable undercarriage, variable pitch airscrews, etc., but in the meantime we must make do with aircraft which are available. The surplus of pilots in squadrons will allow this training to be given, without appreciably interfering with operational training. The above applies to Bomber Command only'.

/(ii)

(1) When the new reorganisation was introduced in 1935 Treasury approval was granted subject to review after a period of three years. (Treasury letter E.31520 dated 10 May 1935). In June 1938 the scheme was pronounced a definite success. It was agreed that the new system resulted in a general raising of the standard of training, and that pilots were more efficiently trained than before. It was decided therefore to retain this system permanently as the standard method of training. (A.M. File S.34816). This was agreed by the Treasury on 17 September, 1938.

(2) A.M. File S.46938.

"(ii) Some time ago, it was decided that even for initial training it was desirable that the aircraft used for this purpose should have, as far as possible, the characteristics of modern service aircraft, i.e. low-wing monoplanes. There is no doubt that the modern low-wing monoplane has certain inherent disadvantages, particularly in regard to spinning, and it seems clear that it is more difficult to recover from a spin in an aircraft of modern characteristics than it used to be in the older biplane types.

I do not consider that it is in any way necessary that ab initio training should be carried out on aircraft with modern characteristics; what we require is a simple aircraft, free from vice, easy to maintain, and easy to fly, which will give the pilot confidence in himself and in flying generally and will be easy to extricate from a difficult position should it, for instance, be inadvertently put into a spin.

I have therefore decided that we will abandon our present ideas at the earliest possible date, and revert to an older type such as the Moth, for ab initio training. The Magister will serve an extremely useful purpose in enabling a pupil to gain air hours when he has left his Flying Training School.

Both these decisions are, I think desirable in order to avoid accidents, particularly under the stress of rapid and extensive expansion'.

Further Developments up to the Outbreak of War

The development of modern trainers had been going on, and the Airspeed Envoy had eventually been modified into a T.E. trainer named the Oxford.⁽¹⁾ It had been decided in 1936 to have special S.E. as well as T.E. trainers with modern characteristics, and the D.H. Don was designed as the S.E. trainer. In April 1938, however, the Don proved unsatisfactory, and it was necessary to continue with Harts for S.E. training until the N.A.16 (Harvard) could be obtained and the Master produced.⁽²⁾ /There

(1) The Oxford was brought into the service of No. 3 F.T.S. South Cerney, No. 5 F.T.S. Sealand, and No. 7 F.T.S. Peterborough in June 1938.

(2) The first Harvards were used at No. 12 F.T.S. Grantham in January 1939. Masters were not introduced until 1940.

There were differences of night flying policy between Commands, and a standard policy for night lights and night flying was worked out in 1937 and 1938. Flying training schools continued to do little more than 'ensure that every pilot had flown at night.' The use of Tutors for instrument flying was discontinued in 1937, Harts taking their place. Link trainers were installed at flying training schools early in 1938. (1)

In 1938 it was considered that certain regular R.A.F. personnel being trained at the civil schools would benefit by an extended ab initio course. (2) Pupils allotted to this course consisted of personnel who, during their elementary training, were considered to need special instruction. There were no real facilities available for this at the normal civil school and it was decided to form a special 'Extended ab initio' course to bring these border line cases up to the necessary standard by additional careful and special instruction. No. 30 E. & R. F.T.S. Derby was selected owing to the capabilities and experience of that school in special instructional methods. The first course of these 'backward pupils' started on 1 January 1939 with a maximum of six pupils.

In February 1939 Air Vice-Marshal Pattinson (A.O.C. No. 23 Group) pointed out that bad weather training (for which Bomber Command had asked) was virtually impossible at flying training schools. (3) No F.T.S. aircraft were equipped with wireless, and it was therefore essential that pupils should keep in sight of the ground on cross-country flights; instrument flying could only be practised under the hood. The syllabus required more than hooded flying and Link instruction: at the elementary civil school stage five hours under the hood and some Link training were given while at the F.T.S. a 10 hours' Link trainer course and as much hooded flying as possible were done.

Air Marshal Burnett (C.-in-C., Training Command) added the argument that there was no time in the F.T.S. course to make the addition of bad weather practice possible. He also considered that no time for it could

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(1) Link trainers were introduced only because it was difficult to give enough airborne practice in instrument flying. In general, it was considered desirable at this time to give as much instruction as possible in the air.

(2) A.M. File 822902/38.

(3) A.M. File 627393/37.

be found in the pilot's navigation course, ~~and~~ and that it could therefore not be done until pilots went to the Group Pools.

The formation of Group Pools for Bomber and Coastal Commands had, however, been postponed, and Air Vice-Marshal Sholto Douglas insisted that pilots should be given the best grounding in instrument flying possible at flying training schools. The syllabus requirements nevertheless remained unchanged, and the impossibility of F.T.S. practice in cloud and bad visibility was agreed.

For the same fundamental reason, lack of wireless facilities, the cross country night flying exercise was cancelled in March 1939.

Air Marshal Burnett said:-

'When this exercise was introduced it was considered that it could give the young pilot confidence in his ability to fly by night out of sight of the aerodrome lights, and that it would relieve air congestion in the immediate vicinity of the aerodrome.

Experience now indicates that the risk involved in sending pupils on cross country flights by night with no proper navigational facilities or wireless aids, particularly in the multi-engined types where the view to starboard is poor, is such that these flights have to be almost entirely confined to nights when the visibility is sufficiently good to enable a pupil to see his own aerodrome's beacon throughout the flight. It will be appreciated that under such conditions there is little to be gained by this exercise whilst any sudden and unexpected deterioration of weather conditions is likely to result in pupils getting lost with probably serious results.'

It was recognised that these shortcomings in night and bad weather training were at variance with the professed intention that F.T.S. training should be carried 'to the stage at which the pupil will have completed his individual training and have had some experience of Flight training', but pressure of time and lack of facilities made it inevitable for night cross country and bad weather training to be left

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to a later stage of a pilot's career.

The training given to Battle pilots came under review later in 1938. It was laid down by the Air Ministry that they should be trained on single-engined (S.E.) aircraft, and be given a limited amount of bomb aiming practice on twin-engined (T.E.) aircraft: and a suggestion from Training Command that it would be better to teach them on twin-engined aircraft so that they got more training in piloting for precision bombing and photography was turned down.

In February 1939 it was decided to standardise the training for all S.E. type pupils at flying training schools, and give no special bombing instructions to those destined for S.E. bomber squadrons.⁽¹⁾ This reduced the difference types of pilots to be trained to two:- S.E. or Group I, and T.E.^{or} Group II. In May 1939 the proportion of pupils to be trained as Group II was two-thirds - reflecting the greater number of multi-engined aircraft planned by Schemes 'L' and 'M' - but some schools continued to train only one-third of the intake as Group II because their strength of T.E. trainers had not yet increased.⁽²⁾

By April 1939 the prospective deficiency of pilots at April 1940 had grown to some 1,200, and a still larger deficiency of 2,000 was promised for 1941.⁽³⁾ Air Vice-Marshal Philip Babington (D.of P.) pointed out that the remedy needed was a violent increase of output in the near future without any general growth of overheads. The difficulty of providing experienced men to staff the schools was still, as it had been a year before, a serious limiting factor.

The only solution possible under these conditions was to put some form of the war training organisation into operation. ((The war training organisation produced a greater rate of output by increasing the number of pupils at each school, working shorter and more intensive courses, drawing extra instructors from the reserve, and using more aircraft.)) The full war training scheme was not considered practicable in peace-time, but the possibilities of either increasing the pupil population or shortening courses were considered. The discussion brought out a number of

//difficulties:

(1) A.M. File 627393/37.

(2) The establishment for a flying training school dealing with two courses of 48 pupils each (two-thirds being Group II) was at this time 26 S.E. and 38 T.E. aircraft.

(3) A.M. File S.51631.

difficulties: the extra wear and tear of more intensive work would need runways and relief landing grounds (R.L.G.) but F.T.S. airfields were grass and the schools had only four R.L.G.'s suitable for the new types of training aircraft against a requirement of twenty. There was also the familiar problem of finding enough instructors. The most serious difficulty turned out to be lack of training aircraft. Additional Ansons, Oxfords, and Harvards would not begin to be available until late in 1939, while Masters would be later still.⁽¹⁾

In the end it was decided to adopt a plan suggested by Air Vice-Marshal Pattinson. The size of F.T.S. courses was to be increased from 48 to 60, beginning in September; each school was to be given 11 extra aircraft (five S.E. and six T.E.) with additional maintenance staff and an improved supply of spares; one additional staff pilot was to be provided; and the instructor strength was to be kept up to establishment. The plan was to apply to all schools except Nos. 1 and 7, and was estimated to produce 468 more pilots per year. Increased intakes at the civil schools began in June, but war broke out before they passed on to the flying training schools.

Formation of Group Pools

On 18 May 1938 a minute was written by the C.A.S. regarding the training of pupils after leaving the F.T.S. The following is a summary:-

'Training has not kept pace with the increased demands made on the fully trained pilot, due to increase in complexity of modern bomber aircraft. There is an "accident prone zone" following immediately on the arrival of a pilot at his squadron after leaving the F.T.S. There should be an interim stage of training between the two'.

The ultimate organisation for the interim 'stage' was agreed to be group pools, which were to be equipped with Oxfords or Ansons. At this time only Bomber requirements were considered, but it was realised that the possibility of doing any form of intermediate training depended on the supply of aircraft, and it would be some time, perhaps more than a year, before they were available.

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(1) A.M. File S.51631.

In November 1938 the scheme was widened to include other commands and it was decided that advanced flying centres (1) (or group pools) should be established for each operational fighter and bomber group and one for Coastal Command, making ten in all; (2) they were to act as reserves of trained pilots and crews from which casualty replacements could be drawn, in addition to carrying out 'interim training' and advanced training for reservists. Their functions were defined as follows:-

In War

- (a) To provide each operational group with a reservoir or 'pool' from which replacement crews could be drawn.
- (b) To train the output of the F.T.S. up to an operational standard before it passed to the operational squadrons.

In Peace

- (a) To provide intermediate training and practice for regular pilots after leaving the F.T.S. and before passing to operational units.
- (b) To act as advanced training centres for flying personnel of the R.A.F.V.R. and thus fit them to take their place in operational units as soon after the outbreak of war as they are required.

During October and November 1938 two conferences emphasised that group pools were urgently needed, both as a measure of war readiness and for the advanced training of reservists, but only one was started before the outbreak of war. (3) This was No. 11 Group Pool, Fighter Command. In Bomber Command this intermediate stage was provided, as a temporary measure, by the use of non-mobilisable bomber squadrons. These squadrons retained a nucleus of their more experienced pilots to act as instructors and had half of their operational types of aircraft replaced by Ansons.

/Thus

(1) The name 'Advanced Flying Centres' was soon dropped.

(2) The Group Pools were to back the following squadrons:-

6 Bomber Pools -	73 Bomber Squadrons
3 Fighter Pools -	36 Fighter Squadrons
1 Coastal Pool -	19 Coastal Squadrons

E.P.M. 158 (38).

(3) A.H.B./V/5/10.

Thus by the outbreak of war, considerable expansion had taken place. There were now 15 F.T.S.'s (1) fed by 16 civil schools. In addition a large volunteer reserve training organisation had been established and more than 40 civil schools were giving part time instruction to volunteer pilots. Further discussions had taken place regarding the possibility of establishing more schools overseas, but the only results achieved were the plan to establish a F.T.S. in Kenya and permission to form a school in France. Advanced or operational training for pilots had been recognised as essential, although little provision had been made to supply the necessary facilities.

((1)) One of which, No. 4 F.T.S., was located overseas. The 14 F.T.S.'s in the United Kingdom are shown in Appendix 9.

War-time Changes

(1)

On the outbreak of war the existing schools were converted as quickly as possible to the planned war training organisation. This meant that courses were shortened and pupil capacities were increased. Reserve training ceased and the civil schools which had previously been numbered and called Elementary & Reserve Flying Training Schools (E. & R.F.T.S.) were now renamed Elementary Flying Training Schools (E.F.T.S.). R.A.F. schools were now being called Service Flying Training Schools (S.F.T.S.). The Service aircraft in the civil schools were withdrawn in order to bring the S.F.T.S. up from peace to war establishment. These aircraft (approximately 540, chiefly Harts and Ansons) were not sufficient: about 600 were needed to make the change at 15 schools and some 50 more to convert Cranwell to a S.F.T.S. At first only nine S.F.T.S.s increased to war establishment. Again, the proportion of T.E. aircraft was not high enough, so that five of the nine schools on war establishment had to produce pilots in the ratio of two S.E. to one T.E., instead of the planned ratio of one S.E. to two T.E. During the autumn of 1939, however, more T.E. aircraft became available, and all schools were then able to train two-thirds of their output as Group II (T.E.).

The S.F.T.S. course was shortened, as had been planned for war-time training, ⁽²⁾ to 16 weeks, the A.T.S. visit to an armament training station being reduced to two weeks. The syllabus requirement of flying hours remained at 100 per pupil, and the amount of S.F.T.S. navigation instruction was increased in consequence of the decision taken in May to bring all pilots up to 'S.W.' standard by S.F.T.S. training followed by a six-week navigation course.

(1) See Appendices 9 and 10 ^{for} the pilot training organisation at the outbreak of war.

(2) S.D. 138/1. See Appendix 11.

The pupil capacity of S.F.T.S.s was scheduled to increase from 96 to 152 per school, but the increase came about gradually. (1) Aircraft instructors (there was a particular shortage of navigation instructors), ground staff, and accommodation were the governing factors. More than half the aerodromes being used as E. & R.F.T.S.s were required for other purposes and were immediately closed. A greater concentration of Royal Air Force training was allowed by the mobilisation, and the flying training given at the 19 civil elementary and reserve flying training schools that continued to function was confined to ab initio pilot training. (2) Prior to the outbreak of war there were forty-six E. & R.F.T.S.s in all and the following types of training were carried out:-

<u>Course</u>	<u>Personnel</u>	<u>No. of Schools</u>
Ab initio	Regular R.A.F.	16
Ab initio	R.A.F.V.R.	45
Annual Training	R.A.F. Reserve	13
Wireless Operator Training	R.A.F.V.R.	45
Observer	Regular Direct Entry	8

The navigation training previously carried out by some of the schools was entirely divorced from the training of pilots and new units known as air observer navigation schools were formed. At the elementary flying training schools pupils under instruction were no longer divided into

(1) See Appendix 11.

(2) The following E.F.T.S.s continued to function on 3 September 1939:-

No. 1 Hatfield	No. 11 Perth
No. 2 Filton	No. 12 Prestwick
No. 3 Hamble	No. 13 White Waltham
No. 4 Brough	No. 15 Redhill
No. 5 Hanworth	No. 18 Fair Oaks
No. 6 Sywell	No. 22 Cambridge
No. 7 Desford	No. 24 Sydenham (N. Ireland)
No. 8 Reading	No. 30 Derby (renumbered No. 16 on 10 April 1940)
No. 9 Ansty	No. 44 Elmdon (renumbered No. 14 on 3 September 1939)
No. 10 Yatesbury	

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their respective categories (Reserve, Volunteer Reserve, Short Service Commission, airmen pilots etc.) but were collectively grouped as Royal Air Force pupils.

Another effect of mobilisation was three main changes in the status of the staffs of the E.F.T.S.s. Firstly, the post of chief instructor, who had previously been in charge of the school, was abolished and that of a commanding officer substituted. Normally the commanding officer was the former chief instructor or other nominee of the operating company and was approved in his post by Flying Training Command. The commanding officer was directly responsible to Flying Training Command for all Service matters, but was responsible to the company for administration, maintenance of aircraft, and the running of the school as a whole. In this way, the commanding officer served as a connecting link between the Service and Civil sides of the school. Secondly, under the commanding officer the new arrangements allowed for a chief flying instructor (an R.A.F. officer) and a chief ground instructor (either an R.A.F. officer or a civilian as circumstances directed). The third change concerned the flying instructors, who hitherto had been employees of the operating companies, but were now serving R.A.F. personnel.

For the first month of the war many of the E.F.T.S.s gave short flying instructor courses to former R.A.F.V.R. pilots: the course was 4 weeks and included 30 hours flying. The first ab initio courses started in October. Although the schools were to be of standard size with 96 pupils, in practice they varied in size and were classified as 'A', 'B' and 'C' with 96, 72 and 48 pupils respectively. The increased output scheduled for the E.F.T.S. was not needed for some considerable time. While the S.F.T.S.s were working to the limit of their facilities and staff to finish the training of V.R. personnel who had done elementary or in some cases intermediate training before the War,

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there was no point in the E.F.T.S.s working at full pressure simply to add to the waiting list for admission to S.F.T.S.s.

Early War-time Difficulties

There were so many V.R. pilots in the earlier stages of training that a number had to be returned to civil life, after mobilisation, to await calling up when training space became available. At the same time, war entrants were coming in, and their turn to start training had to wait until the accumulation of volunteer reservists had passed into the schools.

The planned output from the S.F.T.S.s, about 5,600 pilots per year, ⁽¹⁾ was practically double the intake capacity of the Group pools, and was also far in excess of the demand of wastage and expansion at a time when virtually no fighting was going on. In October Air Commodore Cordingley (Director of Manning) produced figures which showed that with this rate of S.F.T.S. output there would be a slight deficit of pilots at the end of 1939 (i.e. the pre-war deficiencies would not have been quite wiped out), but a surplus of over 1,100 by April 1940 ⁽²⁾ provided the existing low rate of casualties continued. This surplus was likely to be embarrassing, since there was no way of employing the ⁽³⁾ pilots or keeping them in flying practice.

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- (1) The monthly figures, showing the eight-week lag before A.T.S. training of intermediate volunteer reservists affected the output, were:-

<u>1939</u>		<u>1940</u>	
September	- 158	January	- 455
October	- 149	February	- 518
November	- 708	March	- 468
December	- 562	April	- 518

- (2) The possible other side of the picture was shown by a parallel set of figures which forecast shortages of 1,700 pilots at the end of 1939 and of 1,475 in April 1940 if sustained operations were in progress.
- (3) The figures were worked out on the assumption that the Group Pools would be handling as many pilots as possible, and the surplus forecast was the number for whom there would be no room in Group Pools.

At about the same time it appeared that the 16-week S.F.T.S. course was too short for adequate training. Bomber Command, at the beginning of November, criticised the standard of S.F.T.S. output and asked for more attention to instrument flying and night flying.⁽¹⁾ Training Command suggested that more attention could be given to these subjects if the armament station visit were transferred to the Group stage of training, thus saving the time which was usually lost or wasted at the S.F.T.S.s by making so short a visit.

The prospect of an embarrassing surplus, and similar evidence that school courses were too short, could, however, also be seen in the case of observers and air gunners. Air Marshal Portal therefore proposed that courses generally should be lengthened by 25 per cent, which would combine⁽²⁾ an improvement in training with reduction of output.

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- (1) Practically no night flying instruction was being done by schools at this time, partly because they were interpreting black-out to mean an almost total absence of aerodrome lighting, and partly because only a proportion of their aircraft had night flying equipment. (A.M. File S.2546).
 - (2) At about this time (November 1939) Lt. Col. Smith-Barry (who had invented and made successful the Gosport system of training in 1917 and had thus moulded the general character of R.A.F. pilot training) and Major Heenan (who had been with Lt. Col. Smith-Barry at Gosport) put forward a paper in which some radical changes were proposed in order to improve the output efficiency and qualitative standard achieved by Flying Training Schools.

The changes proposed fell under two main heads:- working aircraft and instructors more intensively to obtain greater output without corresponding absorption of resources in training, and establishing 'all-through' schools of considerable size (400 aircraft) to deal with every stage of a pilot's instruction (except operational training) for the sake of efficiency and a higher standard. They were considered in detail by the Air Ministry and Training Command, and met with marked opposition. It was demonstrated at great length that no intensification of the work done by aircraft or instructors was possible, and that no advantages could be expected from all-through training in a large school.

The proposals were turned down, and the matter dropped. It was rather complacently agreed that the existing training system stood in no need of intensification or improvement, and that experiments to those ends were unnecessary. The changes which had taken place since the days of Gosport were stressed repeatedly, as were the unfamiliarity of Lt. Col. Smith-Barry and Major Heenan with recent developments and the assiduity with which training had been constantly improved.

The Smith-Barry proposals, however, were to some extent carried into effect towards the end of 1940, not as a result of the Smith-Barry - Heenan paper, but in consequence of the urgent pressure for pilots which appeared as soon as active operations began.

The Smith-Barry report is at Appendix 12.

Extension of Course Lengths, December 1939

The fact that the existence or absence of active operations could transform deficiencies into surpluses, or vice versa, so completely and so rapidly meant that little significance could be attached to forecasts of numbers, and that it was consequently not sound to base plans on those forecasts. Air Marshal Portal therefore suggested that the basis for fixing course lengths should be the time necessary to provide really adequate training, it being borne in mind that courses might have to be shortened if output were urgently required or lengthened if the demand were light.

The general lengthening of courses by 25 per cent was agreed, and was introduced in December. ^{Air} ~~At~~ Marshal Welsh pointed out that if the lengthening were a permanent measure more schools and more effort in training would be needed, with a corresponding reduction in the front line. Air Chief Marshal Newall, however, ruled that the question of more schools did not arise immediately, and ⁽¹⁾ that the operational effort would have to be adjusted if necessary.

The lengthening of S.F.T.S. courses to 20 weeks and of E.F.T.S. courses to 10 was accompanied by an instruction that the extra time should be devoted to instrument flying and general flying practice at E.F.T.S.s, and to instrument, night and formation flying at S.F.T.S.s.

The actual reduction in the output of pilots during the winter of 1939-40 was a great deal more than the 25 per cent increase in course lengths should have caused. The winter was exceptionally severe, and S.F.T.S. flying hours fell from a normal monthly average of about 40,000 to 22,000 in December, 29,000 in January, and 14,000 in February, the effects of the weather being aggravated by serious unserviceability of grass aerodromes.

S.F.T.S. courses had to be further extended by anything up to ten weeks, their total duration thus becoming between 20 and 30 weeks. The actual output of pilots in January, February and March was 550 less than 20-week courses should have produced, and the surplus which had been forecast for April 1940 completely ⁽²⁾ disappeared.

(1) A.M. File S.58474.

(2) A.M. File S.59175.

Intakes to flying training were, of course, reduced by the factors which reduced output. By February the I.T.W.s had some 2,500 recruits, or nearly six months' supply, waiting for vacancies at schools. Training Command was pressed to take 20 more pupils at each S.F.T.S., but found it impossible because there was not enough accommodation. The rate of flow was therefore increased by putting the S.F.T.S. course duration back to 16 weeks in April.

The E.F.T.S. course was also restored to its originally planned length, i.e. eight weeks, and as further ways of easing the congestion in I.T.W.s the total E.F.T.S. pupil capacity was increased by 144 in March, (1) and advanced elementary training was started, also in March, at No. 9 E.F.T.S., Ansty and No. 10 E.F.T.S., Yatesbury. (2) This advanced training was in night and instrument flying, and was intended to keep pupils profitably and progressively employed until the S.F.T.S.s could absorb them.

Armament Training

Training Command's proposal that pilots' practical armament training should be done at Group Pools rather than at S.F.T.S.s was pursued irrespective of the general lengthening of courses. It arose from the difficulties under which armament training stations were working as well as from a desire to avoid wasted time during S.F.T.S. courses, and had in its favour the strong argument that Group Pools could do crew training on current operational aircraft with up-to-date armament equipment.

Bomber Command supported the proposal, with the proviso that the time saved should be devoted by S.F.T.S.s to night and instrument flying. Fighter Command, whose Group Pool training facilities were practically non-existent, objected to

(1) The increases were effected as follows:-

E.F.T.S.	Location	Upgraded	
		From	To
No. 4	Brough	'C' Type School	'A' Type School
No. 5	Hanworth	'B' " "	'A' " "
No. 15	Redhill	'C' " "	'B' " "
No. 8	Reading	24 pupils	'C' " "
No. 18	Fairoaks	36 " "	'C' " "

(2) The advanced courses began at No. 9 E.F.T.S. Ansty and No. 10 E.F.T.S. Yatesbury on 3 March 1940. A pre-fighter course was also begun at No. 10 E.F.T.S. Yatesbury in March 1940. The object of the course was similar to that of the advanced course except that the pupils were all earmarked for fighters and accordingly as much instruction as possible was given on advanced aerobatics and formation flying. These courses were discontinued in September 1940.

it and insisted that fighter pilots must be given practical armament training at S.F.T.S.s. Fighter Command could not be persuaded to create an adequate Group Pool organisation, and so a further difference between the training given to Group I and Group II pilots had to be introduced.⁽¹⁾

If the system of training both Groups at each S.F.T.S. were continued there would be the complication of arranging armament visits for only a part of the pupils at every school, and Training Command therefore proposed that schools should specialise on training either one Group or the other. Specialisation of schools had two main advantages: maintenance would be simplified because each school would have a single type of aircraft, and the Group I schools could be chosen so that pupils could do air firing on near-by tow lines, thus avoiding the need for any armament training visits at all.

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- (1) No S.E. and T.E. differentiation could be wholly satisfactory, because Group II (T.E.) training did not include the fixed gunnery necessary for T.E. fighters and some bombers, while Group I (S.E.) training did not include the bombing needed by S.E. bombers. T.E. fighter pilots were drawn from Group II output until April 1940, but this proved unsatisfactory, and Air Vice-Marshal Babington decided that they should in future come from Group I and be converted to T.E. aircraft after leaving the S.F.T.S. Bomber pilots mainly came from Group II, but some Group I pilots also went to bombers, partly because Group I training was suitable for Battles. (A.M. file S.58905).

The proportion of T.E. to S.E. pilots required had risen from 2 : 1 to 3 : 1 with the use of T.E. aircraft for fighter and army co-operation work, though this was not necessarily the proportion of bomber to fighter pilots. As first line expansion and re-armament went on the proportion of T.E. pilots required was scheduled to increase until it reached 6.5 : 1 at the end of 1941. (E.T.S.2(40)).

/ Specialisation

Specialisation of Training

In December 1939 Training Command proposed that four S.F.T.S.s should specialise on Group I training, and the remaining eight schools training for the R.A.F. on Group. II. (1) The disadvantages of specialising schools were pointed out by Air Marshal Welsh and Air Commodore Donald (D. of O.). Mixed schools could easily change the proportion of Group I and Group II pupils in their output to meet changing requirements: indeed, this flexibility was the reason which had previously been held to justify them. With specialised schools, on the other hand, the proportion of output could be changed only with difficulty: and more schools would therefore be needed to provide margins of trained men and guard against contingencies. In any case, specialised schools were wanted only because

(1) At this time there were 14 S.F.T.S.s in the United Kingdom:-

No. 1	Netheravon	(Harts and Harvards)
No. 2	Brize Norton	(Harvards and Oxfords)
No. 3	South Cerney	(Harts and Oxfords)
No. 5	Sealand	(Harts and Oxfords)
No. 6	Little Rissington	(Harvards and Ansons)
No. 7	Peterborough	(Harts and Audax)
No. 8	Montrose	(Harts and Oxfords)
No. 9	Hullavington	(Harvards and Ansons)
No.10	Ternhill	(Harvards and Ansons)
No.11	Shawbury	(Harts and Oxfords)
No. 12	Grantham	(Harts and Ansons)
No.14	Kinloss	(Harvards and Oxfords)
No.15	Lossiemouth	(Harvards and Oxfords)
	Cranwell	(Harts and Oxfords)

Nos. 1 and 7 were training for the Fleet Air Arm.

No. 13 Drem, was closed on 27 October because the aerodrome was required by Fighter Command, and was dispersed among Nos. 8, 14 and 15 S.F.T.S.s.

No. 12 Grantham, was transferred from No. 23 Group to No. 21 Group on 10 October. The schools earmarked for Group I training were Sealand, Montrose, Kinloss and Lossiemouth.

There were 19 E.F.T.S.s on 1 January 1940:-

<u>School</u> E.F.T.S.	<u>Location</u>	<u>Aircraft</u>	<u>Pupils</u>	<u>Type</u>
No. 1	Hatfield	48	96	A
No. 2	Filton	24	48	C
No. 3	Hamble	36	72	B
No. 4	Brough	24	48	C
No. 5	Hanworth	36	72	B
No. 6	Sywell	48	96	A
No. 7	Desford	54	108	-
No. 8	Reading	12	24	-
No. 9	Ansty	48	96	A
No.10	Yatesbury	48	96	A
No.11	Perth	36	72	B
No.12	Prestwick	36	72	B
No.13	White Waltham	48	96	A
No.14	Elmdon	36	72	B
No.15	Redhill	24	48	C
No.18	Fairoaks	18	36	-
No.22	Cambridge	48	96	A
No.24	Sydenham	36	72	B
No.30	Derby	54	108	-

Bomber Command and Fighter Command needed different basic training, and this difference in basic training was itself required only because there were immediate shortcomings in Fighter Group Pools. Specialised schools did not seem sound as a measure of long-term planning.

Another disadvantage put forward was that pupils would have to be selected for specialisation on Group I or Group II at the E.F.T.S.s, but not much weight was attached to it. Training Command were confident that any given batch of pupils could be satisfactorily trained on either syllabus, while Air Marshal Portal considered that longer periods of elementary training at the I.T.W. and E.F.T.S., coupled with the physiological and psychological tests then being developed by the Flying Personnel Research Committee, should enable satisfactory selection to be done.

In January 1940, a conference on Specialisation and the Transfer of Armament Training decided to try specialising schools as soon as possible, in order to improve the general standard of training by making more time available at S.F.T.S.s and enable bomber pilots to have their armament training on operational types of aircraft.⁽¹⁾

Armament training attachments of Group II pupils to bombing and gunnery schools stopped at once, and their place was taken by visits from Bomber Command Group Pools. Attachment of Group I pupils from S.F.T.S.s went on temporarily until tow lines and towing aircraft could be provided at the four Group I schools and the specialisation scheme put into effect. No fundamental change in the S.F.T.S. syllabus was involved. Armament subjects were still to be taught in the Advanced Training Squadron, local bombing ranges used by Group II pupils, and cine camera gun exercises carried out. The essential difference was simply that bomber pilots would not do high level bombing and live firing until they went to Group Pools, and would have more S.F.T.S. training in night and instrument flying.

Putting the scheme into effect, however, meant equipping the eight Group II schools completely with Ansons or Oxfords, and this required more T.E. aircraft than were available. It was therefore planned that four of the Group II schools should have Battles, two Oxfords, and two Ansons. Two of the Group I schools were to have Masters and two Harvards.⁽²⁾

(1) A.M. File S.2546.

(2) Hullavington, Shawbury, Grantham and Cranwell were to do Group II training on Battles. Brize Norton and South Cerney were to use Oxfords and Little Rissington and Ternhill, Ansons. Of the Group I schools, Sealand and Montrose were to have Masters, Kinloss and Lossiemouth, Harvards. The Battle was considered a better makeshift Group II trainer than the Hart. Masters began to come into use in the early part of 1940. (A.M. File S.2546).

Even this plan, which Training Command put forward in February 1940, called for more T.E. aircraft than could be provided. Moreover, it had just been decided that no more Ansons or Oxfords could be allotted to Training Command since the whole output was needed to equip new schools overseas. Specialisation of schools could therefore not be started because there were not enough T.E. aircraft to equip even four schools for Group II training, nor yet enough Battles, Ansons and Oxfords, to equip eight Group II schools, though there were enough Masters and Harvards for the four Group I schools. The overall deficiency of trainer types was being covered by using Hart Variants.

A specialised Group I course began in April at Montrose, and specialised Group II courses at Shawbury and Grantham, but there was no prospect of any further development of the scheme. Kinloss and Lossiemouth were being handed over to Bomber Command,⁽¹⁾ Sealand was soon to be abandoned, and Montrose was probably to be abandoned. This meant that no S.F.T.S. would remain near the sea, and therefore that no S.F.T.S. could have the tow lines needed for Group I air to air firing. The possibility of specialising schools appeared at the end of April to have been killed by events.

Shortage of T.E. aircraft was not the only handicap on S.F.T.S.s. There was an acute shortage of spares for Ansons, Oxfords and Harvards, while maintenance work was not satisfactory largely because experienced men had been replaced by newly-trained recruits. The result was a mounting shortage of serviceable aircraft accentuated by a lack of replacements for Oxfords and Ansons.

In February satisfactory lighting and drill for night flying were worked out but further difficulty arose from the lack of relief landing grounds, and there was consequently little increase in the amount of night flying instruction. Difficulty in training Group II pilots came from the lack of local bombing ranges.⁽³⁾ The establishment of link trainers was raised from three to four per S.F.T.S. in November 1939, but they could not be provided quickly. Cloud and bad weather flying could still not be practised because the schools had no wireless.

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- (1) Kinloss and Lossiemouth were taken over in April at short notice for the use of Bomber Command during the Norwegian campaign. No. 14 S.F.T.S. moved to Cranfield, and No. 15 to Middle Wallop; their current courses were lengthened by a fortnight to allow for the dislocation of moving.
 - (2) Part of the drill provided that aircraft were to be recalled on a yellow air raid warning.
 - (3) The first local bombing range, serving South Cerney and Hullavington, was opened on 20 April.

Developments during the first nine months of the War

The variations of the number of pupils between schools which was characteristic of the Volunteer Reserve training scheme, had disappeared upon mobilisation and pupils were now posted to the schools in batches at regular intervals. The flying training was carried out solely on elementary type aircraft, either Tiger Moths or Magisters. (1)

The aircraft were divided into flights of 12 aircraft - 8 of which were regarded as initial equipment and 4 as immediate reserve; in the spring of 1940 the composition of a flight was changed to 18 aircraft (12 I.E. and 6 I.R.). In March owing to the bottleneck of training at the O.T.U. stage, a practice flying unit was formed at Meir to give flying practice and refresher training for pilots after their leaving S.F.T.S. and before entry into O.T.U. (2)

By May 1940 the R.A.F.'s supply of pilots came from 12 S.F.T.S.s in the United Kingdom, (3) each dealing with 160 pupils on 16-week courses, and each training both Group I and Group II pilots. The output was at the rate of 5,300 per year, and the 12 S.F.T.S.s were fed by 19 E.F.T.S.s working on 8-week courses. (4) Two of the E.F.T.S.s were giving advanced elementary training.

The urgent demand for more pilots which arose suddenly towards the end of May was met, so far as the S.F.T.S.s were concerned, to a small extent by posting pupils away from schools a week or so before the normal end of the course, but mainly by increasing the rate of output. Taking pilots early from training was a short-term measure which could give only limited help. It was, in a way, living on capital, and could be done only when a course had been lucky in its flying weather and when some incompleteness in training could be accepted. During May, 52 fighter pilots were found in this way, but they had not been trained in air firing and had flown no more modern type than the Hart. (5)

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- (1) In September 1940, as an experiment, some pupils at No. 7 E.F.T.S., Desford were trained on a twin-engined elementary trainer designed by Reid and Sigrist but nothing came of the experiment.
 - (2) No. 1 P.F.U. formed at Meir on 4 March 1940, with a capacity for 123 pupils, the length of stay was variable and depended on the O.T.U. intakes. It was equipped with 27 Hectors and 27 Dominies. Shortly after its formation its capacity was doubled in size. When the O.T.U. bottleneck subsided, the unit was disbanded and the school actually closed on 16 June 1940. (S.D.155 251/39).
 - (3) There were also two S.F.T.S.s in the United Kingdom training for the Fleet Air Arm and No. 4 S.F.T.S. at Habbaniya in Iraq. All three were below full war establishment, and No. 4 S.F.T.S.'s output went to R.A.F. units outside the United Kingdom.
 - (4) See Appendices 13 and 14.
 - (5) A.M. File S.4928.

In the early part of 1940 the question of pilot or observer responsibility came up again. (1) Although the policy for observer responsibility had been established as far back as May 1938 complaints were being received from Bomber Command stating that their observers were unsatisfactory and requesting that pilots should be given more navigation training. (2) In March 1940 it was decided that all pilots should be given a 4-6 weeks course in navigation, justifying this decision by the argument that pilots needed full navigator training to be capable of acting as captains of aircraft. (3) A month later, however, this decision was reversed and observers were to remain responsible for navigation, with pilots trained only to a supervisory standard in navigation. This was due to the fact that it was the low standard of training of observers, rather than the policy, that was at fault.

The proposal of navigation courses for pilots was dropped, but it was clear that the navigation training given to pilots (and observers) would have to be improved. Some steps had already been taken: elementary navigation instruction had been added to the I.T.W. syllabus: S.F.T.S. instructors were to be experienced men with 's.n.' training and each S.F.T.S. was to have a specialist 'N' to supervise the teaching. Navigation training of pilots showed no rapid improvement, however; experienced men for training as navigation instructors could in the main, only come from Bomber Command, and Bomber Command had hardly enough such personnel for its own first line training requirements. As a result pilot's navigation training was largely theoretical.

Overseas Training

In December 1939 the Empire Air Training Scheme Agreement was signed whereby the three Dominions of Canada, Australia and New Zealand, were to supply, and provide basic flying training for five-ninths of

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- (1) See also Chapter 3.
 - (2) A.M. File S.47667.
 - (3) This alternative was proposed, the course taking place after the S.F.T.S., or between the I.T.W. and S.F.T.S.

the Empire's total requirements in aircrew. E.F.T.S.s and S.F.T.S.s, together with other aircrew training schools, were to be opened in the Dominions. Various plans were worked out for the training of the pilots and aircrew to be trained outside the E.A.T.S.⁽¹⁾ Five S.F.T.S.s were to be located in France, the building of a school in Kenya was put in hand, Southern Rhodesia agreed to provide three S.F.T.S.s and it was hoped that the help offered by South Africa in their expanded S.A.A.F. training capacity would provide four more S.F.T.S.s. These plans for the future training organisation required considerable numbers of trainer aircraft, and an examination of this aspect showed that the production plans by no means fitted the training requirements. Enormous deficiencies of twin-engined trainers were foreseen, and at the same time a surplus of single-engined advanced trainers was likely to occur.

By April 1940 the general shape of the wartime training system had become clear. Basic schools distributed throughout the Empire and in France would train pupils drawn from all parts of the Empire. Their output would pass, for a considerable and essential further stage of training, to O.T.U.s located in the operational theatres. So large and widespread an organisation would need, in addition to despatch and reception facilities, refresher courses after the breaks in travelling, and conversion courses to deal with any mismatchings of output and intake.

These preparations, however, were essentially long-term, and up to May 1940 there had been no increase in the size of the basic training organisation. This considerable programme of additional schools was not due to produce any trained men until the end of 1940 and was then to develop gradually through 1941 and 1942 until an ultimate output of some 20,000 pilots per year became available, about the beginning of 1943.

(1) Originally four-ninths of the total were to be trained outside the E.A.T.S. but the ultimate force was recalculated in December 1939 and the number of S.F.T.S.s required rose from 45 to 60. This meant that the E.A.T.S. provided for five-twelfths of the total force, leaving seven-twelfths to be accommodated elsewhere.

The first line demand for trained men in large numbers, however, came more quickly than this programme of new schools could turn them out. First the imperative need for Fighter pilots before and during the Battle of Britain, and the pressure for rapid Bomber and Coastal Command expansion kept the number of pilots required uncomfortably greater than the number the available schools could produce; and until nearly the end of 1941, demand outstripped supply, even though the opening of new schools was speeded up. As soon as this peak was reached, however, the procedure was reversed and in late 1942, the first signs of what was later to become an embarrassing surplus of pilots, was perceived.

Training Planning: Summer 1940

In the summer of 1940 therefore, there were two distinct requirements. One was short term for June - September 1940, and the other was long term. For the short term plan, the period of basic training had to be shortened and shortened again in order to turn out more pilots in the time. The main bottleneck at this time was advanced trainer aircraft. Production was unbalanced in the sense that too few trainers were being built to provide pilots to fly the operational aircraft. The only alternative to the distasteful and formidable task of modifying the production programme was to transfer training from advanced trainer types, as far as possible, to operational types.

The First Revise

Increasing the rate of output meant shortening courses, since no more training capacity than the twelve United Kingdom S.F.T.S.s could be brought into use for some considerable time. Shortening courses brought up the difference between Group I and Group II training. The immediate purpose of increasing the S.F.T.S. output was to turn out more fighter pilots, and the Group I (fighter) course could be cut down more than the Group II. At the first Training Progress Meeting, on 21 May, it was decided to reduce the Group I course to 12 weeks, cutting bombing, reconnaissance, photography and air firing out of the S.F.T.S. syllabus (but retaining cine-camera gun training), and start

'pre-fighter'

'pre-fighter' training for Group I pupils at the two E.F.T.S.s (Yatesbury and Ansty) which were already doing advanced elementary work. It was proposed to omit night flying training for half the fighter pilot output, but Fighter Command would not agree to this.⁽¹⁾

Different course lengths for Group I and Group II training at once raised the question of specialising schools. One S.F.T.S., Montrose, was able to start at once on 12-week fighter pilot courses, but the others had to wait for the necessary re-equipment with aircraft to be settled before they could begin to specialise. By the middle of June it was decided to have four S.F.T.S.s on Group I training, and eight on Group II, with a 12-week course for Group I pupils and a 14-week course for Group II,⁽²⁾ and this change became known later as the First Revise of pilot training. To provide the necessary larger flow of pupils from elementary training, the E.F.T.S. course was reduced to 7 weeks, the E.F.T.S. pupil population increased by 15 per cent, and a minimum of 50 hours flying was expected for each pupil.

Specialising S.F.T.S.s was a process which needed time. Existing courses had to pass out from the schools, and fresh courses start, before it could be applied fully,⁽³⁾ and so the change and re-equipment with aircraft had to be spread over some three months. The aim was for specialisation to be complete by the end of September,⁽⁴⁾ but there was some doubt about the supply of aircraft; Harts and Battles had to be used for lack of Harvards, Masters, Ansons, and Oxfords. It was at first calculated that with a 12-week course it would be necessary to have 144 aircraft per school, instead of 108, in order to provide 100

(1) A.M. File S.4928.

(2) The F.A.A. schools (Nos. 1 & 7) continued with the 16-week course.

(3) While schools were still training mixed courses of Group I and Group II pupils the course duration was 14 weeks for both Groups.

(4) The Group I S.F.T.S.s were to be No. 5 Sealand, No. 8 Montrose, No. 9 Hullavington, and No. 15 (Brize Norton and South Cerney). The Group II schools were to be No. 2 Brize Norton, No. 3 South Cerney, No. 6 Little Rissington, No. 10 Ternhill, No. 11 Shawbury, No. 12 Grantham, No. 14 Cranfield, and Cranwell.

hours per pupil, but there were not enough trainers to give S.F.T.S.s more than 108 apiece, or 80 hours per pupil. ⁽¹⁾

At the Training Progress Meetings which discussed these changes a good many troubles and difficulties at S.F.T.S.s were ventilated. ⁽²⁾ Skilled men's time was being wasted; flying instructors had to do station duties, and maintenance tradesmen were employed on ground defence. Unserviceability was serious; spares were lacking and cannibalism (process of taking parts from unserviceable aircraft to make others serviceable) consequently rampant. Completing the syllabus to time was a problem; schools had neither the relief landing grounds nor the local bombing ranges needed for full and economical working. Both instructors and aircraft were scarce; there was a constant compromise ⁽³⁾ between efficiency and what could be provided.

At this stage responsibility for the planning and co-ordination of training was passed from the Training Progress Meetings to the newly created Air Member for Training. The First Revise, when the change-over to specialisation was complete, would increase the pilot output from the twelve S.F.T.S.s by about 20 per cent - to some 6,400 per year - but it was becoming clear that this rate of output would not be high enough. The problem was how to turn out more pilots without using more advanced trainers, since there were no more advanced trainers to be had.

The Second Revise

In his preliminary statement on training of 20 July Air Marshal Garrod described a plan for using operational aircraft to make up for the deficiency of trainers by transferring the armament instruction of Group II pilots (a fortnight's work) from the S.F.T.S.s to the O.T.U.s.

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- (1) A.M. File S.2546.
 - (2) A.M. File S.4928.
 - (3) Something was done about each of these troubles - but every one of them needed considerable time to put right. Men to relieve instructors and tradesmen of non-specialised work had to be found and trained; spares and aircraft had to be ordered and manufactured; relief landing grounds had to be built.

This scheme - the Second Revise of pilot training - was introduced during August, and made all S.F.T.S. courses 12 weeks in duration. The Bomber and Coastal O.T.U. courses were lengthened to deal with the instruction thus displaced from S.F.T.S.s, and more O.T.U.s became necessary to keep up the rate of flow to the first-line.

As Air Marshal Garrod pointed out, the Second Revise gave pilots more flying experience on operational types of aircraft, and gave them armament training on the types which they would use in the first line. It also had the advantage of making training expansion a matter of forming more O.T.U.s - which was easier than forming more S.F.T.S.s because operational aircraft were available and O.T.U. instructors did not need C.F.S. training.

The Second Revise, however, made no very large increase in the output of pilots. The theoretical annual production went up by about 10 per cent to 7,000, but the Battle of Britain was making abundantly clear that the largest possible pilot output was an urgent and vital necessity. There were only two ways of putting up the S.F.T.S. output; by getting greater productive effort from the instructors and aircraft at the schools, and by cutting the course to a still shorter duration.

The Third Revise

These possibilities were investigated during August. Working the schools harder was to be the subject of an experiment; six of the S.F.T.S.s were to handle an additional 25 per cent of pupils (i.e. four courses of 50 each, or a total of 200) with no increase in instructors or aircraft. If the experiment proved successful the other schools were also to have this overbearing of 25 per cent. A further shortening of courses on the lines of the Second Revise, by transferring instruction from S.F.T.S.s to O.T.U.s, was proposed in September 1940. The S.F.T.S. period was to go down to 10 weeks, and the O.T.U. period go up by another fortnight (to 10 weeks from Bomber and Coastal O.T.U.s, and to 6 weeks for Fighter).

A 10-week S.F.T.S. course, however, meant only 72 hours flying, and the question at once arose whether pilots would be capable of handling operational types of aircraft at O.T.U.s after a total of only 120 hours flying at the E.F.T.S. and S.F.T.S. (1)

Bomber Command considered that the curtailment would be successful only if bomber pilots were selected early and given thorough training in instrument flying. Flying Training Command held that a ten weeks' course would be too short to allow enough attention to some very important exercises (such as navigation and night flying) which demanded considerable time and concentration but required comparatively little flying. Air Marshal Pattinson (C.-in-C. Flying Training Command) said:- (2)

'I am strongly of the opinion that the bringing of pupils up to a standard at which they will be fit to be trained on the ultimate operational types at the O.T.U.s must be gauged by length of course and not by flying hours, at least as regards the S.F.T.S. course. I assume that the aim of the S.F.T.S. is to turn out pupils that are adequately trained in the basic aspects of flying, i.e. accurate handling of their aircraft and sound airmanship, simple air navigation, instrument flying, night flying and accurate instinctive flying when undertaking advanced flying exercises. On that assumption I consider that pupils with a total of 120 flying hours and with only ten weeks' training in the S.F.T.S. will not be fit to fly operational types. In my opinion a reduction to ten weeks would have the effect of increasing flying accident rate and reducing the flying ability of the pilots that were finally passed out of the O.T.U.s.

I would emphasise that the period required for covering the present minimum of ground instruction must be considered, and that the obtainment of a safe standard in night flying and cross-country flying depends on course duration and not upon flying hours.'

On the other hand, there was a considerable body of opinion that cutting the S.F.T.S. course to ten weeks and lengthening the O.T.U. period by a fortnight would make no material difference to the ultimate output standard, and Flying Training Command's attitude appeared conservative and reactionary. (3)

(1) A.M. File S.4928.

(2) A.H.B./IIM/a9/1a.

(3) Events during the following year, however, seemed to justify Air Marshal Pattinson's opinion completely. The standard deteriorated, and a marked increase in course lengths had to be made at the end of 1941. It should, however, be remembered that the Third Revise intention of longer O.T.U. courses never became effective as far as bombers were concerned. The bomber O.T.U. course was of eight or (after April 1941) six weeks against the 10 weeks of the Third Revise proposal.

The need for a greater output of pilots was vitally urgent, and the Third Revision of pilot training was introduced. (1) In addition a general overbearing of 25 per cent came into operation. The theoretical rate of output became 11,200 per year - more than double what it had been in May - the planned supply of pilots became equal to the estimated demands of the first-line, and there was the prospect of a completely balanced flow to the O.T.U.s.

(2) During these successive revisions of flying training the advanced instruction given in schools' advanced training squadrons had been whittled down by successive transfers of training to the O.T.U. syllabus until there was

- (1) This disregard of Flying Training Command's considered opinion gave Air Marshal Pattinson a conviction that what experience suggested to be possible or wise over training was being subordinated to theoretical planning which seemed feasible on paper but would prove disappointing in practice. In October 1940 he urged that the Air Ministry should not issue detailed orders and instructions, but confine itself to broad policy and leave its execution to Flying Training Command, and in January 1941 he wrote:- 'I am quite certain that a great deal of time is being wasted by working out by D.T.F.'s people schemes that greatly affect this Command and without consulting us as to their value in the early stages of their consideration. One unfortunate result of that method is that I am constantly, as you are aware, having to oppose suggestions that have been accepted as sound by an Air Ministry Director.' (A.H.B./IIM/a9/1a).

In February 1941 Air Marshal Pattinson objected strongly to some investigations made by Mr. M.S. Laing (T.P.) at certain schools into the organisation of S.F.T.S.s for maximum efficiency. He disapproved of such investigations unless they had the supervision and collaboration of Flying Training Command, and considered them 'symptomatic of wrong methods in handling training matters, mainly on a purely figure basis, by clever people with no knowledge'. He later urged that it was impossible for 'a civilian who had been associated with training only a year' to have the necessary knowledge and experience, but Air Marshal Garrod refused to accept this view of Mr. Laing's investigations, saying that it was of the utmost importance to keep flexible and receptive minds towards proposals. Air Marshal Garrod also made it clear that his T.P. staff was constantly, and rightly, watching to see that training facilities were adequate, and that its work on this aspect overshadowed the work of all A.M.T.'s Directors.

- (2) A summary of these three revisions is tabulated:-

	Original		1st Revise		2nd Revise		3rd Revise	
	Duration Weeks	Flying Hours	Duration Weeks	Flying Hours	Duration Weeks	Flying Hours	Duration Weeks	Flying Hours
E.F.T.S.	8	50	7	50	6	50	6	50
S.F.T.S.								
Group I	16	100	12	100	12	100	10	84
Group II	16	100	14	100	12	80	10	72
O.T.U.								
Fighter	4	40	4	40	4	40	6	60
Bomber	6	55	6	55	8	70	10	85

The resultant weekly output from the United Kingdom S.F.T.S.s was as follows:-

Original programme	-	104
1st Revise	-	124
2nd Revise	-	133
3rd Revise	-	163
25% increase in capacity	-	204

/ practically

practically none of it left. With the Third Revise, the A.T.S. was abolished, and the S.F.T.S.s ⁽¹⁾ concerned themselves only with I.T.S. training. ⁽²⁾ All these changes, which had happened rapidly and in little more than the duration of one S.F.T.S. course, were summarised in a tabular form usually known as the ⁽³⁾ 'batting averages'.

Moves and Changes: Summer of 1940

In the meantime most of the S.F.T.S.s changed over to specialisation, and were re-equipped with aircraft. No. 15 S.F.T.S. had an unsettled existence; it was evicted on 12 June 1940 from Middle Wallop, some two months after it arrived there from Lossiemouth, when the station was urgently wanted by Fighter

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- (1) The two schools training for the Fleet Air Arm were unaffected by any of the Revises; they went on with 16-week I.T.S.-A.T.S. training, but expanded to war establishment, any pilots trained in excess of naval requirements being at the disposal of the Royal Air Force.
 - (2) The changes in the S.F.T.S. syllabus made by the Third Revise were summarised by Air Commodore Orlebar as:-
 - (a) The complete deletion of all gunnery and bombing exercises and all higher tests and high flying.
 - (b) The deletion of all photography except for photographs of pinpoints included in the navigation air exercises.
 - (c) The new navigation syllabus, which has lately been co-ordinated with O.T.U. and Operational Command requirements is retained in full.
 - (d) Formation flying has been deleted from the second half of the T.E., S.F.T.S. syllabus, but has been retained in the first half. In the S.E. syllabus formation flying is retained in the first half, plus para. 3 of the old A.T.S. formation flying syllabus.
 - (e) Pending the availability of additional R.L.G.s and the additional hours of darkness which winter might bring if weather conditions permit, night flying has of necessity been reduced to 3 satisfactory dual and 6 satisfactory solo landings as a minimum, with goose-necked flares (hooded if possible) and floodlights, to be repeated with Glim lamps and aircraft headlamps; night flying instruction to be given on at least 4 separate nights.
 - (f) In regard to instrument flying, S.F.T.S. pilots with 5 hours solo and approved by instructors have been authorised to act as safety pilots in order to raise the general standard of instrument flying. This measure both increases the proportion of instrument flying time in the total time of the course, and spreads the practices more fully throughout the course.
 - (g) In the method of instruction it is intended to direct increased concentration on to cockpit drill and to other forms of flying drill. (A.M. File S.4928).
 - (3) For hours of flying involved per pupil, per instructor, and per aircraft at E.F.T.S.s, S.F.T.S.s and O.T.U.s in the United Kingdom under the Various Schemes for the Acceleration of Pilot Output (incorporating amendments dated 22 October 1940) see Appendix 15.

Command, and had to work throughout the summer partly at Brize Norton, partly at South Cerney, and partly at a relief landing ground (R.L.G.) at Chipping Norton. Its scattered parts were gathered together again on one station at Kidlington between August and October. The other schools had no more disturbance than came from changes in syllabus, overbearing, and sporadic enemy attacks, and were helped to meet the demand for more intensive work and a faster tempo by a summer of remarkably fine weather. (1)

Due to the increased air activity over southern England it became necessary to move certain of the elementary flying training schools further north during the summer months of 1940, and six schools were moved in all. (2)

The E.F.T.S. course lengths changed in sympathy and phase with the S.F.T.S. changes. In June 1940 consequent on A.M.T.'s 'First Revise' the course lengths of the E.F.T.S.s were reduced from eight weeks to seven. The pupil populations were increased at all the E.F.T.S.s by 15 per cent, and a minimum of 50 hours flying was expected for each pupil. In August the E.F.T.S. courses were again reduced in length; the course now being six weeks (A.M.T.'s Second Revise). A.M.T.'s Third Revise once more reduced (in September) the E.F.T.S. courses to five weeks. Units were informed as follows:

'While it is appreciated that considerable difficulties are being, and will be, experienced, it is absolutely imperative, in the present circumstances, that as much flying time as is humanly possible must be given to the pupils undergoing the course'.

'All schools therefore are to take advantage of every available hour of daylight to carry on flying training and nothing is to stand in the way of the training programme.'

'X' Courses

The heavy and urgent demand for fighter pilots during the Battle of Britain caused every pilot who was suitable for fighters, even if he had been nominally trained for Group II, to be sent to a Fighter O.T.U. (3) Fighter O.T.U.s had priority of supply from the S.F.T.S. output (which was too small to meet all demands), while Bomber O.T.U.s were at the bottom of the list. As a result, the Bomber O.T.U.s were partly idle for lack of pupils, and

(1) The S.F.T.S. organisation by the end of September 1940 is shown in Appendix 16.

(2) The following moves took place during the summer of 1940:-

<u>E.F.T.S.</u>	<u>From</u>	<u>To</u>	<u>Date</u> <u>1940</u>
No. 5	Hanworth	Meir	15 June
No. 15	Redhill	Carlisle	3 June
No. 3	Hamble	Watchfield	22 July
No. 24	Sydenham	Luton	22 July
No. 2	Filton	Staverton	4 August
No. 10	Yatesbury	Weston	7 September

(3) A.M. File S.4928.

experimental courses were begun to see what would come of training selected pupils, after 50 hours flying at E.F.T.S.s, on operational types of aircraft. These 'X' courses began in September at Abingdon (eight pupils on Whitleys) and Bicester (sixteen pupils on Blenheims).⁽¹⁾ They were intended to last for 12 weeks, but had to be extended by a fortnight because of bad weather. The pupils did over 120 hours' flying, more than half of it at the controls, and about one third at night; they were fresh and keen, quick in their reactions and in learning, and with retentive memories; but it was found that going direct from elementary trainers to operational types of aircraft did not pay in the long run. The 'X' course experiment showed that the 'advanced trainer' stage could not be cut out completely, and the need⁽²⁾ for Masters, Harvards, Oxfords and Ansons thereby avoided.

Further Difficulties and Moves during the last months of 1940

While the 'X' course experiments were going on, in the last months of 1940, the S.F.T.S.s were beginning to work to the Third Revise programme, and finding difficulty in doing it. The programme called for 7,200 flying hours per month from 108 aircraft, but shortage of spares and winter weather made it impossible to reach this target, with⁽³⁾ the result that courses had to be extended by several weeks with a consequent reduction in the output of pilots. By December lack of spare parts caused 21 per cent of the schools' Masters and 13 per cent of their Oxfords, to be unserviceable, and much the same proportion of advanced trainers continued to remain immobilised for lack of spares⁽⁴⁾ until about July 1941, when matters began slowly to improve. The direct effects of bad weather in reducing the hours fit for flying were seriously aggravated by unserviceability of grass aerodromes caused by the heavy traffic of intensive work. The flying times of No. 14

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- (1) Further experimental courses began in October at Kinloss (Whitleys), Bassingbourn, Harwell, and Lossiemouth (all on Wellingtons).
- (2) AMT/447.
- (3) In fact, no Third Revise S.F.T.S. course was completed in the scheduled ten weeks before June 1941.
- (4) A.H.B./IIM/a9/1.

S.F.T.S. at Cranfield, which had runways, were markedly better than those of the other schools, which had grass aerodromes.

Another serious difficulty was night flying. Only three aircraft could be operated at night, at the same time, from one landing ground; the amount of night flying that could be done therefore depended not only on the hours of darkness and the fitness of the weather, but also on the number of R.L.G.s. The possibility of lighted aerodromes being bombed also came into the calculation, and night flying was confined to R.L.G.s unless it was essential to use the parent aerodrome. Each school had only one R.L.G. at this time, and the amount of night flying that could be done was severely limited.⁽¹⁾

Some slight improvement came about with the introduction, after experiments by No. 3 F.T.S., South Cerney, of hooded goose neck flares.⁽²⁾ These flares could be seen at 1,000 feet, but the flare path was practically invisible from 3,000 feet. In October it was decided that night flying at R.L.G.s, which had previously stopped on receipt of a 'purple' or 'red' warning, might go on irrespective of warnings, while parent aerodromes, which had hitherto stopped on a 'yellow' warning, might go on until a 'purple' or 'red' was received.

The difficulty of finding enough night flying time stimulated experiment on ways and means of simulating night conditions in daytime. A method of using sodium flares and filters was developed at No. 7 S.F.T.S. Peterborough and tested in October at Peterborough and South Cerney, but although results were promising it was not brought quickly into general use.⁽³⁾

(1) Each S.F.T.S. was scheduled to have two R.L.G.s but it was not until July 1940, in most cases, that the first was brought into operation. The amount of night flying per pupil at United Kingdom S.F.T.S.s in the winter of 1940-41 averaged some 1½-2 hours.

(2) A.H.B./IIM/a9/1b.

(3) A.H.B./IIM/a9/1b.

Transfer of Schools Overseas

The imminent threat of heavy attack which followed from the German conquest of France was expected to produce serious difficulties for schools in the United Kingdom. The restriction of areas, height and weather conditions for training flights, together with the vulnerability of training aircraft and aerodromes (especially at night) would press heavily on the S.F.T.S.s.

Canada was quick to realise this changed situation and offered to accommodate R.A.F. schools transferred from the United Kingdom; this could be done without interference with the development of the (1) Empire Training School. By 8 July 1940 the Air Ministry decided that it would be desirable to move four S.F.T.S.s out of the United Kingdom immediately. Canada, Southern Rhodesia and South Africa were all considered, but the balance was heavily in favour of Canada because aerodromes and buildings could be available more quickly there, because the resources of the U.S.A. would be near at hand, and because communications with Africa might become difficult.

An official request for transfer to Canada was made on 13 July 1940. It asked that four S.F.T.S.s complete with their staff, equipment and aircraft might be received from the United Kingdom and proposed that they should be administered generally by the R.C.A.F. The schools were to continue to draw their pupils from E.F.T.S.s in the United Kingdom. Canada agreed on 15 July and said that locations and buildings could be ready by 31 August. Canada also asked whether it was proposed to transfer any more schools, in order that any necessary changes in the building programme might be made. On 18 July the United Kingdom expressed appreciation of Canada's alacrity and asked that 10 (2) more schools, making 14 in all, might be accommodated. Four of these

(1) A.M. File S.5614.

(2) The United Kingdom's proposal was to transfer eight S.F.T.S.s., one B. & G.S., one A.N.S., two A.O.N.S.s., one G.R.S., and one T.T.U.

were S.F.T.S.s which meant that it was proposed to move eight S.F.T.S.s to Canada, in all. Canada agreed, but pointed out that it was impossible to locate all these schools compactly⁽¹⁾ as this would interfere with the development of the E.A.T.S., she suggested that since the number of schools was so large R.C.A.F. control would be necessary.

Plans went ahead and by the end of July the following schools⁽²⁾ were earmarked for transfer to Canada:-

<u>S.F.T.S.</u>	<u>Location</u>	<u>Transfer</u> <u>Date - 1940</u>
No. 7	Peterborough	16 September
No.10	Ternhill	12 September
No.12	Grantham	2 October
No. 6	Little Rissington	November

Plans were also made, after all, to transfer some schools to South Africa. None of these, however, were concerned with the basic training of pilots, and are therefore outside the scope of this chapter.

The Ministry of Aircraft Production objected to the Secretary of State's proposal to send the schools abroad.⁽³⁾ They gave as their reasons:-

- (a) The M.A.P. could not service the aircraft required, or supply them with spares of which there was an extreme shortage at that time.
- (b) Even when this had been overcome, the process of shipment abroad would entail 'locking up' a large proportion of spares, amounting to perhaps one sixth of the total.
- (c) This would mean that a very high proportion of training aircraft would be idle, requiring the shipment of a large number of training aircraft to keep the schools working at full capacity.
- (d) The schools would be divorced from the skilled labour of the aircraft factories; technicians would not be

(1) The United Kingdom had asked that the 14 schools should be located compactly for ease of R.A.F. control.

(2) Three other schools (one A.O.N.S., one G.R.S. and one A.N.S.) were also planned to move to Canada or S. Africa.

(3) WP(40)323, 20 August 1940.

available at the time; these personnel were small in numbers in Canada and such as there were would have to be trained in the new types with which they would have to deal.

Against these arguments Sir Archibald Sinclair put forward the handicaps on training in the United Kingdom, especially at night, the urgent need for a larger operational force, and the fact that no aircraft were available to start new schools than were already planned. Maintenance difficulties would be greater outside the United Kingdom but they would not be insuperable.

The Prime Minister's judgment on the points of view of the Minister for Aircraft Production and the Secretary of State for Air was that in view of the air battle in progress which showed no signs of diminishing, it would be unwise to take out of the country any large portion of the nation's reserves of men and aircraft. The scheme for moving part of the training establishment to Canada and to South Africa should, therefore, be postponed until the beginning of December. In the meantime efforts had to be made to continue night flying training as far as possible, and new methods such as infra red lighting of landing grounds would have to be devised.

(1)
Canada was told of these decisions on 5 September 1940. One S.F.T.S., however (No. 7 S.F.T.S. Peterborough) had already begun to move and went on moving. The rest of the transfer plan was held up until October 1940, when No. 10 S.F.T.S. Ternhill started to leave the United Kingdom.⁽²⁾ Complete transfer of existing schools then came to an end, and new R.A.F. schools were started overseas, as Lord Beaverbrook (the Minister of Aircraft Production) had proposed, on the aerodromes which had been earmarked for transferred schools. These schools were intended, eventually, to replace United Kingdom schools and were referred to as 'Transferred Schools'.

(1) A.M. File S.62894.

(2) No. 7 S.F.T.S. began to move on 26 August; started training on its first course in Canada (as No. 31 S.F.T.S.) on 7 October, and was working at full capacity again on 24 February 1941. No. 10 S.F.T.S. began to move on 21 October; started training in Canada (as No. 32 S.F.T.S.) on 9 December, and was working at full capacity by 20 January 1941.

Five other schools (one A.N.S., two G.R.S.s and two A.O.N.S.s) were also moved to Canada and South Africa at this time.

Further Developments during 1940

Thus the pilot training organisation in the United Kingdom showed little change as a result of the German conquest of France. The fears of heavy attack were not altogether fulfilled. Apart from their indirect result of limiting night flying because of the danger that lighted aerodromes and near-by factories might be bombed, German attacks during the Battle of Britain and the following winter had comparatively little effect on training. Most of the S.F.T.S.s, and some of the E.F.T.S.s, were bombed at one time or another, but the attacks were sporadic, casual, and in no great strength. A few pupils were attacked in the air, while one S.F.T.S. pupil destroyed a German raider by collision (though it was uncertain whether the collision was deliberate or accidental).

The S.F.T.S.s (No. 7 Peterborough and No. 10 Ternhill) were transferred to Canada in the autumn of 1940, and No. 5 S.F.T.S. moved, between November and January, from Sealand to Ternhill as No. 10 S.F.T.S. moved out. Two more S.F.T.S.s (No. 6 Little Rissington, and No. 12 Grantham) were earmarked for transfer to Canada, but never moved: their re-equipment with Oxfords was delayed until it was decided that they should stay in the United Kingdom and two new 'transferred' R.A.F. schools be formed in Canada. In February 1941, No. 9 S.F.T.S., Hullavington, which had previously been using Harts, was re-equipped, as an experiment, with 84 Masters and 24 Hurricanes.

Under the new five weeks' E.F.T.S. course, pupils were accepted for S.F.T.S. training with a total of 35 hours flying including 10 hours solo. The minimum number of flying hours was raised to 42 in December 1940, without any lengthening of the courses as it was recognised that 35 hours was too little.

In September 1940, the special advanced courses which had been carried out at Yatesbury and Ansty were discontinued.

In December, it was necessary to increase the length of the E.F.T.S. courses to six weeks, as it was found that the suspension rate was too high (i.e. too much satisfactory pilot material was being wasted owing to the short time available for training). It was also noticed that more

accidents were occurring with the shorter courses. Furthermore the United Kingdom E.F.T.S.s had to supply pupils for the two new 'transferred' schools in Canada as well as for the original fourteen S.F.T.S.s (two of which were now in Canada). The E.F.T.S.s at Desford, Perth, Cambridge and Woodley were expanded in December 1940, and plans were made to open three new schools at North Luffenham, Sealand and Yeaden, early in the new year.⁽¹⁾ In January 1941, White Waltham was needed for the headquarters of the Air Transport Auxiliary and No. 13 E.F.T.S. was destined to move from there to Peterborough on 23 December 1940. This move, however, was later cancelled and No. 13 E.F.T.S. closed down on 1 June 1941, and No. 21 E.F.T.S. opened at Booker to replace it. No. 12 E.F.T.S. Prestwick was also closed, on 23 March 1941, as the aerodrome was needed as an Atlantic Ferry Terminus.

Then by the end of 1940, there were still 19 E.F.T.S.s feeding 12 S.F.T.S.s in the United Kingdom together with a Polish school carrying out all-through training.⁽²⁾ Extensions of courses during the winter of 1940 - 41 because of bad serviceability and weather were common, and S.F.T.S. delays compelled extensions at E.F.T.S.s. The output of pilots fell below schedule in numbers, while in quality it lacked night flying practice.

Training of Allies

In March 1940, a course of 10 days' duration commenced for the testing and grading of Polish pilots, at No. 15 E.F.T.S. Carlisle.⁽³⁾ Four Magisters and nine Battles were added to the establishment of this school to carry out this training. This commitment was extended the following month to a three weeks' course with a population of thirty. This scheme continued until November 1940, whereupon No. 1 (Polish) Flying Training School was formed for giving both elementary and Service flying training and this training formerly given at No. 15 E.F.T.S. was transferred to the new school. On 28 October 1940, a Franco-Belgian Training school was formed at Odiham with the object of

(1) In the first few months of 1941 four new E.F.T.S.s were opened:-

<u>E.F.T.S.</u>	<u>Location</u>	<u>Date opened</u>
		<u>1941</u>
No. 17	North Luffenham	18 January
No. 19	Sealand	10 February
No. 20	Yeadon	17 March
No. 21	Booker	1 June

(2) See Appendices 17 and 18.

(3) The first course commenced on 1 March 1940 and the last course finished on 28 November 1940.

/ providing

providing initial training and elementary flying training to non-English speaking French and Belgian pupils. This school closed on 9 June 1941.

Instrument Flying

In December 1940 and January 1941 an investigation by Squadron Leader Macdonald (T.F.4) revealed that the existing Link Trainer syllabus for S.F.T.S.s was obsolescent, that instrument flying instruction was neither standardised nor correlated with operational requirements, and that S.F.T.S. instructors were largely ignorant of the first principles of instrument flying and of its importance in operational work. ⁽¹⁾ In fact, 95 per cent of the instructors examined were not noticeably better on instrument flying than the average pupil turned out of an S.F.T.S., while a fair proportion of them believed that it was unnecessary for an instructor to be himself competent in instrument flying in order to teach it. In July 1941 instrument flying was standardised by notes laying down what should be taught at the C.F.S. and S.F.T.S., by requiring S.F.T.S. instructors to practise instrument flying for half an hour per week, and by revising the S.F.T.S. Link Trainer and ⁽²⁾ instrument flying syllabuses, and the E.F.T.S. Link Trainer syllabus.

One or two interesting observations were made on this need for a drastic overhaul of instrument flying teaching. The off-hand attitude of instructors towards it was put down to lack of emphasis on its importance and to the impression given by the lack of any standardised method of instruction that instrument flying was of no special significance, while Air Commodore Cochrane (D.T.F.) asked what the C.F.S. had been doing to allow such a state of affairs to come about.

Shortage of Aircraft and Airfields

Various ways of reducing the demand for advanced trainers were investigated during the winter of 1940-41. At a meeting held on 21 December a number of suggestions were put forward. ⁽³⁾ Adapting such aircraft as Lysanders and Hurricanes for use as advanced trainers turned out to be impracticable: the modifications involved were formidable and would need a great deal of time to put into production. Synthetic training was fostered, but the balance between synthetic and air training had to be watched carefully, and it appeared likely that synthetic training would have more value for improving the output standard than for replacing practice in the air.

(1) A.M. File A.45454/39.

(2) A.H.B./IIM/a9/1.

(3) A.M.T./IM/182.

The use of Hurricanes instead of Masters in the later weeks of S.F.T.S. training was the subject of an experiment which began at Hullavington in February. (1) The Hurricanes were used, with check dual on Masters, during the last five weeks of the (ten-week) course: night flying was done on Masters. (2) The experiment was found to be entirely satisfactory from the training point of view: there was a marked improvement apparent at Fighter O.T.U.s in Hurricane-trained pilots, and in May Hurricanes were brought into use at No. 5 S.F.T.S. Ternhill and No. 8 S.F.T.S. Montrose. By August, however, it was found that the Hurricanes' accident rate was high: their average wastage was some four times that of Masters. The main causes were heavy landings and engine failure. (3) Because of this high wastage and the fact that more maintenance staff were needed for a mixed establishment of advanced trainers and single-seater fighters the use of Hurricanes at S.F.T.S.s died out.

A somewhat similar proposal, following from the 'X' courses, that a Wellington S.F.T.S. should be formed, was discussed in January 1941, but never reached the experimental stage. At the ab initio stage of training, some pupils were trained at Desford in November 1940 on a twin-engined elementary trainer designed by Reid and Sigrist, but nothing more came of the experiment.

In February 1941 S.F.T.S. training ⁱⁿ the United Kingdom was badly held up by unserviceable aerodromes, and Bomber Command agreed that schools which were short of serviceable R.L.G.s should use certain operational aerodromes where there was room for trainers. (4) The primary purpose was to increase the amount of night flying done, but this purpose was only partly achieved.

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- (1) A.M. File S.69512.
 - (2) Of the 72 hours flying in the Third Revise S.F.T.S. course, 22 were done on Hurricanes.
 - (3) The explanation was put forward that the high Hurricane accident rate was due to the generally low standard of flying instruction in the summer of 1941, to the rough surface and inadequate size of Montrose and Ternhill, and to the aircraft's high speed and small endurance, which caused pupils to lose themselves and make forced landings.
 - (4) The aerodromes used were Driffield (No. 5 S.F.T.S.), Lindholme (No. 11 S.F.T.S.), West Raynham (No. 14 S.F.T.S.), and Watton (No. 15 S.F.T.S.). At the end of March the use of Driffield had to stop because of persistent enemy attacks at night in consequence of the lights shown while training.
(A.H.B./IIM/a9/1b and A.M. File S.58474.

Planning and the Shift System

The lengthening of E.F.T.S. training to 6 weeks brought up the problem of phasing E.F.T.S. output with the 10-week S.F.T.S. course, and in February 1941 it was suggested that outputs and intakes should be made fortnightly, thus giving S.F.T.S.s five courses of 40 instead of the four courses of 50 which had previously operated.⁽¹⁾ The suggestion was opposed by Flying Training Command on the ground that a five course organisation would need more instructors and accommodation, would be wasteful, and would be difficult to work. Flying Training Command's reception of this attempt at planning suggested that the Command's inherent resistance to change might be greater than its eagerness to try experiments for improving training, and the organisation of schools was brought under review by the Air Ministry with the object of raising the general level of efficiency.

In April Group Captain Gordon Dean investigated the maximum capacity of which S.F.T.S.s were capable (i.e. how their aircraft and staff could best be used to produce flying time) and reported in May⁽²⁾ that by organising a school so that the load was spread as evenly as possible over the aircraft, instructors, pupils, and maintenance staff it should be capable of handling 288 pupils with an establishment of 108 aircraft and 63 (i.e. an increase of nine)⁽³⁾ instructors, and the addition of 100 men to the ground maintenance staff. To achieve this he proposed working by day in a system of five-hour shifts, keeping flying going constantly throughout all fit day flying weather. By this system each instructor would have six pupils. The main difficulty was night flying: a school with two landing grounds in use for night flying would be barely able to give each pupil, in summer, the $4\frac{1}{2}$ hours required by the syllabus.

By contrast, Flying Training Command estimated that the maximum training effort would be produced by giving each instructor four pupils, and requiring him to do 80 hours flying per month.⁽⁴⁾ In June Flying Training Command put forward an alternative scheme for increasing S.F.T.S. efficiency.⁽⁵⁾

(1) A.M. File S.58474.

(2) This report is included at Appendix 19.

(3) S.F.T.S.s were working with six instructors fewer than the number quoted in Group Captain Gordon Dean's report.

(4) A.M. File S.58474.

(5) See Appendix 20.

It was clear that the S.F.T.S.s could work more intensively than the Third Revise with 200 pupils required, and in June seven of the T.E. S.F.T.S.s began to handle 240.⁽¹⁾ The eighth, No. 6 S.F.T.S., Little Rissington, began on 18 June an experiment in working to Group Captain Gordon Dean's shift system with 288 pupils. Some increase in staff was needed for both 240 and 288 pupils, while Little Rissington was given priority in the supply of spares, to avoid delays which would upset the experiment.

Maximum Output of E.F.T.S.s.

An increased flow of pupils from the E.F.T.S.s was wanted, partly to fill the expanded S.F.T.S.s, and partly to feed the growing number of R.A.F., S.F.T.S.s in Canada for which E.F.T.S. training was at this time done in the United Kingdom. In May and June ten flights (of 30 pupils each) were added to the schools,⁽²⁾ the Service-operated school at Peterborough was closed and replaced by a civilian-operated E.F.T.S. (No. 24) at Booker, and the ab initio part of the Polish Flying Training School at Hucknall was made a separate unit and established at Peterborough as No. 25 (Polish) E.F.T.S. In June and July all the E.F.T.S.s except seven⁽³⁾ increased their pupil population by 20 per cent (i.e. from 30 to 36 per flight). In July, August and September, six⁽⁴⁾ more flights were added to existing schools and three new schools were opened.

By the end of the summer the United Kingdom flying training organisation reached its maximum intensity of production. Eleven S.F.T.S.s were training for the R.A.F. and turning out pilots at the rate of some 11,300 per year. In addition there was one S.F.T.S. training for the Fleet Air Arm and another training Poles. Twenty-five E.F.T.S.s (one of them Polish) with a total annual capacity of about 22,000 per year were feeding the S.F.T.S.s. This⁽⁵⁾ was the peak of basic pilot training in the United Kingdom.

(1) No. 2 Brize Norton, No. 3 South Cerney, No. 11 Shawbury, No. 12 Grantham, No. 14 Cranfield, No. 15 Kidlington, and the College S.F.T.S. Cranwell. The S.E. schools could not deal with more than 200 pupils because lack of spares for Masters prevented any intensification of their flying.

(2) Nos. 1, 3, 5, 6, 7, 8, 9, 15, 18 and 22 E.F.T.S.s were expanded by the addition of extra flights.

(3) The population of the following E.F.T.S.s was increased by 20 per cent:- Nos. 1, 3, 5, 6, 7, 8, 9, 11, 15, 17, 18, 19, 20, 21 and 24.

(4) (a) One flight was added to each of Nos. 3, 6, 15, 16, 17 and 20 E.F.T.S.s.

(b) The following schools opened on the dates shown:-

E.F.T.S.		1941
No. 26	Theale	18 August
No. 28	Wolverhampton	15 September
No. 29	Clyffe Pypard	15 September

(No. 27 was due to open at Bagington but never commenced training owing to a change of requirements).

(5) See Appendices 21 and 22.

It was clear that many factors had to be taken into account when planning for maximum efficiency. Winter conditions made a course of 10 weeks' duration beginning between April and August equivalent to one of 12 weeks beginning in March, or of 14 weeks beginning in September, October, January or February, or one of 18 weeks beginning in November or December. Unserviceability of aerodromes showed that grass surfaces would not stand up to the heavy traffic of intensive flying; the lesson of Cranfield and experience in Canada led to a decision that United Kingdom S.F.T.S.s should have two runways at right angles.⁽¹⁾ Night flying was a problem in landing grounds; three⁽²⁾ were necessary to carry out the syllabus properly. Maintenance difficulties could be a serious handicap if there were delays over replacement aircraft and spares, or if hangars could not be used because of dispersal.

In September the basic length of S.F.T.S. courses in the United Kingdom was raised to 12 weeks, with planned equivalents of 14, 16 and 18 weeks in the winter, and the flying hours went up to 85.⁽³⁾ The night flying target remained at 5 hours. Night flying had been re-instated at the E.F.T.S.s in July 1941, it having been discontinued on the outbreak of war. Half-an-hour's night dual was laid down in the summer of 1941 and this was gradually extended during the autumn.

In November 1941, owing to the bottleneck of E.F.T.S. trained pupils awaiting entry into Service flying training schools, three special pools known as Pupil Pilots Pools were opened at selected E.F.T.S.s. Their function was to continue the training of E.F.T.S. trained pupils awaiting entry into S.F.T.S.s; training was carried out on Tiger Moths and the duration of the course was indefinite, depending on the rate of intakes of the S.F.T.S.s. These schools were not required when the bottleneck at S.F.T.S.s

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- (1) Canadian S.F.T.S.s had three runways on parent aerodromes and R.L.G.s, and in some cases the parent aerodrome had double runways. There was at first some concern about the need for off-wing landings, but it proved unfounded. Canadian E.F.T.S.s were also being provided with runways.
 - (2) The use of parent aerodromes, as well as R.L.G.s, for night flying was allowed in the United Kingdom from July 1941. The 'Drem' electric, centrally controlled, system of lighting was adopted in October 1941, but not brought into use until later.
 - (3) Previously the syllabus required 72, but in the summer of 1941 the schools actually averaged 80 hours per pupil. (A.M. File S.58474).

was solved, and one closed down in June 1942 and the remaining two schools⁽¹⁾ disbanded in March 1943.

Due to the surplus of pilots and that schools overseas were turning out larger numbers, basic pilot training in the United Kingdom began to disappear towards the end of 1941. The United Kingdom schools gradually changed over, during the winter of 1941-1942, from basic S.F.T.S. instruction to refresher courses for acclimatising pilots trained overseas. By⁽²⁾ March 1942 the change was practically complete. Cranwell was the only S.F.T.S. left in the United Kingdom: it was kept (half on S.E. and half on T.E. training) for experimental and research work on new ideas. There was also a Polish S.F.T.S. (No. 16) at Newton.

The virtual disappearance of S.F.T.S. training in the United Kingdom was, of course, accompanied by a reduction in the E.F.T.S. training needed, and the reduction was accentuated by a decision to do elementary training in Canada for the R.A.F., S.F.T.S.s there. E.F.T.S. capacity in the United Kingdom, however, had dropped only slightly by the end of 1941,⁽³⁾ and this drop was more than made up in January 1942 when additional flights were⁽⁴⁾ added to the E.F.T.S.s. During this period various moves of elementary

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- (1) No. 1 P.P.P. formed at Peterborough (No. 17 E.F.T.S.) on 3 November 1941 and disbanded on 1 June 1942.
- No. 2 P.P.P. formed at Clyffe Pypard (No. 29 E.F.T.S.) on 3 November 1941 and disbanded on 8 March 1943.
- No. 3 P.P.P. formed at Wolverhampton (No. 28 E.F.T.S.) on 3 November 1941 and disbanded on 8 March 1943.
- (2) Except at Montrose (which became a Flying Instructors School), Lynsham (which was transferred to Ferry Command), Netheravon (which went on to Glider and Parachute training) and Kidlington (which became a Glider O.T.U.). (A.M. File S.62856).
- (3) The following reductions were made:-
- No. 27 E.F.T.S. scheduled to open at Bagington did not open.
 - No. 19 E.F.T.S. Sealand disbanded on 27 December 1941.
 - No. 5 E.F.T.S. Meir disbanded on 24 December 1941.
 - No. 20 E.F.T.S. Yeadon disbanded on 3 January 1942.
 - No. 2 E.F.T.S. Staverton was converted into No. 6 F.I.S.(E) on 1 November 1941.
- 3 Flights of No. 1 E.F.T.S. Hatfield disbanded in November 1941.
- (4) Additional flights were added to the E.F.T.S. in early 1942:- Nos. 1, 3, 4, 7, 9, 11, 21, 22, 28 and 29.

schools took place. No. 3 E.F.T.S. moved from Watchfield to Shellingford on 18 December 1941, No. 10 E.F.T.S. had moved from Weston-super-Mare to Stoke Orchard on 29 September 1941, and No. 24 E.F.T.S. moved from Luton to Sealand on 7 February 1942.

Need for Better Basic Training

The shortage of pilots which had caused so much anxiety had disappeared by the summer of 1941, a rapidly mounting flow of trained men was coming from schools overseas, and the supply of pilots was at last greater than the first line requirement. It was possible to give attention at last to the quality rather than to the quantity of the output. For some time it had been realised that the standard of pilot training was not as high as it should be: the standard of instruction was generally low because good and experienced instructors were hard to find; a large percentage of accidents was caused by bad flying technique and bad airmanship; there was general ignorance of the principles of handling modern aircraft; squadrons devised undesirable methods because the C.F.S., without a handling squadron, was not a live centre for disseminating sound technique.⁽¹⁾ Thus, when the results of the Little Rissington experiment were considered in August 1941, the main purpose to be served by greater efficiency and intensity at S.F.T.S.s had changed from turning out larger numbers of pilots to the producing of better trained men.⁽²⁾ The experiment was hampered by shortage of spares (about 15 aircraft out of the total of 108 being constantly out of action for this reason), and took place rather too late in the summer for the hours of daylight to allow three five-hour shifts. It produced a higher accident rate and a lower standard of output. Within these limitations it was successful in showing⁽³⁾ that S.F.T.S.s could achieve greater intensity of flying.

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- (1) A.M. File 855861/38. The Handling Flight at C.F.S. was reconstituted (it had been disbanded in 1940) and made a Handling Squadron in July 1941, but it remained ineffective.
 - (2) A.M. Files S.58474 and S.71940.
 - (3) It also showed the need for efficient airfield control, and that a shift system had the drawback of causing irregular meals.

In a letter to the Air Ministry on 2 December, Bomber Command complained of the standard of training of aircrew personnel reaching their O.T.U.s. (1) The main trouble, it seemed, was their lack of night flying, and now following the policy of building a relatively small number of heavy bombers instead of a large number of small bombers, the emphasis was on quality rather than quantity.

It will be recalled that in the summer of 1940, during the Battle of Britain, it was necessary that the system of training should be reorganised to produce the quantity which was urgently needed, and to this end the pre-O.T.U. stages had been reduced from 24 to 16 weeks with a total of some 122 hours flying. (2) The O.T.U. (Bomber) was 10 weeks and included 85 hours flying.

These courses provided the minimum instruction necessary to enable a pilot to handle his aircraft under favourable conditions, but they gave too little background of general flying experience and this led to a higher accident rate at the later stages of training when flights were undertaken in more difficult conditions. A review of the number of aircraft written off per 10,000 hours flying during the nine-month period 1 January to 1 September 1941 revealed the following position:-

E.F.T.S.	2.5		
S.F.T.S.	5		
O.T.U.	15	decreasing to 10	} Decrease largely seasonal
Operational Squadrons	20	decreasing to 10	

It will be seen that operational aircraft were being written off at twice the rate of S.F.T.S. aircraft which, in turn, was double the E.F.T.S. rate.

Clearly the skill of the pupil had not been increasing as fast as his advance to more complex types of aircraft. (3)

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- (1) BC/C.22872/Tr/C.-in-C. and A.M. File S.77400.
 (2) Owing to lack of capacity, in the summer of 1941 these were reduced to 6 weeks with 42 hours flying.
 (3) Expressed in terms of aircraft the monthly average loss of operational aircraft from accident causes was:-

<u>Command</u>	<u>No. of Aircraft</u>	<u>Equivalent to</u> <u>(No. of squadrons)</u>
Bomber	67	4
Fighter	78	5
Coastal	25	1½
Total	170	10½

These figures were for write-offs only and did not include those seriously damaged. Even so, they represented some 20 per cent of the output of operational aircraft during this period.

During 1941 the standards of training had been largely dictated by necessity. By the end of 1941 with the target of front-line squadrons being shared by the Allies, the extent of the expansion of the Metropolitan Air Force could be cut down to a figure more approaching that which the United Kingdom could produce from her own resources. At the same time the long term measure that had been taken in the Dominions resulted in such a large flow of trainees that the Air Ministry were embarrassed by the bottle-neck created at the O.T.U. stage. It can, therefore, be seen that extra time all along the training pipeline could now be afforded.

The price which had to be paid in loss of efficiency and the crash rate in order to overcome the critical shortage of pilots during 1940/early 1941 had been heavy. The operational commands had emphasized the need for longer training while more modern equipment demanded higher standards of flying technique. At the same time the scale of the training effort did not admit of much choice in the selection of aircrew personnel. It was a fact that individuals were being trained who had little or no mechanical knowledge, including some who had never even driven a motor car, and this, coupled with a low general standard of education, necessitated a longer period to absorb the necessary instruction.

The following factors had to be borne in mind in considering the future standard of training:-

- (a) Experience had pointed to the need for longer training, and this need had been emphasized by the commanders-in-chief of all the operational commands.
- (b) The force which was then being trained would be equipped with more powerful and complicated aircraft calling for higher standards of flying technique.
- (c) The scale on which training was being undertaken did not admit of the same measure of choice in selecting aircrew personnel. Individuals were then being trained who had little or no mechanical knowledge and they consequently needed a longer period to absorb the necessary instruction.
- (d) The basic training organisation had largely been transferred overseas, and this necessitated a period to acclimatise pilots to the blackout and meteorological conditions in the United Kingdom and to give them practice in map reading before starting operational training.

A.M.T.'s Proposals: The New Deal

The following proposals were put forward by the Air Member for Training, for improving the standard of training:-

- (a) Future plans should be based on pilots receiving 300 hours flying experience before joining an operational squadron; this figure was to be 350 hours for pilots proceeding direct from O.T.U.s to heavy bomber squadrons. This target was desirable but at the moment impossible to attain before training capacity had been increased; in the meantime therefore A.M.T. suggested that the following standards could be realised:-⁽¹⁾

On elementary trainer aircraft	-	80 hours
On advanced trainer aircraft	-	150 hours ⁽²⁾
On operational aircraft	-	30 hours
Total		<u>260 hours</u>

- (b) Advanced Flying Units should be set up in Britain to accustom crews trained overseas to United Kingdom conditions and to undertake their conversion to the operational type of aircraft: this instruction was to occupy one month. It was considered that the capacity left vacant by the transfer of the S.F.T.S.s to Canada could now be taken up with this additional stage, which not only compensated for some of the inadequacies of the previous syllabus but which also provided an essential period for refreshing inexperienced crew after the delays inseparable from overseas travel and training.
- (c) Pilots should be given an air test in Britain to eliminate all but the most promising pupils before they were sent for training overseas. The E.F.T.S. capacity left vacant by the transfer overseas could be utilised for this purpose. By this means (known as grading) not only would it be possible to select the most promising material i.e. those candidates who went solo the quickest, but it was also estimated to save some 350 passages a month in both directions.

(1) AC.70[^](41).

(2) Of the 150 hours on the advanced trainer aircraft, pilots destined for the M.A.F. were to be given 120 hours at S.F.T.S.s overseas, and 30 hours in Advanced Flying Units in this country. This was to ensure that before conversion to the operational type they would have had experience of flying in the United Kingdom, also map reading, training in beam approach and general practice after the voyage period.

- (d) The Central Flying School should undertake the training of flying instructors for the Central Flying Schools of the Empire.

The proposals also included improvements in the training of other members of aircrews besides pilots, which entailed an increase in the training capacity for observers and air gunners overseas.

The A.M.T.'s proposals to increase the course lengths were the subject of discussion by the Air Council and the Commands, particularly Bomber Command, where the problem arose in its most acute form. In the meantime, however, on grounds of emergency, instructions were given in anticipation of approval for the extension to 16 weeks of the S.F.T.S. courses (both E.A.T.S. and transferred schools) in Canada, and to 16 weeks in New Zealand and Southern Rhodesia. Courses in Australia and South Africa were already at 16 weeks. In the main there could be no quarrel with the need for a revision of training, but the implications were serious, chiefly in the organisational aspect. It was unfortunate, for instance, that a revised estimate of requirement in advanced trainer aircraft, which did not allow for the new proposals, had just been put to the Ministry of Aircraft Production. There was the embarrassing possibility that this estimate would now have to be revised. There was also the fear that what was now a surplus of trainees ex-S.F.T.S. might become a deficit which would not balance aircraft output, and particularly new demands for aircraft arising from developments in the Far East.⁽¹⁾ The cost in units and aircraft also had not been measured and there was likely to be the paradox of increased training overheads for a reduced target force. There was also some criticism that, with the transfer of basic training overseas, the Air Member for Training would lose touch with the organisation for whose syllabus he was responsible.

These proposals were only practicable if existing 'Arnold' capacity in America continued to be available, and the A.M.T. would have preferred to have asked for more U.S.A. capacity in order to bring his proposed 260 hours up to 300. At this moment, however, when the President and the American people were feeling the reactions of the Japanese attack at Pearl Harbour and when it could be easily seen

(1) Japanese aggression at Pearl Harbour, Singapore and Hong Kong on 7, 7/8 and 18/19 December respectively.

that the Americans would soon be eager to expand their fighting forces in order decisively to participate in the war, this would not be a good time to suggest that the United Kingdom should increase their demands on the all too few training facilities existing in the U.S.A. There did not seem to be at this time any immediate fear that 'Arnold' capacity would be lost, but if this did happen, then the Air Ministry had to be prepared either to accelerate training in Canada or do less hours.

In general it can be said that the new training proposals met with approval in principle subject to discussion with the Commands and investigations of the logistical aspect. There also followed discussion on the pilot and observer Advanced Flying Units and on Elementary Training in the United Kingdom.

It was considered essential that the scope of training at the A.F.U. should be planned in relation to the standard of the trainees on entry. After experience of Dominion trained personnel already undergoing training at A.F.U.s it was found that, while on the whole their standard of flying was good, they lacked finish and their knowledge of instrument flying, navigation, armament, aircraft recognition and R.T. procedure was poor. It therefore required from four to six weeks at the A.F.U. in order to bring them to the standard attained by a good United Kingdom trained S.F.T.S. product.

Elementary Training Requirements in the United Kingdom

The subject of 'Grading' is explained in detail in Chapter 1; here it suffices to say that it was at this time (December 1941) that the 'New Deal' also embraced the principle that in order to cut down wastage or elimination during basic training overseas, pupils should be graded according to their quickness in learning and ability in the air before being posted overseas. This proposal was adopted because it had been established that the quicker a pupil reached the solo flying stage, the better proposition he was from a general pilot training point of view. Conversely, the slower he was, the more likely he was to be eliminated during subsequent training. It will be understood that from all points of view it was desirable to cut down wastage in training, and that therefore a preliminary testing or grading course was the best and most practical means of actually finding out in any batch of pupils what was their practical ability in the air. 'Grading' was therefore grading pupils according to their abilities, and selections for Pilot, Navigator or Bomb Aimer training were made from the higher, middle and lower grades respectively.

At the Training Meeting in the Air Ministry on 10 December 1941, when the proposal for grading was discussed it was decided that:-

- (a) The length of the air testing course should be three weeks.
- (b) The minimum useful flying time on the course should be eight hours, with further instruction in flying if time were available.
- (c) No modification should be made in the existing organisation and establishment with the exception that the instructor establishment should be of 10 per flight of 30 pupils on the 10 weeks' course at E.F.T.S.s where all-through elementary training would be carried out. In this connection it was noted that the A.M.T. proposed that the 80 hours flying on the 10 weeks' course should be allocated in the proportion of 40 hours dual to 40 hours solo. The meeting held the view that the flying time should be in the proportion of 30 hours dual to 50 hours solo.

- (d) The 10 weeks' course, whilst acceptable, was not sufficiently flexible or conducive to smooth working since enemy action might interfere with the arrival of drafts in Canada on the due date and that deficiencies could not quickly be made good unless some pool system were established in Canada to meet such eventualities.

The next question concerning elementary training requirements was whether there were training advantages in retaining E.F.T.S. capacity in Britain to feed transferred S.F.T.S.s or whether it were desirable that this capacity should itself be transferred.

The conclusions reached were that there were considerable advantages in retaining E.F.T.S. training capacity in the United Kingdom, e.g.:-

- (a) The necessity for retaining control of the standard of flying training in Britain.
- (b) The desirability of the flying instructor carrying out a reasonable proportion of complete elementary flying training failing which his standard of instruction would deteriorate and his valuable services would not be adequately employed.
- (c) Absence of all-through training would result in an increased wastage rate.
- (d) Training under weather conditions comparable with those in which the pupil would subsequently operate was of high value, particularly in regard to night flying.
- (e) The supply of trainer aircraft was ensured from home production.
- (f) The E.F.T.S. aerodrome capacity of 43 flights would become redundant and, generally, could not be used for other purposes.

On the subject of elementary glider training it was stated that the existing six flights at Derby could only produce 166 pilots by July 1942 against a requirement of 400 and that since the need for these pilots was one of urgency, the further training capacity required to produce the pilots was:-

- (a) Two additional glider schools which were equivalent to nine flights.
- (b) E.F.T.S. capacity of 15 flights against the six mentioned.

To meet this commitment, 100 staff pilot instructors were required of whom 25 only were available. The balance therefore would have to be found from S.F.T.S.s and from the glider training schools. In addition it was decided that the four glider schools working on a four weeks' course would have to be established by the first week in January 1942, or otherwise the 400 pilots required would not be available by July 1942. In order to meet the additional glider training commitment there would be a loss of 18 E.F.T.S. flights, i.e. nine at aerodromes turned over to the glider schools and nine (in addition to Derby) required for training Army personnel.

It was decided that the syllabus at the Glider School at Thame should be used as a basis and modified in the light of experience and having regard to the course being reduced from six to four weeks. It was also decided that the E.F.T.S. course for Naval pupils should be extended from eight to ten weeks as in the case of R.A.F. pupils.

A summary of E.F.T.S. capacity required in the United Kingdom following on the discussions was as follows:-

	<u>Flights</u>
Air Testing	44
R.A.F., E.F.T.S.s	35
Glider E.F.T.S.s	15 (plus 2 additional schools of 9 flights)
Naval E.F.T.S.s	7
Miscellaneous	4
	<hr/>
Total	105
plus	9
	<hr/>
	114 = an increase of 18 flights

New Training Proposals

It will be realised that the pressure from operational commands, and particularly Bomber Command, to improve the standard of training in order to achieve better operational results had become a vital necessity, and the period from that time and extending into the early months of 1942 was one of intensive discussion and activity. By that time the requirement to build up the offensive element of the air forces was receiving the strongest political backing, and it remained for the training authorities, within the limits imposed by the various restrictive factors, to concentrate, so far as practicable, on quality before all else.

On 19 December 1941 in pursuance of this object, a conference was held in the Air Ministry to discuss improvements in the standard of training of crews for Bomber Command, and especially to consider the application of the Air Member for Training's new proposals to Bomber Command's requirements. A series of proposals was therefore discussed, and they are outlined in order to bring the reader up-to-date in his knowledge of what had passed and what could be achieved in the future.

To recapitulate the basic facts, the reader will perhaps remember that in the summer of 1940 it became necessary, owing to the grave shortage of aircraft and to lack of advanced trainer aircraft, to reduce the amount of instruction given at the E.F.T.S.s and S.F.T.S.s. The scheme which was introduced was known as the 'Third Revise' and allowed the following periods of training:-

E.F.T.S.	50 hours for 6 weeks
S.F.T.S.	72 " " 10 "

The course provided the minimum instruction necessary to enable a pilot to handle his aircraft, but it was realised that it was most desirable and essential to extend the courses as soon as the situation made this possible. By that time improvements in pre-O.T.U. training for pilots were taking place, and improvements in the training of the other members of aircrew were also effected on a similar scale.⁽¹⁾

In the same way the standard of training in medium and light bomber O.T.U.s had been laid down as follows:-

	<u>Hours per</u> <u>Pilot</u>	<u>Length of Course</u> <u>- Weeks (Summer)</u>
Wellington and Whitley	30	6
Hampden	54	8
Blenheim or Light Bomber	60	8

(1) See Appendix 23.

These courses were agreed in the spring of 1941, and catered for pupils passing out of the E.F.T.S. and S.F.T.S. course in accordance with the Third Revise.

It will be realised that the slow-down of first line expansion due to the entry of America into the war coincided with this need for improved quality in training, and therefore from all points of view the situation was now favourable for a drastic reorganisation of training. The Commander-in-Chief, Bomber Command, once more gave expression to his conviction that his force was inadequately trained, and that the results expected were not being achieved from bombing attacks. In particular, he considered that it was essential that much more time should be devoted to night flying in pre-O.T.U. training. At that time unsuitable personnel were reaching O.T.U.s, and he considered that they should be eliminated at an earlier stage of training if heavy losses of crews and available aircraft at the O.T.U. stage were to be avoided. He criticised the amount of time devoted to training on elementary aircraft and considered that the E.F.T.S. flying hours should be reduced from 80 to 60 in order to allow the balance to be used at a later stage of training. This was because of the lack of a more modern type of elementary trainer aircraft than the Moth. If the full instrument panel could be taken then more time could be given at the elementary stage to night and instrument flying. The A.M.T., however, was not to be deterred from his policy of giving as sound a basic flying experience as was possible, fully cognisant though he was of the limits of the equipment at his disposal.

With regard to S.F.T.S. training, the Commander-in-Chief emphasized the need for more than 15 hours night flying, and proposed that this should be doubled. The A.M.T. considered that some additional night flying could be obtained by working all blind approach training flights for the whole of the 24 hours if Bomber Command were prepared to agree to such extended use of their aerodromes. The Commander-in-Chief considered that the proposal was acceptable so far as it went, but considered that it was not good enough and required something much more substantial. It was pointed out, however, that this could only be achieved by making available more aerodromes and more aircraft. It appeared from the discussions that by March 1942, on the

assumption that the transferred schemes in Canada would get their trainers from the U.S.A., there would in theory be a surplus of 800 to 1,000 advanced trainers, including Oxfords, in Britain, and it was, therefore, in the direction of more night flying at the A.F.U.s that some improvement could be achieved. This met a further criticism by the Commander-in-Chief that the 4½ hours night flying proposed by the A.M.T. for advanced flying units was quite inadequate.

Altogether, the A.M.T. was most anxious to raise the general standard of training and he fully appreciated the very high standard required for bomber crews, but his proposals represented the best that could be done under the circumstances in pre-O.T.U. training. He considered that the policy should be to make a drive for greatly improved pre-O.T.U. training so that the proportion of operational type aircraft used in O.T.U. training might be kept as low as possible. He assured Bomber Command that everything possible within the available resources would be done to meet their requirements, and in particular he would do all he could to increase the amount of night flying instruction to be given.

C.A.S. Conference on pre-O.T.U. Training, February 1942

The C.A.S. held a conference to consider the 'New Deal' proposals on 11 February 1942.⁽¹⁾ Once more the A.M.T. recapitulated the fact that in the summer of 1940 the Air Ministry were forced to reduce progressively the pre-O.T.U. period of training for pilots from a total of 24 weeks with 150 hours flying to 12 weeks with 122 hours flying or less, at the same time transferring 4 weeks with 28 hours to the O.T.U. stage. It was, however, always intended, as soon as the supply of advanced trainer aircraft permitted, to restore to the pre-O.T.U. stage the training which had been transferred to the O.T.U. stage. The postponement of first line expansion now enabled this intention to be fulfilled, and as a first step, the length of all S.F.T.S. courses at Home and Overseas had just been extended to 16 weeks with some adjustment of the E.F.T.S. period. It had also been found necessary to introduce a new feature into the training organisation, namely, the Advanced Flying Unit for pilots and observers. In addition to the reasons for this

(1) C.A.S. 782, 11 February 1942.

step, the A.M.T. mentioned that it also relieved the O.T.U.s of the burden of having to convert single-engine trained pilots to twins.⁽¹⁾

In considering the total length of the revised course, two considerations had to be borne in mind, firstly, the need for the standard of training to be sufficiently high to lead to a substantial reduction in the wastage of aircrews and aircraft, and secondly, the desirability that courses should not be increased to such an extent as to rob the pupils of their zest for the fight. In terms of flying hours prior to joining an operational squadron, the answer was considered to be 300 hours minimum at the controls with an additional 50 hours for pilots going on to heavy bomber squadrons direct from O.T.U.s. This allowed for an adequate amount of instrument flying, night flying and formation flying during the period of training and gave an adequate background of flying experience.

The operational commands had concurred in these proposals except that Bomber Command considered that 50 hours' solo night flying should be included in the period of training. It was not practicable, however, under the circumstances then existing, to provide this amount of night flying, nor was so much night flying considered essential with the greatly improved standard of training now contemplated.

(1) A comparison of the training given under each scheme will indicate the improvement that was expected. The new scheme:-

- (a) Doubled the total flying time on all types.
- (b) Converted all pupils to twin-engined types.
- (c) Passed the pupils to the O.T.U. training in beam approach, with the standard in instrument flying which that entailed.
- (d) Increased the flying time at night by about five times.
- (e) Took the training in navigation to a far higher standard.
- (f) Introduced elementary training in bombing and gunnery.
- (g) Gave the Dominion pilots an acclimatisation course to accustom them to United Kingdom conditions before their crew O.T.U. training.

The difference in flying times can be seen from this table:-

	<u>Old Scheme</u>		<u>New Scheme</u>	
	<u>Day</u>	<u>Night</u>	<u>Day</u>	<u>Night</u>
Elementary Flying	60	0-1	80	3
Advanced Trainer S.F.T.S.	72	4	120	12
A.F.U.	-	-	30	4½
<u>Total</u>	<u>132</u>	<u>4½</u>	<u>230</u>	<u>19½</u>

The A.M.T. went on to say that the next problem to be considered was whether the standards which he had indicated could be reached and maintained. Regarding the S.F.T.S.s, he considered that it would be possible, subject to confirmation by the A.M.S.O., to give the necessary training in the schools already planned so far as the year 1942 was concerned, provided that the population of the schools overseas could be increased to 240⁽¹⁾ and that the existing training facilities in the U.S.A. could be retained. He appreciated the difficulty in finding all the capacity required for the A.F.U.s in Britain and suggested that pupils and aircraft might be distributed on operational aerodromes, some of which, he felt, were not being used to the fullest extent.

In the general discussion which followed the A.M.T.'s proposals, the A.M.S.O. said that a year previously the Air Ministry had been fairly confident that an increased and adequately trained flow could be maintained from the shortened courses which were then introduced. The new proposals represented a tremendous swing of the pendulum and he wondered if they were not going too far in the other direction. It emerged that the total period for a pilot training abroad might be as much as 18 to 19 months before he reached a squadron. The German period of pre-O.T.U. training for bomber pilots took about 17½ to 23 months during which they completed 270 hours' flying.

Mention was made of a proposal by Flying Training Command that there should be a six months' initial training wing course, the main object of which was to instil more discipline into the pupils and to give more instruction in ground subjects so that they could more readily absorb instruction at a later stage in their training. It was considered doubtful, however, whether these reasons held good in view of the increased course lengths now proposed.

There then followed an argument on the A.F.U.s. The Director of Bomber Operations said that the operational commands had asked for more night flying, and this was one of the reasons for accepting the setting up of A.F.U.s. He complained that little night flying was being done at these

(1) Canada had already agreed to put up their population by 240 by May 1942.

units and to that extent they might be regarded as a luxury. It was explained, however, by the Director of Flying Training, that the A.F.U.s had only just started and that it was not possible to do much night flying in the absence of the necessary aids and radio equipment, but the intention was to do 50 per cent of the flying at night. On the other hand, night flying was not, of course, the only function of the A.F.U. The Deputy Chief of the Air Staff said that the operational commands were of the opinion that the A.F.U.s should be absorbed by the O.T.U.s. He himself thought that the 60 hours' flying proposed at these units was excessive. It was pointed out that if A.F.U.s were absorbed into O.T.U.s the result would be that more O.T.U.s would be required. It was also suggested that economies might be effected by combining the pilot and observer A.F.U.s, but it was pointed out that the seating capacity of the aircraft would be fully occupied.

Finally, in reply to the C.A.S., the A.M.T. said that he was satisfied that the new scheme would produce all the crews required during 1943. If the circumstances required it, he could once more shorten courses, but this would have unfortunate repercussions throughout the training organisation at home and abroad.

Assessment of the cost of the New Training Programme

The C.A.S. in commenting on the proposals before him, said that some 50 per cent of accidents involving write-offs were due to lack of skill on the part of pilots and the need for an improved standard of training was apparent. He felt that it would be excellent if a reduction of the wastage in crews and aircraft could be achieved by the improved standard of training, but it depended on the A.M.S.O.'s ability to find the necessary resources for the new training programme under discussion and on the ability to maintain an adequate output of aircrews under the new conditions.

The A.M.S.O. was then invited to give an assessment of the cost of the new scheme:-

Aerodromes

Sixty-seven additional aerodromes would be required to house the pilot and observer A.F.U.s. This included the S.F.T.S. aerodromes being used for the purpose, as they would otherwise

have been available for other purposes. On the assumption that it was feasible to increase S.F.T.S. populations to 240, no additional S.F.T.S. capacity beyond that already planned would be required during 1942.

Aircraft

An output of 40 Masters per month from October 1942 onwards would be required. Under existing plans, the production of Masters was due to cease by February 1943. The production of Oxfords, which was due to drop to 115 a month at the end of 1942, would be required at the rate of 190 per month. The output of Ansons (100 per month) would have to be increased to 130 per month.

Engines

A greatly increased number of Cheetah engines would be required, and this threatened to affect the production of Merlins.

Personnel

The new programme of pre-O.T.U. and O.T.U. training would require some 83,000 additional personnel including 5,000 officers. This, it was considered, would probably require a high level approach to the Ministry of Labour in view of the large number of personnel required.

In discussing trainer aircraft for the S.F.T.S.s the A.M.S.O. said that he was doubtful whether 108 trainer aircraft per school was adequate, in view of the spares difficulty, and he had therefore assumed that 135 would be required. The A.M.T. said that if the flow of spares were no better than in the summer of 1941, he agreed that 12 to 15 aircraft per S.F.T.S. would be needed over and above what would otherwise be sufficient. This indicated the wastefulness of an inadequate supply of spares.

It was stated that so far as Canada was concerned, with 108 aircraft plus an adequate supply of spares, there would be no difficulty in training a population of 240, although it was agreed that it would be rash to assume that an adequate supply of spares would in fact be available.

The C.A.S. said he was prepared to approve the A.M.T.'s proposals on the understanding that if it were not found administratively possible fully

to implement the scheme, the A.M.T. would adjust the training periods so as to provide the necessary flow of aircrews.

It was further agreed that:-

- (a) It would be necessary for A.M.S.O. and A.M.T. to watch closely whether reduced wastage of operational type aircraft might enable expansion to be accelerated, thus demanding an accelerated flow of aircrew.
- (b) A.M.S.O. would approach M.A.P. in regard to the additional production of aircraft and spares required.
- (c) A.M.P. would take any necessary steps with the Ministry of Labour regarding the additional personnel required.
- (d) In view of the urgent need for more night flying training both in A.F.U.s and in O.T.U.s, full advantage had to be taken of the existing lull in the enemy activity over Britain, to relax the restrictions which had been imposed by Fighter Command.

It may thus be seen that the first obstacle had been surmounted, and the A.M.T. had received the C.A.S.'s qualified approval for the pre-O.T.U. portion of 'New Deal' in spite of the greatly increased cost in terms of manpower and material that this involved.

The second problem, that of the improvements recommended for O.T.U. training, was considered at a further conference held by the Chief of the Air Staff on 12 February 1942.⁽¹⁾ This, however, is outside the scope of the present chapter and is dealt with in Chapter 15.

Approval of the one-pilot policy, March 1942

The C.A.S. held a further meeting on 29 March 1942 when the interim decisions on the various important measures which have been described came up for final decision.⁽²⁾ The main decisions were:-

/ (a)

(1) C.A.S. 782.

(2) C.A.S. 782.

- (a) That all medium and heavy bomber crews should have one pilot only.
- (b) That the functions of the observer in medium and heavy bomber squadrons should be divided between a navigator and a bomb aimer.
- (c) That the number of wireless operators/air gunner should be reduced from two to one per crew. A straight air gunner would be substituted to man the dorsal turret where applicable.
- (d) That a pilot's mate should be provided for each bomber aircraft. (The flight engineer would undertake this task where the crew included this type of aircrew member).
In the event of the pilot being unable to fly the plane his task would be to fly the aircraft back over friendly territory by use of the automatic pilot, and thereafter the crew would normally bale out.

On the question of the introduction of the one-pilot crew policy it was explained that the immediate introduction of this policy would result in an embarrassing accumulation of pilots at Bournemouth, but, by the immediate extension of the S.F.T.S. course length in South Africa and Southern Rhodesia from 16 to 24 weeks, a two months' hiatus in output would be caused, followed by a reduced flow approximately on the same scale as that required. Owing, however, to the number of pilots on passage to Britain, the surplus at Bournemouth would build up almost immediately to a four months' supply, but this would soon fall to $2\frac{1}{2}$ to 3 months as soon as the hiatus became effective. It was further pointed out that if the S.F.T.S. course length were not extended, then the pilot population at Bournemouth would grow to between ten and eleven thousand during the course of the following nine months, which would involve a stay at Bournemouth rising to eight months by the end of 1942, and falling gradually thereafter. The planned length of stay at Bournemouth was approximately two months, which included an Army fortnight and a Navy fortnight.

/ After

After some discussions on the various considerations effecting a gradual or an immediate introduction of the one-pilot scheme, the C.A.S. ruled that the policy be applied forthwith to pilots then undergoing training in O.T.U.s.⁽¹⁾

The C.A.S. requested the A.M.T. to submit the proposals to the Air Council at the earliest possible date,⁽²⁾ and in the meantime the A.M.T. informed the Air Council that he was anxious to increase the S.F.T.S. course in Canada from 16 to 24 weeks immediately. The E.A.T.S. Committee agreed to this proposal on 31 March 1942 and also that Canada should be invited to adjust the course forthwith.⁽³⁾ At this E.A.T.S. meeting the High Commissioner for the United Kingdom in Canada, who was present, stated that he had formed the opinion that the introduction of the one-pilot scheme created the possibility of political difficulties with the Canadian authorities, and the C.A.S. was asked if he would signal the Canadian C.A.S. informing him of the one-pilot decision and assuring him of the necessity for it from an Air Force point of view.⁽⁴⁾ The C.A.S. agreed to send the signal. Some doubts were expressed as to whether the 24 weeks' course would provide a steady and adequate flow of aircrew to man the aircraft which would be available and whether the flow had been stopped in the stages prior to the S.F.T.S. course. The A.M.T. affirmed that the 24 weeks' course would provide a sufficient flow of pilots for many months to come and until the expansion of the frontline Force necessitated a return to a 16 weeks' course. In the meantime the flow to S.F.T.S.s overseas was stopped for a period of eight weeks, but this still allowed numbers at Bournemouth to build up a peak of four months' supply, falling gradually to under three months and finally stabilising at the planned two months' supply.⁽⁵⁾

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- (1) This would interrupt the flow of pilots into O.T.U.s for some weeks.
(2) AC.27(42), 5 April 1942.
(3) AC.6(42).
(4) AX 191, April 1942.
(5) In actual fact only course lengths in South Africa and Southern Rhodesia were extended. The Canadian course length remained at 16 weeks.

Summary of 'New Deal' Arrangements, April 1942

The discussions and decisions which brought in the new era of training laid down a system whose broad characteristics remained until the end of the war.⁽¹⁾ This system was admittedly not ideal, but it was a compromise which steered delicately between the prohibitive cost in time and resources of ideal requirement and the wastefulness of a too hastily trained first line whose crews could not exploit the weapons they had been given nor fulfil their operational aim. It will be realised that there was indeed a very small margin for the needs of first line expansion which was left over after wastage had been met and training requirements had been satisfied. On the one hand too much wastage owing to a low standard of training would have eaten up this margin in a very short space of time and would, indeed, have led to a serious deficit. On the other hand, the outlay in training establishments, particularly on the operational training side, had to be most carefully calculated if there were to be anything left over for the equipment of the first line squadrons. The reader will have noticed the concern of the Air Member for Supply and Organisation in this respect.

The A.M.T.'s proposals in detail for pre-O.T.U. training were discussed and approved by all Commands in the United Kingdom. They were also examined in detail and approved by the Empire Aircrew Training conference. Finally, they were discussed at the C.A.S. meeting (on 11 February 1942), at which it was agreed that they were necessary for efficiency.

The new proposals provided for between 180 and 230 hours flying for pilots at the end of the S.F.T.S. stage with an additional 60 hours at the A.F.U. for pilots destined for heavy and medium bombers, night fighters and general reconnaissance squadrons, and an additional 30 hours at the A.F.U. for other pilots, prior to O.T.U. training. This gave totals of 240 to 290 hours for bomber, night fighter, and general reconnaissance pilots, and 210 to 260 hours for others. These totals, together with the flying times at O.T.U.s were designed to produce pilots with adequate flying experience by day and by night to enable them to take part in operations on joining their squadrons.

(1) A.C.27(42), 5 April 1942.

This was a most important and fundamental decision, the practical recognition and fulfilment of which was to set the seal on the early aim of the Director of Training, who it will be remembered, had laid down the principle of his reorganisation of training in October 1939, that 'the war system of training should deliver pilots fit to take their places without delay in the first line squadrons'.

So far as the S.F.T.S. training was concerned, the proposals involved a reversion to the sixteen-week course which was generally in operation under the War Training Organisation before the crisis of 1940 forced the reduction of course lengths.

The total represented a considerable increase in the lowest totals reached during the shortened courses of instruction (under the A.M.T.'s three 'Revises') but were no more than was necessary under existing conditions, and they represented the most economical employment of resources.

The addition of the Advanced Flying Unit stage of training for pilots and observers trained overseas has already been described. The main points about this stage were acclimatisation, particularly at night, and their use as a pool to feed the O.T.U.s and to cut down the period of waiting. Some time was to elapse before aircrews trained from the start of the new standards were available for operational commands. In particular, the provision of A.F.U. facilities presented difficulties in regard to night flying, and the provision of the required aircraft and airfields. Much depended upon the provision of aerodromes with Lorenz Beams, and on Fighter Command not objecting on operational grounds to the large amount of night flying training which was involved.

A further important series of decisions followed from the earlier proposals, namely the revision of the composition of bomber crews. The completion of discussion of training requirements had been delayed by the proposals for the revision of crew composition in medium and heavy bomber squadrons. These proposals, as we have seen, were discussed at a conference held by the C.A.S. on 12 February 1942. This led to further consideration of the proposals by the Air Officer Commanding-in-Chief, Bomber Command followed by a meeting under the chairmanship of the Deputy C.A.S. on 11 March 1942. A further meeting held under the chairmanship of C.A.S. at

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which the Air Officer Commanding-in-Chief, Bomber Command was present was held on 29 March 1942 and at this meeting general agreement was reached in (1) future crew composition.

Introduction of Grading

Thus by early 1942 great changes had been made in the pilot basic training organisation. The development of the overseas training scheme was now almost complete, and this meant that the E.F.T.S.s and S.F.T.S.s in the United Kingdom were becoming redundant. The 'New Deal' as proposed by the Air Member for Training, however, besides making provision for a much higher standard of E.F.T.S. and S.F.T.S. training, also introduced Grading and the Advanced Flying Unit (A.F.U.). Grading was the classification of pupils, to ensure that only those with a marked pilot aptitude actually commenced flying training. The Advanced Flying Unit was established to provide refresher, acclimatisation, and advanced training for pilots trained overseas. The redundant E.F.T.S.s were ideal for carrying out the grading, whilst the S.F.T.S.s were easily converted into advanced flying units.

These changes came about gradually. Although both the Grading Course and the A.F.U. stage were not introduced officially until the early part of 1942, the first courses of this training, in both cases, actually began as early as November 1941.

With the increase of training overseas in 1941 the problem of wastage at the elementary stage became important. Rejects from pilot training were in most cases sent for training as other categories of aircrew, but this meant that R.A.F. pupils rejected in the United States or Canada had to be brought back to the United Kingdom, since almost all R.A.F. training of non-pilot aircrew was done in Britain. The problem first became serious as a result of training in the United States, (2) and the new policy of giving R.A.F. pupils their elementary training in Canada was clearly likely to make it more serious. The obvious way of dealing with it was to use E.F.T.S. facilities in the United Kingdom for weeding out pupils before they were sent

(1) See Page 177.

(2) Principally from United States Army Air Corps Schools, which had a high elimination rate.

overseas, thus cutting down the elimination rate in the United States and Canada, and so providing smaller numbers of rejected pupils for transfer to other forms of training. Grader training, as introduced in twenty United Kingdom E.F.T.S. flights in November 1941, consisted of a three weeks' course with up to 15 hours' flying (dual only) and normal ab initio ground instruction. Pupils who showed promise of making satisfactory pilots could be taken off grader training at any time after five hours' flying and passed as fit to go on their flying training overseas. Pupils not considered promising enough to be sent overseas either went to United Kingdom schools (if they appeared to be slow starters)⁽¹⁾ or were transferred to other training.

Grading at this time was still in its experimental stages as at this time no definite flying hours were fixed but pupils passed out either as 'Fit to commence E.F. Training' or 'Suspended'. Grader pupils carried out ground training in accordance with the E.F.T.S. syllabus.

In March 1942 instructions were given that Grader pupils were, if possible, to carry out one solo flight on the grading course. On 7 May 1942 Grading was formally introduced at the E.F.T.S.s and elementary flying training finished except for special courses at a few schools.⁽²⁾ The schools were established by flights each flight comprising 18 aircraft and 36 pupils. The total number of flights in operation at the E.F.T.S.s on 1 June 1942 was 91. Their functions were as follows:-

	<u>Flights</u>
Grading	58
Fleet Air Arm	8
Army - A.O.P.	1
Glider Pilots	18
Ab Initio	6

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- (1) Perseverance with slow starters and backward pupils had always been a characteristic of R.A.F. instruction, and special treatment of such men was required by Air Marshal Garrod when the quicker tempo of the Third Revise was introduced.
- (2) Nos. 14 and 24 E.F.T.S.s at Elmdon and Sealand had been carrying out ab initio training of Fleet Air Arm personnel and continued to do so when grading was introduced. Training for the Army was also carried out (at Nos. 1, 16, 21 and 29 E.F.T.S.s).

Formation of Advanced Flying Units (A.F.U.)

Whilst the elementary flying training schools in the United Kingdom were in the process of turning over to 'Grading' pupils destined for overseas schools, so the Service flying training schools were also utilised for other purposes. To reduce the undesirable load of basic training on O.T.U.s an advanced stage of flying training at advanced flying units, through which pilots passed between the P.R.C. and the O.T.U.s, was started at the beginning of November 1941. As the pressure for turning out pilots at the maximum rate of which schools were capable began to relax, it became possible to make basic training courses longer and also turn over most of the Service flying training school capacity in the United Kingdom to refresher and acclimatisation courses for men from overseas. (1) The change was gradual: schools finished training S.F.T.S. courses and then replaced them with A.F.U. pupils. The names of the schools were officially changed to (P) A.F.U. when the last S.F.T.S. courses ended in the spring of 1942. The advanced training course was at first intended to be quite short; three weeks were to cover conversion, night flying, instrument flying, navigation, and S.B.A. In December, however, it was decided that A.F.U. courses should be eight weeks for twin-engined pilots and four weeks for single-engined pilots.

Developments during the summer of 1942

By the spring of 1942, the whole pattern of basic training had changed. Apart from one S.F.T.S. fed by one E.F.T.S. there was no basic training of pilots carried out in the United Kingdom after the end of 1941. The

- (1) The S.F.T.S.s changed over to this refresher and acclimatisation training as follows:-

<u>S.F.T.S.</u>	<u>Location</u>	<u>Date</u>
No. 2	Brize Norton	1 November 1941
No. 3	South Cerney	1 November 1941
No. 9	Hullavington	1 November 1941
College	Cranwell	22 November 1941
No. 12	Grantham	6 December 1941
No. 5	Ternhill	13 January 1942
No. 6	Little Rissington	13 January 1942
No. 11	Shawbury	13 January 1942

No. 14(P) A.F.U. started at Ossington in January 1942 with staff and aircraft from No. 14 S.F.T.S., Lyneham. No. 15(P) A.F.U. started at Leconfield with staff and aircraft from No. 15 S.F.T.S., Kidlington. No. 17(P) A.F.U. started in February at Watton with staff lent by Bomber Command. The units were named (P) A.F.U.s when it was decided that they should train pilots only.
(A.M. File S.75860).

E.F.T.S.s continued to function in name, but were directed mainly to flight testing pupils before they proceeded overseas for basic training. The S.F.T.S.s had been converted into advanced flying units, and these concentrated on advanced and acclimatisation courses for pilots trained overseas.⁽¹⁾

The twenty elementary flying training schools also undertook various other duties during the early part of 1942. The only ab initio training was carried out at No. 28 E.F.T.S. Wolverhampton⁽²⁾ and the output from this school fed the R.A.F. College S.F.T.S. Cranwell; No. 25 E.F.T.S. Hucknall, continued ab initio training for Polish pupils and these personnel then proceeded to No. 16 S.F.T.S. Newton for their Service training.

Pre-glider training had commenced at No. 16 E.F.T.S. Derby in December 1941⁽³⁾ and in March the entire capacity of No. 16 E.F.T.S. (6 flights) was turned over to the training of Army personnel. The pupils were supplied by the Army and were all keen volunteers; they were given a full E.F.T.S. course of 12 weeks' duration using the normal ab initio syllabus with minor modifications only. The only real differences were that each pupil had to do eight solo landings at night, and more attention had to be paid to forced landings and glide approaches. This training was carried out principally on Tiger Moths but 15 hours had to be completed on Magisters in order to accustom the pupils to the use of flaps. In May 1942 No. 21 E.F.T.S. Booker and No. 29 E.F.T.S. Clyffe Pypard also commenced glider pilot training. This brought the total capacity up to 18 flights (468 pupils).

In the autumn of 1941 arrangements were made to carry out the training of artillery officers (known as A.O.P. training) at No. 17 E.F.T.S. These officers were required to carry out air observation with the object of increasing the efficiency of artillery shoots: they carried out the normal 12 weeks E.F.T.S. course, the intake being 18 every six weeks. In June 1942,

(1) See Appendix 24.

(2) No. 3 E.F.T.S. Shellingford also commenced E.F.T.S. training for Army personnel in August 1942.

(3) The first intake of army personnel for pre-glider training arrived at Derby on 31 December 1941.

(1)
when No. 17 E.F.T.S. closed down, the training commitment was transferred to No. 1 E.F.T.S. Hatfield.

Ab initio training for Fleet Air Arm personnel had been carried out for many years at R.A.F., E.F.T.S.s (commenced at No. 20 E. & R.F.T.S. Gravesend on 6 March 1939 and No. 23 E. & R.F.T.S. Rochester on 25 June 1938). On the outbreak of War two schools (Nos. 14 and 24) carried on with the training. The course was identical to that of the R.A.F. pupils. By June 1942 the Fleet Air Arm commitment consisted of eight flights (i.e. 288 pupils).⁽²⁾

Developments during 1943

During the following three years, only two S.F.T.S.s operated in the United Kingdom: the College S.F.T.S. Cranwell, which remained mainly as an experimental and research school, training mainly personnel who had been retained in the United Kingdom on compassionate or other grounds, together with some Allied personnel, and No. 16 S.F.T.S. Newton, training Polish pupils, which was fed by No. 25 (Polish) E.F.T.S. Hucknall.⁽³⁾

The E.F.T.S.s too, continued on this same basis; the only ab initio training carried out, apart from Army and Fleet Air Arm requirements, was to feed the College S.F.T.S. Cranwell and the Polish S.F.T.S. Newton.⁽⁴⁾

In December 1942, the Grader intakes to the E.F.T.S.s were substantially reduced, and as this reduction was only expected to last for a short period, it was not proposed to close any of the schools. At this time, the period spent in Personnel Reception Centres (P.R.C.) by aircrew trained overseas and awaiting posting to an advanced flying unit was steadily increasing. The A.F.U.s were complaining that their pupils were unable to get the full benefit from their A.F.U. course for two reasons:- firstly, because they were out of flying practice and secondly, because their standard of map reading was exceptionally low. (These pilots found map reading conditions in the United Kingdom very different to those where they had been trained, where visibility was good and railway lines, main roads, etc. were rarities and therefore perfect landmarks).

(1) No. 17 E.F.T.S. closed on 1 June 1942 as the aerodrome was needed for (P) A.F.U. training.

(2) See Appendix 25.

(3) See Appendix 27.

(4) See Appendix 26.

It was therefore arranged that personnel from the P.R.C.s should be attached to the E.F.T.S.s for a general refresher course. The whole scheme was very flexible; the courses were nominally of three weeks' duration, but could be extended to keep the E.F.T.S.s up to strength. There was no set course but the pupils were expected to carry out as much flying practice as possible. (1) The average time flown on the course was around 30 hours in the summer months, the weather, of course, being the limiting factor. The first courses commenced on 1 January 1943, and consisted of pilots only; subsequent courses, however, included navigators and bomb aimers. The courses were known at first as 'P.R.C. courses' but later became known as 'Pre-A.F.U. courses'. In 1944, many pilots were doing as many as three attachments to E.F.T.S.s. The P.R.C. intake was used as a buffer; whenever the Grading output had to be increased, P.R.C. intakes were reduced or vice versa. The provision of the intakes was not very satisfactory; pupils were often withdrawn after being at the E.F.T.S.s only a few days, and on many occasions the proportion of navigators and air bombers to pilots was too high.

When these courses started personnel were warned of the necessity of maintaining strict flying discipline. After spending up to 12 months in a P.R.C. it was conceivable that they might lose sight of the fact that one day they might again be required to fly. The general flying discipline, however, turned out better than was expected and, in most cases, ground discipline was satisfactory. The A.F.U.s reported that appreciable benefit was derived by these personnel from the E.F.T.S. courses.

From the beginning of 1943 to January 1945 the E.F.T.S.s continued to carry out these various training commitments during which time there were no major fluctuations in overall E.F.T.S. capacity. The E.F.T.S. flights were allocated to the following training commitments:-

(1) Although there was no rigid syllabus the following guide was issued:-

- (a) All pupils to carry out three hours' night flying to accustom them to flying in completely blacked-out conditions.
- (b) Priority should be given to map reading and cross-country flights.

The pilots were authorised to carry a navigator or air bomber on all navigational flights to give these personnel the necessary experience of conditions in the United Kingdom.

- (a) Grading.
- (b) Pre-Glider training.
- (c) A.O.P. training.
- (d) Fleet Air Arm ab initio training.
- (e) Fleet Air Arm Grading.
- (f) E.F. training to feed Cranwell.
- (g) Ab initio training of Allied personnel.
- (h) Pre-A.F.U. training.

Although the overall capacity of the schools did not appreciably change, the allocation of the flights was continually changing. The policy was to keep the schools in full employment by using the Pre-A.F.U. course as a stop-gap whenever the schools were not employed on other types of training. Throughout this two year period grading was the principal type of training carried out.

Various small changes took place during 1943. The College S.F.T.S. Cranwell was reorganised so as to relieve the growing congestion in the A.F.U.s. In the early part of 1943 there was a serious bottleneck in the A.F.U. training of pilots, which, in turn, led to difficulties in meeting the O.T.U. commitments. In order that the maximum use could be made of the A.F.U. training capacity, it became necessary to relieve the A.F.U.s of any extraneous commitments. At this time there were two such commitments:-

- (1)
 - (a) Turkish Training This consisted of advanced training for Turkish pilots (virtually an O.T.U. course) carried out at Grantham and Ternhill (Nos. 12 and 5 (P) A.F.U.s.).
 - (b) Refresher Training This consisted of giving refresher courses to foreign nationals, escapees, officers who had been on staff appointments, etc. and was carried out at Ternhill and South Cerney (Nos. 5 and 3 (P) A.F.U.s.).

It was decided that these commitments should be transferred to the R.A.F. College Cranwell and a corresponding reduction in the S.F.T.S. capacity accepted. (2) In February therefore the College S.F.T.S. Cranwell was reorganised to undertake the following training:-

-
- (1) E.F. and S.F.T.S. training of Turks was being carried out at Wolverhampton and Cranwell, but these merely took the place of R.A.F. pupils.
 - (2) A.M. File S.62856.

/ (a)

- | | |
|---|--------------|
| (a) <u>S.F.T.S. Training</u> for allied and foreign personnel,
compassionate cases, etc. | - 120 pupils |
| (b) <u>Refresher Training</u> | - 60 " |
| (c) <u>Turkish Advanced Training</u> | - 60 " |

The population of Cranwell remained unaltered at 240 pupils.

From April 1943 onwards the training of Polish flying instructors was also carried out at No. 16 S.F.T.S. Newton. Formerly this training had been undertaken by No. 2 Flying Instructors' School, Montrose. Considerable difficulties were experienced at Montrose, however, owing to the language difficulty, and the lack of Polish ground instructors. As the numbers trained were small there was no difficulty in carrying out this training at the Polish S.F.T.S.

In September 1943, in order to meet the increased demands for Polish pilots the capacity of No. 16 S.F.T.S. Newton was increased by 25 per cent to 200 pupils.⁽¹⁾

The E.F.T.S. organisation also underwent minor modifications. No. 22 E.F.T.S. Cambridge undertook some elementary flying instructor training. This was caused by the closing of No. 4 Supplementary F.I.S. Cambridge which had formerly carried out this training.⁽²⁾ The Fleet Air Arm Elementary Flying Training commitment was transferred to Canada in the summer of 1943, thus releasing two E.F.T.S.s for other types of training.⁽³⁾ Consequent upon the move was the necessity to institute a system of grading for Fleet Air Arm personnel proceeding to Canada for their flying training. This however did not start until the summer of 1944. Flying training facilities for the Army were also reduced. The pre-glider courses were reduced to six flights in the beginning of 1943⁽⁴⁾ although the A.O.P. commitment was temporarily increased

(1) A.M. File S.6395.

(2) No. 4(S) F.I.S. had been formed in July 1940 as a lodger unit of No. 22 E.F.T.S. Cambridge in order to meet an urgent demand for elementary flying instructors to fill vacancies existing at E.F.T.S.s. When, in July 1942, all flying instruction training was concentrated into one unit, No. 4(S) F.I.S. was temporarily retained until the deficiency of instructors had been made up. The unit closed in April 1943 and No. 22 E.F.T.S. took over the temporary commitment. (It actually lasted from 30 April 1943 to 5 April 1944, and 4 Masters and 12 Magisters were used to carry out this training). In April 1944, by which time the requirements had been met, the two F.I.S. flights were converted to grading and pre-A.F.U. training.

(3) No. 14 E.F.T.S. Elmdon and No. 24 E.F.T.S. Sealand commenced grading training on 8 and 15 September 1943 respectively.

(4) In March 1943 when the glider training schools closed down, the E.F.T.S.s carried out refresher courses in order to keep those pupils awaiting entry to G.T.S.s in flying practice. In August the normal pre-glider courses restarted.

for six months in February 1943. Austers were introduced into the schools carrying out A.O.P. training in May 1943.

In addition to the Polish training commitment at Hucknall, ab initio training for Turkish personnel was carried out at Wolverhampton. Various other nationalities, Iraqis, Iranians, Dutch, Belgians, Czechs and French, were among the pupils completing the E.F.T.S. course at Wolverhampton. Grading for Allied personnel was carried out at No. 6 E.F.T.S. Sywell. (This school trained mainly French and Belgian personnel, and several French instructors were provided. French E.F.T.S. training was eventually carried out at Sywell).

By the end of the year there were still only two S.F.T.S.s operating in the United Kingdom, fed by two E.F.T.S.s. The 17 remaining E.F.T.S.s (1) carried out miscellaneous training duties.

Developments during 1944

In March 1944 a Pre-F.I.S. course was started at No. 26 E.F.T.S. Theale. For some time it had been felt that the average pilot selected for instructor duties was poor not only in flying ability but also in 'instructor temperament'. When the F.I.S. course was revised in March 1944, it was decided that a high standard of flying skill and ground instruction would be needed of pilots proceeding for instructor training, and since there was a surplus of E.F.T.S. capacity at this time, it was arranged to carry out this training in one of (2) these schools.

During this static period, in spite of the growing surplus of E.F.T.S. capacity, only one school was actually closed. (3) These schools, most of which had been operating for years before the war, were run by civil companies (mainly large aircraft manufacturing firms) and represented a valuable source

(1) See Appendices 28 and 29.

(2) The course was of 5 weeks' duration, and included 30 hours flying. Roughly two thirds of the pupils from the course were then selected to proceed to the F.I.S. for instructor training.

(3) No. 9 E.F.T.S. Ansty. This school was closed because the airfield was needed for the testing of Mosquitos produced by the Standard Motor Co. Ltd. In September 1943 a system of flying control had been introduced at Ansty in order to enable both elementary flying and Mosquito testing to be carried on, but this proved unsuccessful and as there was a surplus of E.F.T.S. capacity at this time, the school was closed. No. 9 E.F.T.S. Ansty disbanded on 31 March 1944.

of manpower and facilities which would otherwise remain untapped. (Many of the civilian staff were too old for R.A.F. service and many airfields were too small to be used by heavier or faster aircraft).

The closure of these schools would have meant dispersing these facilities and great difficulty would have been experienced in re-starting the schools when the time came to re-establish basic flying training facilities in the United Kingdom.

In March 1944 it was decided to give a number to the S.F.T.S. at Cranwell. The reason for doing so was that the S.F.T.S. no longer occupied the College buildings and, with a probable move in the future, would become dissociated with the College altogether. The school was numbered 'No. 17 S.F.T.S' on 20 March 1944.

The aircraft establishment of Nos. 16 and 17 S.F.T.S.s were revised in July 1944 owing to the lengthening of the courses to a maximum of 28 weeks. The increase was in accordance with the policy to reduce the flow of pilots into the O.T.U.s. The increased courses raised the flying hours carried out to 200 per pupil. More ground instruction was also given. At the same time the Masters in use at these schools were replaced by Harvards.

In September 1944 it was decided to set up an organisation for training French personnel.⁽¹⁾ Owing to the reduction in O.T.U. requirements there was a surplus of A.F.U. capacity in the United Kingdom and it was decided to utilise part of No. 7 (P) A.F.U. Peterborough to provide S.F.T.S. training for French pupils. Accordingly the A.F.U. capacity at Peterborough was reduced to 75 (60 and 15 reserve) pupils and a capacity of 120 pupils established for French S.F.T.S. training.⁽²⁾ The S.F.T.S. trained both single-engined and twin-engined pilots. In October 1944, the single-engined trainers at No.7 (P)

(1) S.D.155/2132/44.

(2) No. 7 (P) A.F.U. was reorganised as follows on 14 September 1944.

	<u>Capacity</u>	<u>Aircraft</u>
A.F.U. Training	75	Master 60 Anson 2
S.F.T.S. Training	120	Master 35 Oxford 40 Anson 2

A.F.U. and all other S.F.T.S.s and A.F.U.s were changed, all Masters being replaced by Harvards.

In December 1944, consequent on the reorganisation of the A.F.U.s due to the increased single-engined training capacity required, No. 7 (P) A.F.U. was re-established to undertake French S.F.T.S. training only. The (P) A.F.U. training commitment at Peterborough was transferred to No. 11 (P) A.F.U. and the remainder of the school became No. 7 S.F.T.S.

Throughout this period there was a steadily increasing surplus of training capacity at the elementary flying training schools. This, however, was employed in providing the pre-A.F.U. courses for P.R.C. pilots, navigators, and air bombers, and no schools (except No. 9 E.F.T.S. Ansty) were closed. By the summer of 1944 out of a total of 62 grading flights, 36 were now surplus to requirements.⁽¹⁾ After lengthy discussions as to whether or not these surplus flights should be retained, it was decided to utilise them for additional refresher courses for pilots accumulating at the P.R.C.s.⁽²⁾ These pilots who were spending six months or more in the P.R.C. needed to be kept in flying practice; it was suggested that surplus A.F.U. capacity should be used for this work, but subsequently that capacity was closed down (No. 14 (P) A.F.U.) and the grading flights were used instead.

As a result of the large scale reductions now being made in the overseas training organisation, all grading courses for overseas pupils ceased in September 1944 and the E.F.T.S.s concentrated on the Pre-A.F.U. training; a few months later, however, grading recommenced at some of the schools.

Re-establishment of Basic Training Facilities in the United Kingdom

Towards the end of the year the necessity for re-establishing basic training facilities in the United Kingdom was becoming apparent. The end of the German War was now in sight.⁽³⁾ Since the spring of 1944 the Overseas Training Organisation had commenced a large scale reduction, and by

(1) A.M. File S.82928.

(2) In September 1944 there were over 7,000 pilots in P.R.C.s in the United Kingdom, and there was little prospect of that number decreasing before the end of the year.

(3) By December 1944 the target date for the defeat of Germany was set at June 1945.

this time (December 1944) the planned size of the basic training organisation overseas was less than half what it was a year ago. Schools overseas, however, were, at this time, to function only to supply war-time requirements (i.e. they were now training personnel who would be used in Phase II - the Japanese War). The Empire Air Training Scheme was due to come to an end on 31 March 1945. Drafts of Australian and New Zealand pupils to Canada had already ceased, and it was agreed that these two Dominions should now concentrate merely on the needs of their own air forces in the South West Pacific Area. (1) In Southern Rhodesia and South Africa, training for the R.A.F. on a very much reduced scale was to continue until at least the summer of 1945, and it was probable, especially in the case of South Africa that training for the R.A.F. in those locations would cease as soon as it was evident that the Japanese war was coming to a close. (2) In Canada a new agreement was being negotiated to cover the training of small numbers of R.A.F. personnel after 31 March 1945. In America training continued more or less unchanged; the acute manpower shortage made it desirable to retain these schools, costing nothing in R.A.F. manpower and financed under Lease/Lend for as long as possible.

In Canada and America, however, because of political and financial factors, it was not possible to train R.A.F. personnel other than for war purposes, so there also, it meant that intakes would have to cease after the summer of 1945. Thus by the end of 1944, the question of the re-establishment of training schools in the United Kingdom to meet the requirements of the Japanese War and at the same time to lay sound foundations for the post-war training scheme, was under consideration. After much discussion it was calculated in December 1944 that the Basic Training Organisation in the United

(1) There were sufficient Australian and New Zealand personnel in pools in the United Kingdom to replace wastage in the Article XV Squadrons in Europe up to the end of Phase I (The defeat of Germany - estimated at June 1945).

(2) At this time it was estimated that Japan would be defeated 18 months after the collapse of Germany, i.e. the end of 1946. Owing to the length of time taken to train a pilot this meant that pupils entering training after the summer of 1945 were unlikely to be required for the Japanese War phase.

Kingdom for Phase II would require a total S.F.T.S. capacity of 1,560 pupils. (1)

This was made up as follows:-

Personnel	Capacity		
	Existing	To be Provided	Total
R.A.F.	120	780	900
Allied	360	120	480
Foreign	-	180	180

Two schemes were put forward concerning the future design of the new schools and it was decided to form two schools experimentally, on the lines suggested. Both of the schools involved the combination of the E.F.T.S. and S.F.T.S. courses into one all-through course. Scheme I was evolved by A.M.T. and was based on the experiences of the British F.T.S.s in the United States which had operated most successfully on an all-through system of training. Scheme I course lengths were as follows:-

	Training		Total
	Elementary	Advanced	
Hours Flying	65	135	200
Course Length (Weeks)	11	22	33)
Leave (Weeks)	1	2	3)
			36

Scheme II suggested by Flying Training Command, followed the idea of having an 'all-through' school. Whereas, however, Scheme I accepted pupils direct from a grading school and having only 10 - 15 flying hours to their credit, and Scheme II required that the pupils received 30 - 40 hours of elementary flying instruction before commencing the course. This scheme

(1) The E.F.T.S. capacity requirement was set at 960:-

<u>Personnel</u>	<u>Capacity</u>
R.A.F.	520
Allied	320
Foreign	120

This capacity could be provided from the existing schools. A 'Grading' capacity for 828 pupils (23 flights) would also be required. (A.M. File S.10747).

/ contemplated

contemplated a F.T.S. equipped with advanced trainer aircraft (Harvards) and the pupils carried out 150 hours flying in a 30 weeks' course (and three weeks' leave).

To meet the R.A.F. requirements of 1945 (Stage II) i.e., a capacity of 780 pupils to be provided, it was decided to form two 'all-through' schools to be known as flying training schools.⁽¹⁾ One was to operate the Scheme I plan and the other Scheme II in order that their products could be compared for the purpose of determining whether one type of school or the other, or whether a modification of either, should be adopted for post war training. The remaining capacity was to be provided by the utilization of normal E.F.T.S.s and S.F.T.S.s. The course lengths of the three systems of training are summarised as follows:-

		<u>Course Length</u>
		<u>Weeks</u>
(a) Type I F.T.S.	Elementary	12
	Advanced	24
	<u>Total</u>	36 (including 3 weeks' leave)
(b) Type II F.T.S.	E.F.T.S.	4
	F.T.S.	33
	<u>Total</u>	37 (including 3 weeks' leave)
(c) Normal E.F./S.F.T.S.	E.F.T.S.	11
	S.F.T.S.	22
	<u>Total</u>	33

In the meantime, however, pilot training continued as before. By the end of the year the two S.F.T.S.s and the eighteen elementary flying training schools were still carrying on with their various duties.⁽²⁾ The despatch of pupils overseas for training had died down to a mere trickle, and consequently only three schools were required for 'Grading' purposes. Flights of four more schools were carrying out elementary flying training of pupils for No. 17 S.F.T.S. Cranwell and for the French and Polish S.F.T.S.s. The remainder of the E.F.T.S. capacity was being used for pre-A.F.U. courses and for army and naval training.

(1) A.M. File S.103164.

(2) See Appendices 30 and 31.

Developments during 1945

By March 1945 the basic training position was becoming more clearly defined. In view of the retention of certain schools in Rhodesia and Canada to meet the needs of Phase II it was possible to reduce the United Kingdom requirements to the following:-⁽¹⁾

	Personnel	Capacity			Remarks
		Required	In Existence	To be Provided	
Grading	R.A.F.	972 (27 Flights)	-	-	At this time the existing capacity was more than the requirement.
E.F.T.S.	R.A.F. Allied Foreign <u>Total</u>	340 320 <u>120</u> 780 (26 Flights)	-	-	
S.F.T.S.	R.A.F. Allied Foreign <u>Totals</u>	560 460 <u>180</u> 1,200	120 360 <u>-</u> 480	440 100 <u>180</u> 720	-

The question of providing the grading and elementary flying training capacity presented no difficulties, but in order to provide the additional S.F.T.S. capacity required (720 in all) four new schools would be needed.⁽²⁾ As a first step two schools were to be formed, both were to be all-through schools, and one of each type was to be formed. A Type I F.T.S. was to form at Cranwell with a capacity for 252 pupils on a 36 weeks' course. This school formed on 1 May 1945, and involved moving No. 17 S.F.T.S. from Cranwell to Spitalgate in April 1945. The second school, a Type II F.T.S., was to have a capacity for 200 pupils on a 33 weeks' course. Two aerodromes had to be used for this Unit, which was eventually formed at Church Lawford and Snitterfield. Both aerodromes were numbered and operated as separate schools. Nos. 20 and 21 F.T.S.s formed at Church Lawford⁽³⁾ and Snitterfield respectively on 3 March 1945 each with a capacity for 100 pupils.

When the German War ended on 8 May 1945, the Phase II basic training requirements for the United Kingdom were again revised and reduced.⁽⁴⁾ The

(1) A.M. File S.104747.

(2) LM.1408/OF2, 6 March 1945.

(3) No.18 (P) A.F.U. Church Lawford was disbanded on 29 May 1945.

(4) A.M. File S.104747.

S.F.T.S. capacity requirements was now set as:-

<u>Personnel</u>	<u>Capacity</u>
R.A.F.	452
Allied	498
Foreign	<u>180</u>
<u>Total</u>	<u>1,130</u>

This meant a capacity requirement at the only schools still to be provided of 138 for allied personnel and 180 for foreign nationals.

In May 1945 the E.F.T.S. situation was also again reviewed. At this time there were 17 E.F.T.S.s in operation with a total of 81 flights. The requirements for Stage II were:-

	<u>Personnel</u>	<u>Capacity</u>	<u>Flights</u>
Grading		864	24
(1)			
E.F.T.S.	Allied	360	16
	Foreign	<u>120</u>	
	<u>Total</u>	<u>1,344</u>	<u>40</u>

In addition four flights were needed for Fleet Air Arm grading, one for A.O.P. training and eight for glider pilot training, making an overall requirement of 53 flights.

It was decided to keep all the schools in being and effect reductions in the number of flights at certain schools so as to permit of the derequisitioning of buildings and the release of relief landing grounds. The chief reason for the policy of retaining the schools was that, being civilian operated, once a school was disbanded it was lost forever to the R.A.F., as the Ministry of Labour would withdraw all personnel. It was realised that in Stage III (the post-war phase) the close co-operation of the civilian companies would be required for such things as reserve training etc., as the Stage II requirements aimed at keeping the civilian schools alive. When No. 2 Radio School, Yatesbury closed down, No. 2 E.F.T.S. was transferred to Yatesbury from its requisitioned accommodation at Worcester to avoid losing the facilities of the Bristol Aeroplane Co., Ltd., who had been managing the airfield at Yatesbury, on behalf of the Royal Air Force, for the past nine years.

(1) Now that the S.F.T.S. requirement had been reduced, all E.F.T.S. training for R.A.F. personnel could be carried out at the three newly formed 'all-through' flying training schools at Church Lawford, Snitterfield and Cranwell.

In June 1945 Phase II requirements were again revised as follows:-

	<u>Personnel</u>	<u>Capacity</u>	<u>Flights</u>
S.F.T.S.	R.A.F.	452	
	Allied	480	
	Foreign	180	
	<u>Total</u>	<u>1,112</u>	
(1)			
<u>E.F.T.S.</u>			
Grading	R.A.F.	936	26
E.F.T.	Allied	330	15
	Foreign	120	
A.O.P.		30	1
Glider		240	8
Grading	F.A.A.	144	4
	<u>Total</u>	<u>1,800</u>	<u>54</u>

It should be pointed out that the capacity for Allied personnel included Polish, French, Norwegian and Belgian Schools already formed in the United Kingdom (by May 1945) and also Greek and Yugoslav Schools being formed in their own countries. (2) The capacity for foreign nationals was for neutrals and other allies outside the Stage II Target Force (e.g. Turks, Persians etc.). (3)

The eventual E.F.T.S. capacity was to be achieved by July 1945, and under the new arrangements only one school (No. 26 E.F.T.S.) was closed. This school was on requisitioned property and, therefore, had to be given up. The rolling up of certain flights led to the de-requisitioning of 14 airfields namely:-

(1) Grading flights were for 36 pupils whilst E.F.T. flights were for 30 pupils.

(2) S.F.T.S. Capacity for Allied Personnel - Stage II

Nationality	<u>Capacity</u>		Location	Remarks
	Required	Existing		
Belgian	23	72	Snailwell	R.A.F. (Belgian) Training School.
Czech	34	-	-	-
Dutch	106	-	-	-
French	162	160	Peterborough	No. 7 S.F.T.S.
Greek	20	-	-	No U.K. commitment.
Norwegian	19	84	Winkleigh	Norwegian Training Base
Polish	88	200	Newton	No. 16 S.F.T.S.
Yugoslav	13	-	-	No U.K. commitment.

(3) C.O.S. (44) 120.

/ Alton

Alton Barnes	Denton
Battlestead Hill	Kirkpatrick
Bellasize	Penkridge
Braunston	Thrale
Burnfoot	Whitefield
Caxton Gibbet	Winkfield
Denham	Worcester

At the same time the aircraft establishments of the flights were reduced from
(1)
18 to 15 aircraft. The final reorganization involved:-

- (a) The disbandment of No. 26 E.F.T.S. Theale on 9 July 1945.
- (b) The move of No. 2 E.F.T.S. from Worcester to Yatesbury on
9 July 1945.
- (c) The disbandment of 29 of the E.F.T. Flights on 9 July 1945.

It was also necessary to establish schools for the training of Fleet Air Arm pilots in the United Kingdom to replace the schools closed in Canada. No difficulty was found in providing E.F.T.S. capacity, but in order to meet the Admiralty requirements a new S.F.T.S. with a capacity for 120 pupils was needed. This School was formed at Calverley on 22 October 1945.

(2)
The end of the Japanese War in August 1945 made little immediate difference to the Phase III basic training requirements for pilots in the United Kingdom. The long term policy was for four 'all-through' schools together with grading facilities for 800 pupils. The allied and foreign personnel training commitment would progressively reduce as the various allied and foreign air forces were reconstructed, and the surplus E.F.T.S. would eventually be required for the training of reservists.

In all, 110,600 pilots were trained between 3 September 1939 and 15 August 1945, on behalf of the Royal Air Force, and only approximately one-eighth of these personnel were trained in the United Kingdom. The actual outputs were as follows:-

United Kingdom	14,400
Canada	54,100
South Africa	7,400
Southern Rhodesia	7,400
Australia	10,500
New Zealand	4,200
U.S.A.	11,800
India	700
Iraq	100
<u>Total</u>	<u>110,600</u>

(1) S.D.155/1403, 9 July 1945.

(2) The pilot training organisation in the United Kingdom at 15 August 1945 is shown in Appendices 32 and 33.

CHAPTER 3

BASIC TRAINING OF OBSERVERS, NAVIGATORS AND
AIR BOMBERS IN THE UNITED KINGDOM

The First Observers

Up to 1934 all aircrew duties other than those of pilot were carried out, with few exceptions, by part-time air gunners who were selected and trained by units. As these airmen were tradesmen borne on unit establishment they were only employed on aircrew work at intervals. A few of them were trained in both bombing and gunnery but none received any instruction in navigation which was the responsibility of the pilot, a principle carried on in the Service from the 1914-18 war. Air gunners varied considerably in standard of training as well as in their qualifications, and the part-time system was proving awkward owing sometimes to a conflict between two essential functions, when each required the work of the airman at the same time. (1)

In August 1934 it was decided to replace gradually the part-time air gunners by a new class of aircrew, trained in special schools for the trade of air observer. (2) The change-over was introduced gradually, old style air gunners as their period of service in the bracket trade ended being replaced by the new observers. The new observer policy intended that all observers should be drawn from the skilled tradesmen who had been recruited as apprentices (Group I) or as boy-entrants (Group II), and that they should be employed half-time at their trade and half-time as air observers. Employment as observer would be continuous from seven years service (i.e. the normal time for promotion to corporal) until the N.C.O. received promotion to flight sergeant, normally at 14 or 15 years' service. Those not selected as flight sergeants would continue as observers (sergeants) until completing 18 years' service. The objects of the Scheme were:- (a) to secure a good type of airman for the observer trade, (b) to give a long period of continuous service on observer duties, and (c) to improve the position of promotion in

(1) A.M. File 519517/37.

(2) A.M.O. A.196/34.
The term 'air observer' had been used in the 1914-18 war, but with a slightly different connotation, as they were then chiefly air gunners.

the trades concerned, which had been very poor owing to the policy of restricting expansion of the Royal Air Force, by providing additional non-commissioned officer posts. It was still assumed that aircraft would be navigated by the pilot, the observers merely being trained by a basic course in bombing and air gunnery.

(1)
An Air Observers' School was formed on 1 January 1936 at North Coates to train these aircrew candidates on a course lasting two months and having an expected output of two hundred per year. The short course was not intended to turn out fully competent observers. In parallel with usual practice at that time it remained the responsibility of individual squadrons to train them to a high standard of efficiency in the type of aircraft concerned.

The Revised Aircrew Policy

In April 1937 the Chief of Air Staff ruled that there should be in all multi-seater aircraft a crew of one pilot and one observer. It was assumed that navigation was the pilot's responsibility. (2) In special cases, as in all general reconnaissance aircraft where accurate navigation was essential, a navigator would be carried who was a trained pilot (not air observer). With this crew policy it was estimated that 1,264 observers would be needed to man the front line under expansion Scheme 'F'. (3) But the newly formed air observer school would only train 580 observers before April 1939; and even if all the suitably qualified air gunners were also employed as observers (some 500 - 600) there would remain a deficiency of approximately 200 at the target date for Scheme 'F'.

At this stage observer requirements became linked with problems of navigation as it was necessary to provide some person other than the pilot flying the aircraft to attend to the navigation. Two possible solutions were proposed; one was to provide a second pilot, and the other was to train the observer in navigation.

(1) North Coates had previously been an armament training camp. Its place as A.T.C. was taken by Aldergrove.

(2) A.M. File S.40289.

(3) A.M. File A.519517/36.

The Director of Staff Duties (D.S.D.) in the Air Ministry and A.O.C.-in-C. Bomber Command both criticised the new crewing policy. The D.S.D. observed that one-pilot crewing had as its inevitable corollary the necessity for producing air observers fully trained in navigation as well as in bombing and gunnery. On the other hand the A.O.C.-in-C. Bomber Command argued strongly in favour of the two-pilot solution; since navigation was the most important duty in bombers, the responsibility for it must rest on the captain of aircraft, i.e. the pilot. An additional argument advanced by Bomber Command for the two-pilot policy was that longer range flying and operating by night would need a high standard of skill in navigation to which only pilots were trained.⁽¹⁾ Moreover, as long endurance meant fatigue and strain on the pilot a second pilot would be required in any case. Supporting these arguments the Director of Training also pointed out that the only training in navigation then being given to observers was done by squadrons, and if this training should be continued or if observers should have to be trained in special schools it would be some considerable time before the observers could attain anything like the navigational skill required.

Further Revision of Aircrew Policy

As a result of the discussion the two-pilot solution was accepted, the crewing of aircraft being revised in April 1937. Heavy bombers were to carry two pilots and two wireless operators; medium bombers - one pilot and one observer, with the addition of a wireless operator in case of long range or of night flying; and general reconnaissance aircraft were to carry two pilots. The remainder of the crew were to be air gunners.

This solved the problem of navigation, except in the case of medium bombers, and at the same time reduced the number of observers required.⁽²⁾ The training of pilots in navigation was improved,⁽³⁾ but in medium bombers such as Battles, Blenheims and Wellesleys, which could not carry two pilots, the observer was required to give the pilot some help in navigation. Consequently, in May 1937, the course at the Air Observers' School, North Coates, was extended from two to three months and its capacity was increased at the same time in order that the output should remain at two hundred per year.

(1) A.M. File S.40289.

(2) A.M. File 519517/37.

(3) See Chapter 2.

This navigation training, similar to that given to a pilot in a flying training school, was recognised as being only a basic preparation for squadron training and the following directive was issued in May 1937 to all Commands:-⁽¹⁾

'The air observer has not been, and cannot for the present be trained up to a complete operational standard at the Air Observers School. This can only be achieved in the squadron to which he is posted, as a member of a crew. It is considered that a period of six months advanced training in a unit will be necessary before the required standard can be reached, except in those cases when the observer has had considerable previous experience as an air gunner. The necessity for the thorough training of air observers should be brought to the notice of the units concerned. With the additional navigation courses already arranged, it is anticipated that there will be a "s.n." navigator in every flight in Bomber Command. This will materially reduce instructional difficulties. A further scheme for the training of all pilots up to "s.n." standard is also under consideration.'

Even this revised crew policy still left a deficiency in observers to meet the requirements of Scheme 'F' by 1939 despite the fact that North Coates was maintaining the output of two hundred per year with the longer courses. The prospect did not cause much concern as it was then thought that there was likely to be a surplus of pilots to act as observers until 1940, by which date enough airmen would have been trained at the Air Observers School. The revised policy for aircrew also made heavy demands for air gunners and wireless operators.

Shortage of trained Observers: Need for full-time Observers

In the autumn of 1937 the Air Staff at the Air Ministry and the A.O.C.-in-C., Bomber Command both pointed out that war readiness was gravely jeopardized by the lack of adequately trained observers. The A.O.C.-in-C.,⁽²⁾ Bomber Command wrote as follows:-

'In all single pilot types (Battles, Blenheims and Wellesleys) the air observer is a factor vital to operational efficiency. In the Blenheim he is the navigator, and in the Battle and Wellesley he performs certain navigational functions. Efficient observers are, therefore, essential to all-weather flying. There is, however, a considerable shortage of air observers, and furthermore the present air observer scheme does not provide individuals of a standard of efficiency adequate to their responsibility. Some improvements in conditions have been approved subsequent to the Crew Policy Conference held at the Air Ministry which may result in making the air observer trade more attractive, but the real difficulty of the air observer scheme, which is the part-time employment in his basic trade, still remains. This arrangement, particularly at a time when the shortage in technical trades

(1) A.M. File 519517/37.

(2) Bomber Command File BC/7913/Air.

is serious, tends to result in the air observer failing to come to his air duties fresh or to make adequate preparations prior to flight, and renders it impossible to give him adequate ground training in his air duties, which is particularly disastrous in respect of navigation in which he receives comparatively little initial training.'

In a further letter concerning the readiness for war of the Command the A.O.C.-in-C., Bomber Command stressed the need for bomber aircraft being able to operate and to train crews in all weathers, and he particularly emphasized (1) the need to provide a thoroughly trained full-time observer.

The Air Staff was in full agreement with Bomber Command. Operational training was gravely jeopardized by lack of adequately trained observers in Wellesleys, Battles and Blenheims; old style air gunners were not capable of meeting the navigation demands made by these aircraft, and observers needed very considerable additional training in squadrons. The Director of Staff (2) Duties said:-

'We have created an Air Force of long range and high offensive potential. If we are to use this potential in war and give full scope to its training in peace, a highly skilled full time air observer is just as much an essential as is any other member of the crew, not excluding the pilot.'

The demand thus was not only for an observer with better training in navigation but also for a full-time observer instead of a part-time tradesman observer.

The Air Member for Personnel was against the proposal for employing full-time observers. He pointed out that as part-time observers formed a portion of the unit establishment in tradesmen they could not be released for full-time aircrew duty until there were enough skilled tradesmen to replace (3) them. Furthermore, the part-time system provided an inducement for recruiting the right type of man into the skilled trades from which observers were chosen. Full-time observers recruited direct from civil life would have to be given rapid promotion if the same type of man as came forward for pilot duties was to be recruited; and this rapid promotion would compare badly with the slower promotion in the trades from which Service-entry observers were chosen. If observers were to be highly trained in navigation there would be

(1) Bomber Command File BC/S.20711/C.-in-C., 10 November 1937.

(2) A.M. File 519517/36.

(3) A.M. File S.41243.

little difference in the type of man recruited or in the instruction needed between observers and pilots; it might be simpler therefore to 'go the whole hog' and provide pilots. The Air Member for Personnel advanced the further argument that since the aircraft concerned were to be replaced in a few years by larger aircraft capable of carrying two pilots, the need for observers highly trained in navigation was consequently purely temporary.

The Air Staff reiterated the views of D.S.D. concerning whole-time observers and in November 1937 the Deputy Chief of Air Staff summed up the position as follows:-

(1)

'I consider that from the operational point of view the whole-time air observer is a necessity. The types of aircraft now coming into the Service take a heavy load considerable distances at high speed. The delivery of that bomb load at the target depends as much on accurate navigation and bomb aiming as on piloting, and the air observer is, depending on the type, partly or wholly responsible for these duties. To expect a really high standard of efficiency in these duties from an air observer who spends part of his time on technical ground duties is to expect too much.

One of A.M.P.'s arguments against the whole-time air observer is the increase in the personnel vote which such a policy would entail. I submit that this cannot be accepted as a serious reason. We have created an Air Force of long range and high offensive potential. The crew must not be of a lower standard than the aircraft otherwise our ends will be defeated. But there seems to be a danger of this so long as our potential is governed by personnel policy.

D. of T. has recently increased the standard of training of air observers; in particular navigation is being given increased attention. These improvements in training, when they have had time to take effect, should go some way towards removing some of the difficulties to which Bomber Command refer. They are not a remedy.'

Introduction of full-time Air Observers

The insistence on war readiness as the chief criterion prevailed, and in December 1937 the Chief of Air Staff gave the following rulings:

(2)

- (a) In all aircraft when the size of the crew permits, every important function of the crew should have two men capable of performing it.
- (b) Consequently, observers must be trained in navigation, bombing and gunnery, photography, and the elements of W/T.
- (c) Observers must be trained in W/T sufficiently to enable them to operate the navigational aid equipment and the transmitting key; they must have the rudiments of this training before they are posted to squadrons.

(1) A.M. File S.41243.

(2) Minute by C.A.S. to A.M.P. and A.M.S.O. 14 December 1937.

- (d) Observers are to be trained in navigation up to the standards given (to pilots) by the ten weeks navigation course at the School of Air Navigation, Manston. This requirement is subject to reconsideration when, for aircraft in which two pilots are carried, the training output permits of both being trained in navigation.
- (e) The proposals for the direct entry of observers as corporals in combination with a direct entry pilot scheme, and for a continuance of an entry from the Service of 200 tradesmen a year are accepted.
- (f) The proposals for obtaining 400 observers a year would mean that scheme 'F' requirements⁽¹⁾ could not be met until about 1940. A larger entry is therefore essential. The numbers of observers obtained from the Service should remain unaltered, but the number of direct entrants should be increased as far as possible.
- (g) I accept in principle that the whole-time observer is desirable. At present however the demands of maintenance make any alterations of the present half-time scheme impossible.

Thus the principle of full-time observers trained up to the same navigational standards as pilots was accepted. Owing to the shortage of skilled tradesmen, only direct entry observers⁽²⁾ were to be full-time observers, Service entrants continuing on a part-time basis.

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- (1) Under Scheme 'F' Treasury approval was obtained for training 1,500 pilots in six civil schools. In March 1938 the Air Council decided that the need for observers was more pressing and so four of the six schools were allotted to observers instead of pilots, the intention being that they should revert to pilot training when observer requirements had been met. This change made no difference to the schools because the navigational courses for both were identical. (A.M. Files 740853/38, 765961/38 and 778984/39).

(2) Direct Entry Observers' Scheme

Age Limit

17½ to 25 (as for short service commission personnel).

Selection

Made by S.S.C. board.

Service

Three years' regular, followed by six years on the Reserve. All suitable men to be selected for pilot training after 2 years' service, their engagements being extended to 6 years' regular and 6 years on Reserve.

Training

One month's navigation training at a civil school, 14 days ground instruction at Uxbridge and 2 months' instruction in bombing and gunnery at the Air Observers' School.

Rank

Enlisted as A.C.2 and reclassified L.A.C., promoted Corporal observer on completing A.O.S. Course, promoted sergeant when qualified as pilot.

Pay

L.A.C. 5/- per day, corporal 9/- per day.

Gratuity

£25 per year for every year of service (excluding the first) on transfer to Reserve.

Fresh plans for training Observers

These decisions of December 1937 demanded not only a higher standard of navigational training and a longer course for observers, but also accelerated output. As the increased commitment was beyond the capacity of the Air Observers' School, North Coates, plans were made to give the navigation part of the syllabus at Civil schools (12 weeks) and the armament part (bombing and gunnery) at Service schools (8 weeks).

The observer badge was re-introduced on 21 October 1937, the qualifications for it being that the candidate must have:-

- (a) Passed an air observer course.
- (b) Served in a squadron for six months.
- (c) Completed 50 hours' flying as observer.
- (d) Been recommended by his Commanding Officer.

In December 1937 the plan of training required by the Chief of Air Staff's ruling that observers should be trained up to the Manston 10-week standard in navigation was sketched out. Three weeks were to be given to gunnery (with 10 hours' flying), three weeks to bombing (12 hours' flying), and twelve weeks to navigation. Some Service subjects, such as wireless direction finding, photography, and reconnaissance, were to be included in the navigation course for Service entry observers, and to be taught later to direct entry observers. Armament subjects were to be taught at Service schools (40 hours flying); navigation at a Service school to Service entry and to direct entrants at civil schools (36 hours' flying).

Little further progress was made, however, the supply of aircraft being the limiting factor both in Service and civil schools. The aircraft required to start the scheme for better navigation training amounted to 48 Ansons; the four civil schools needed six each, and two Service schools together twenty-four. The direct entry observer scheme also moved slowly because difficulty was experienced over recruiting, especially at a time when an intake of pilots⁽¹⁾ was due.

(1) December 1937 to April 1938. (A.M. File 719582/37)

In the meantime, observer training went on, at North Coates only, at the unchanged rate of 200 per year and on the unchanged three months course. The most that could be done was to inform Commands of the intention to improve observer training and of the necessity for squadrons to train up to the higher standard until the school training of observers could be improved. (1)

(2)
Conference on Training Air Crews, April 1938

In April 1938 the serious results of a lack of trained crews became fully realised. On 12 April a conference on the training of regular and reserve crews, instructed by the Secretary of State, (Lord Swinton) that the matter must be treated 'exactly as it would be treated in war', decided that more observers must be trained to a higher standard without delay. The prospective deficiency on 'Scheme L' requirements was then 700, before observers had been included in every crew. The four civil schools were to start observer training as soon as possible, with aircraft found from various sources. The direct entry scheme was to be settled, and observers recruited, immediately.

There would be an inevitable delay before the training of direct entry observers could be started, and so the training of Service entry observers was stepped up at once. A temporary air observer school was provided, by converting a bomber station with two non-mobilisable Heyford squadrons, and supplying the necessary specialist instructors. Leconfield, with Nos. 97 and 166 Squadrons, started the navigation training of Service entry pupils on the 12 weeks' course in June 1938, the instructors being transferred from North Coates. The latter station ceased navigation training and concentrated on the armament training of the output from Leconfield.

Observer Training at Civil Schools

The direct entry scheme for observers was introduced eventually and two civil schools began training in August 1938. Already engaged in ab initio training of pilots they undertook the navigational training of observers.

(1) A.M. letter 638478/37/S6, 6 April 1938.

(2) A.H.B./V/5/10.

(1)
A month later two other civil schools began observer training. After a navigation course lasting twelve weeks at the civil schools, the pupils passed to Service schools for training in bombing and gunnery on a course of eight weeks either at No. 1 Air Observers' School North Coates or at No. 2 Air Observers' School Acklington. The latter station, formerly No. 7 Armament Training Station, was converted to an air observers' school on 15 November 1938. Each civil school had a capacity for entry of 30 pupils. The total planned output of observers was 600 per year, 400 from direct entrants and 200 from Service candidates. When the civil schools came into operation the temporary Air Observers' School at Leconfield stopped navigation training and closed in November 1938 after passing out some 150 observers.

To deal with the armament training of observers two more armament training schools, after being equipped with Heyfords, became air observer schools. The rate of recruiting direct entrants was to increase between December 1938 and February 1939 from 480 to 1,920 per year, but owing to difficulty in recruiting enough direct entrants some of the places had to be filled by Service entrants. The shortage in direct entry pupils also prevented the change from pilot training at two schools (Hamble and Shoreham) scheduled for observers, and these schools continued to train pilots. A further effect of the shortage was that the facilities at Nos. 3 and 4 Air Observer Schools could not be fully employed.

(1) Civil Schools began observer training as follows:-

<u>E. & R.F.T.S.</u>	<u>Location</u>	<u>1938</u>
No. 12	Prestwick	15 August
No. 7	Desford	15 August
No. 9	Ansty	15 September
No. 10	Yatesbury	15 September

Note: Two civil schools commenced navigation training for pilots on 23 May 1938:-

No. 3 E. & R.F.T.S. Hamble and Martins Navigation Ltd.,
Shoreham.

/Change

Change of Policy concerning Observers: Effect on Training

Even before the schools began training it was realised that the estimated output of 600 observers a year was inadequate. It will be recalled that a conference on Training and Establishment of Air Observers decided in May 1938 that observers were to be made responsible in war for the navigation of aircraft. The corollary to this decision was the need for adding observers to peacetime establishments to avoid complete reliance on the Volunteer Reserve for trained observers when war started, and training them in peacetime. Observers were accordingly added to the peacetime establishments of all bomber and general reconnaissance aircraft and the requirement for observer training went up sharply. (1) The Air Council decided in November 1938 to double the entry at each civil school from 30 to 60 pupils, (2) to bring into the scheme two additional schools (3) and to change the two schools then training pilots (4) to training observers.

Although navigational policy underwent a radical change in May 1938, the status of observers was not raised to that of pilots until the following year, (5) when the policy of giving responsibility for navigation to observers was reaffirmed at a further conference in May 1939. (6) In reviewing the general policy the conference declared that safe and efficient navigation of a bomber aircraft could be attained if:-

- (a) The captain possessed sufficient knowledge and practical experience of navigation to enable him to superintend the navigator's work in the air and to bring the aircraft safely back if the navigator should become a casualty.
- (b) The observer was trained to the highest standard and navigated under the direction of the Captain.

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- (1) At first the expedient was tried of displacing a 'straight air gunner' by an observer, but in suitable types of aircraft the air gunner was restored early in 1939.
 - (2) Effective date was 6 February 1939.
 - (3) The two schools, which both commenced training on 9 January 1939, were No. 6 E. & R.F.T.S., Sywell and No. 11 E. & R.F.T.S., Perth.
 - (4) The schools at Hamble and Shoreham were due to change from pilot training to observer training in May 1939, but Martin's school at Shoreham was transferred to Gloucester and a new school was opened at Weston-super-Mare to replace Hamble. Both the Gloucester and Weston-super-Mare schools opened on 15 May 1939.
 - (5) A.M. File S.40289.
 - (6) A.M. letter S.47667/S.6. 22 May 1939.

Training was designed for the future to give the air observer a complete course of instruction in all aspects of air navigation which would fit him to navigate long range bombers. Pilots were to receive basic training in dead reckoning navigation. The ten-week course for pilots was reduced to six and basic navigation training added to the syllabus for elementary and reserve flying training schools. The status of observer was raised to sergeant and it was proposed that a proportion of the observers would be given commissions. When this policy was laid down it was intended that N.C.O. observers should be drawn entirely from the wireless operator (aircrew) trades. After completing three years on flying duties wireless operators/air gunner would be eligible for training as observers; they would receive training in bombing and navigation for four months and would thereafter be remustered and promoted to sergeant.⁽¹⁾ The scheme did not materialise owing to the outbreak of war. During the interim, while these airmen were wireless operators, direct entry observers were recruited as a purely temporary measure.

Expansion due to the Outbreak of War

At the outbreak of war responsibility for navigation was in process of being transferred from pilot to navigator. Wartime policy of the Air Council ended the navigation courses for pilots as part of their basic training, owing to the time and effort involved.⁽²⁾ Under war-time policy for observers, armament training stations should convert to air observer schools, teaching both armament and navigation subjects. This change was manifestly impossible in September 1939 because the armament training stations were too small to contain the increased pupil population, and the required aircraft, staff pilots, and maintenance crews could not be found. Training of observers at civil schools therefore had to be continued and in fact increased. As there had only been time to give elementary ground training and a little flying experience to volunteer reservists, a reserve of trained observers did not exist for making up deficiencies or providing replacements for casualties. Moreover some of the pre-war tradesmen observers were sorely needed for work in their ground trades.

(1) E.P.M. 156.

(2) A.M. File S.47667.

The extra schools which had been intended for continuous service or for militia pupils were brought into the scheme and by the end of September 1939 there existed ten civil schools with a total capacity of 4,200 observers per year. These civil schools were separated from their respective elementary and reserve flying training schools and they were re-named Air Observer Navigation Schools (A.O.N.S.).⁽¹⁾ The estimated output exceeded the air armament capacity, which was a limiting factor in the proposed expansion. The course at air observer navigation schools lasted 12 weeks and included 36 hours flying, some of it by night. The syllabus aimed to reach the same 's.n.' standard to which pilots were trained, but only two extra weeks were allowed for recovering the leeway that observers had to make up through the lack of flying experience and general basic training received by pilots.

Bombing and Gunnery Schools

Armament training stations on the outbreak of war were renamed Air Observer Schools, though they did not carry out any navigation training, as had been intended under the war organisation. Those situated on the east coast were closed and the remainder accepted both observers and air gunners for instruction in bombing and air gunnery.⁽²⁾ In November 1939 they were

(1) On 30 September 1939 the following A.O.N.S.s were operating:-

<u>A.O.N.S.</u>	<u>Location</u>	<u>Capacity</u>
No. 1	Prestwick	390
No. 2	Yatesbury	30
No. 3	Desford	60
No. 4	Ansty	60
No. 5	Weston-super-Mare	60
No. 6	Gloucester	120
No. 7	Perth	60
No. 8	Sywell	60
No. 9	Blackpool	120
No.10	Grangemouth	60

(2) The following change occurred on the outbreak of war:-

(a) East Coast Stations

<u>A.O.S.</u>	<u>Location</u>	<u>Absorbed by -</u>	<u>Location</u>
No.1	North Coates	-	No. 9 Penrhos
No.2	Acklington	-	No.10 Warmwell
<u>A.T.S.</u>			
No.1	Catfoss	-	No. 3 Aldergrove
No.3	Sutton Bridge	-	No. 4 West Freugh
Temporary	Leuchars	-	No. 8 Evanton

(b) The following A.O.S.s were operating by 30 September 1939:-

<u>A.O.S.</u>	
No. 3	Aldergrove (formerly No. 2 A.T.S.)
No. 4	West Freugh (" " 4 ")
No. 5	Jurby
No. 7	Porthcawl
No. 8	Evanton
No. 9	Penrhos
No.10	Warmwell

/ more

more accurately designated Bombing and Gunnery Schools (B. & G.S.). The course for observers lasted six weeks (including 20 hours' flying) and each school planned for an output of 520 observers per year. In September 1939 actual capacity was only half this number. In addition the schools trained air gunners on a four weeks' course and provided facilities for the attachment during 14 days of advanced training squadrons from Service flying training schools to carry out their armament training practice.

In October 1939 Reserve Command attempted to improve the standard of observer training by raising the flying hours to 50 and by stressing the importance of long flights with frequent alterations to course. Schools could not increase cross-country or night flying exercises. Training areas were restricted: A.O.N.S.s near the east coast were seriously handicapped by war restrictions; and there was a serious shortage of wireless facilities and of night flying beacons. ⁽¹⁾ In November various moves took place chiefly to locate the schools away from Fighter Command area, and a new school was opened at Hamble. ⁽²⁾

Criticism of Navigation Training

In November 1939 the Air Ministry (T. Nav.) drew attention to the formidable list of shortcomings in navigation training. The civil schools suffered not only from restricted flying area, lack of wireless, and difficulty in night flying, but were also short of aircraft and had master mariners, with little or no air experience, as instructors; moreover, by no

- (1) The limited use which could be made of wireless affected all navigation training. In the early days of the war no communication whatever was allowed except the use of M.F. D/F in dire emergency. In October Reserve Command obtained permission for aircraft to use H.F. for making position reports at hourly intervals, but there was no regular service of fixes or bearings available to training aircraft. A.O.N.S.s were not given M.F. D/F stations, and M.F. D/F could still only be used in serious emergency. Loops were of little value because beacons were few and badly placed for training flights. The School of Air Navigation had to work under the same conditions, except that a H.F. D/F station was provided at St. Athan towards the end of 1939. (A.M. File S.75988)

(2)	<u>A.O.N.S.</u>	<u>Moved</u>	<u>Absorbed by -</u>	<u>Date</u>
		<u>From</u>	<u>To</u>	<u>1939</u>
	No. 3	Desford	Carlisle	November
	No. 10	Grangemouth	Prestwick	2 December
	No. 8	Sywell	Blackpool	November

No. 11 A.O.N.S. formed at Hamble on 20 November 1939

/ means

means all the schools were efficient, and they were not co-ordinated in their standard and methods of instruction. The School of Air Navigation, apart from the congestion at St. Athan and lack of wireless and beam facilities, was handicapped by inadequate provision for high altitude work and shortage of astro-navigation equipment.

To make some improvement, it was proposed that the length of the air observer navigation school course should be increased from 12 to 16 weeks, that the A.O.N.S. instructors should be given a course at St. Athan, that a navigation specialist should be established at Reserve Command to look after the civil schools, and that the 'astro' training commitment of the School of Air Navigation should be cut down from 2,000 to 500 per year.

These proposals were carried out, but they were described by a staff officer (O.R.3) as rather a counsel of despair. He added suggestions that the effect of operational restrictions on flying should be avoided by putting as much training as possible in Canada, and that 'astro' training should be put on a satisfactory basis by giving the School of Air Navigation a satellite in the south of France.

The inadequacy of observer training as well as difficulty in disposing of surplus output were taken into account in proposals by the Chief of Air Staff for a general lengthening of courses by 25 per cent and the course at air observer navigation schools was extended to 16 weeks in December.

The shortcomings of Air Observers

Attention was focused at this time more on defects in the pupils than on shortcomings in their training. Difficulty in recruiting observers before the war had led to the acceptance of men with moderate intelligence and general education, whilst V.R. observers had been selected more for quantity than quality: some 30 per cent of pupils were in consequence being rejected at the air observer navigation schools. Whether the main reason was the low standard of pupils, the inefficiency of civil schools or the cramping effect of restrictions and shortages, observers were not being trained to a high enough standard. The Air Officer Commanding-in-Chief, Bomber Command criticised them consistently for lacking experience of practical navigation. As a result, the only men on whom squadrons could rely for competent navigation were pilots who had been trained before the war and the few experienced observers.

(1) This criticism at first referred to observers whose training had begun before the war: but it continued in spite of the changes in A.O.N.S. training.

Wartime entrants, it was expected would be of a higher standard of general education and a marked improvement might be found in the future. However, some 40 hours preliminary ground training in navigation (and morse), mainly on the mathematical side, was given by education officers in the initial training wings.⁽¹⁾

Inevitably many squadrons did not use nor accept the observers as navigators. The Air Officer Commanding-in-Chief, Bomber Command, drew attention to this at the end of 1939 and attributed the lack of faith in observers to two probable causes:-⁽²⁾

- (a) an extensive fostering of the prestige of the pilot with consequent belittlement of the other members of aircrew, and,
- (b) the low standard and inadequate training of the direct entry or V.R. observers who had so far reached the squadrons.

Reliance on pilots for navigators could not continue: war-time pilots were reaching squadrons with little knowledge of navigation; some observers were proving successful, thus indicating that the policy of making the observer entirely responsible for navigation was a sound one.

Thus two fundamental problems had to be reviewed once again (a) pilot or observer responsibility for navigation, and (b) the composition of crews.

Conference on Aircrew Duties, 4 March 1940

In view of the conflicting opinions expressed by commands a conference was held at Air Ministry on 4 May 1940 for full discussion of these problems. As a result the conference recommended the training in navigation of all pilots on a course lasting from four to six weeks to enable them to act as captains of aircraft.⁽³⁾ The other crew problems were summarised as a choice between simplifying the duties of each member (which would have entailed a large increase in numbers of aircrew), or multiplying each man's duties (a saving in manpower, but adding considerably to strain and fatigue in war).

(1) No. 54 Group File 54G/29/Air.

(2) A.M. File S.75988.

(3) A.M. File S.47667/I, Encl. 53A.

The Air Member for Personnel defined the crew problem in war as 'providing a large number of efficient observers and air gunners at the earliest possible moment', adding that the time needed to train observers in wireless as well as in bombing and gunnery would mean a failure to meet observer requirements.⁽¹⁾ The result was that direct entry of observers proceeded and the system of drawing upon wireless operators for observer trade ceased. To make up for this alteration in crew, observers would be trained in wireless and the new trade category called observer/wireless. A month later Air Ministry reaffirmed that navigation should be the responsibility of observers and that pilots should be trained in navigation only to supervisory standard.⁽²⁾ Thus after two years of uncertainty the policy was finally settled.

Some steps had already been taken towards proving a higher standard of observer. Elementary instruction for both pilots and observers at initial training wings had been added to the syllabus; and civilian instructors at air observer navigation schools were being given courses at the School of Air Navigation, St. Athan.

Obstacles to Observer Training

The amount of flying to be carried out in the observer course was increased in April 1940 to 67 hours, without lengthening the duration of the course; but night flying ceased to be included because of the difficulty of satisfactory practice without wireless aids. There were not enough aircraft available for the increased flying, all Ansons being needed for training schools overseas. At the largest Air Observer Navigation School (No. 1 at Prestwick) the shortage of Ansons was overcome by using three Fokkers, each carrying 30 pupils and fitted as a flying classroom. The Fokker supplied enough flying hours, but the value of the experiment was not very high: the method did not develop a pupil's independence and self-reliance, while the amount of Anson flying after elementary instruction in Fokkers was seldom enough to overcome the handicap.

(1) A.M. File S.40289.

(2) A.M. File S.40289.

Training was also hampered by lack of equipment. For example, No. 11 Air Observer Navigation School, Hamble began training pupils on 20 November 1939, but did not receive any equipment until a month later, and the school was not fully equipped until May 1940.

Thus observer training at the end of the first eight months of war was a patchwork affair. Pupils were trained at civil operated schools almost entirely in daylight, fair weather, and dead reckoning navigation. Night and bad weather experience and practice in using wireless aids were effectively prevented by lack of facilities, while the general shortage of aircraft reduced the possibility of completing the required number of flying hours. Moreover, astro-navigation ceased to be part of the regular sequence of navigation training because the total capacity of the School of Air Navigation was required for pupils specially selected from squadrons and operational training units.

Training in bombing and gunnery was hampered by shortage of equipment, of aircraft, and of accommodation at the bombing and gunnery schools. The ruling given by the Chief of the Air Staff in December 1939 to lengthen courses by 25 per cent increased the course to eight weeks but even so these handicaps, added to the bad winter of 1939/40, prevented completing the syllabus. Consequently, the number of observers actually passed out only reached half of the theoretical output. By March 1940 the predicted surplus of observers had not materialised and it appeared that the syllabus could not be completed in the time laid down. Furthermore, in June 1940 when there was a considerable number of wireless operators awaiting training they were given priority over observers for places in the bombing and gunnery schools.

The German Air Offensive, Summer of 1940: Effects on Observer Training

The immediate result of German air attacks during the summer of 1940 was an increase in operational restrictions which limited flying for training purposes, and increased the difficulties noted in preceding paragraphs. In these circumstances no immediate improvement in the admittedly unsatisfactory quality of navigation training could be expected. When the Air Officer Commanding-in-Chief Bomber Command pointed out in July 1940 that although observers were responsible for navigation, they were not taught 'astro' as part of their basic training, could not be given it at operational training units, and could not be sent on 'post-graduate' astro-courses without

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breaking up crews. It had to be explained that an observer's basic Dead Reckoning training was not good enough to warrant the addition of 'astro' instruction until he had gained more experience, and that in any case the teaching of 'astro' in the United Kingdom was practically out of the question. When the observer's basic course at the Air Observer Navigation School was extended in June to fifteen weeks, and a flying target of 80 hours, little difference in results followed: the limitations on flying areas and night flying, and the competence of the instructors, remained unchanged.

Transfer of A.O.N.S.s Overseas

The flying restrictions inevitable in an operational area, and the handicaps on training caused by British weather could be avoided only by moving schools overseas. Plans were made in July 1940 to move two air observer navigation schools and one bombing and gunnery school to Canada, and in August 1940 one air observer navigation school, a Fleet Air Arm observer school, and a school of air navigation to South Africa.

The plans for transfer to the Dominions presented a number of problems, the chief of which was the fact that air observer navigation schools in the United Kingdom were operated by civilian companies to which there would be political objections in South Africa. There were no civil firms in South Africa to operate them; therefore the schools would have to become Service schools and the civilian companies in the United Kingdom would have to be compensated. Plans were changed so that two air observer navigation schools went to South Africa and one school of air navigation to Canada. The latter change was occasioned because no 'astro' tables for the Southern hemisphere had been prepared. In conjunction with the transfer overseas of four Service flying training schools and two general reconnaissance schools it was planned to move No. 5 A.O.N.S., Weston-super-Mare and part of No. 1 A.O.N.S., Prestwick to South Africa and No. 1 School of Air Navigation, St. Athan to Canada. The School of Air Navigation was to train observers as well as 'N' specialists and astro pupils; whilst No. 5 A.O.N.S. undertook instruction to 's.n.' standard for pilots as well as observers.

(1) A.M. File S.47667.

The transfer plans were opposed by the Minister of Aircraft Production on the grounds that a high proportion of aircraft and spares would be looked up in transit and that the schools would be remote from the aircraft industry. (1) He urged the forming of new schools overseas. (2) Despite arguments by Air Ministry that handicaps in training in the United Kingdom and that the need for a larger operational force made these transfers imperative, the Prime Minister decided at the end of August that it would be unwise to move any large part of the reserves of men and machines out of the country while the air battle was in progress. (3) He agreed that, since navigation training in the United Kingdom was especially handicapped, the two air observer navigation schools should move to South Africa as planned. The School of Air Navigation had also begun to move by September, so this transfer was completed. (4) This marked the end of the transfer of schools overseas, though later in 1941 and 1942 new R.A.F. schools formed overseas, gradually replacing those in the United Kingdom.

Reorganisation in the United Kingdom 1940

A further result of interference by the German air attack was a re-shuffling of schools in the United Kingdom. When No. 1 School of Air Navigation moved to Canada a second school (No. 2 School of Air Navigation) for Hampden pilots and instructors in navigation was formed from the remainder of the original school, and it started training at Cranage on 21 October 1940. Two general reconnaissance schools were also moved overseas, one to Canada and one to South Africa, and No. 3 General Reconnaissance School formed in November at Squires Gate as the other schools moved away. No. 9 Air Observer Navigation School, Squires Gate had closed on 27 May to

(1) W.P.(40) 323.

(2) W.P.(40) 326.

(3) W.P.(40) 38.

(4) No. 5 A.O.N.S. Weston-super-Mare closed on 1 September 1940 and as a Service operated school opened at Oudtshoorn, South Africa on 22 October. In February 1941, 'S.N.' courses began in addition to the basic training of 120 observers. Part of No. 1 A.O.N.S., Prestwick closed on 23 October 1940 and began training as a Service school at Queenstown, South Africa on 23 December with a capacity of 120 observers. It was numbered No. 7 A.O.N.S. No. 1 School of Air Navigation, St. Athan began its move on 30 September and started training on 18 November at Port Albert, Canada as No. 31 A.N.S. Courses in basic training for 120 observers were added on 6 January 1941.

make room for No. 2 General Reconnaissance School; No. 3 Air Observer Navigation School had moved from Carlisle to Weston-super-Mare on 2 June 1940 when it was absorbed by No. 5 Air Observer Navigation School which subsequently moved to South Africa. No. 11 Air Observer Navigation School moved from Hamble to Watchfield on 22 July 1940 and No. 2 Air Observer Navigation School, Yatesbury disbanded on 17 December 1940. By the end of 1940 only four air observer navigation schools remained in the United Kingdom. Owing to a predicted shortage of observers for 1941 the course was reduced ^{to} ~~by~~ 12 ⁽¹⁾ weeks in order to supply an output of 2,000 observers per year.

Further Expansion of Observer Training

Transfers overseas interrupted training, thus reducing the total output, but the effect was delayed because observers had to pass through a six weeks' armament course at a bombing and gunnery school after their basic navigation training. At the end of 1940 there was a surplus of observers. The needs of Fighter Command had cut down the flow of pilots and therefore of crews to Bomber Command; but a large deficiency seemed probable in 1941. ⁽²⁾ In January 1941 the bomber expansion planned for the second half of that year suggested that, unless more capacity were provided for training observers in navigation, there would be a shortage of some 200 in June and 600 in ⁽³⁾ September, even when the shortened course (from 15 weeks to 12), the output from Empire Scheme Schools in Canada and Australia, the settling down of transferred schools, and the start of basic training at No. 31 Air Navigation School in Canada were all taken into account.

To provide the additional capacity there were new schools at Bobbington, which had been due to open as a Service operated air observer navigation school in December 1940 (but did not in fact start until April 1941), and at

(1) The four A.O.N.S.s in operation at the end of 1940 were:-

<u>A.O.N.S.</u>	<u>Location</u>	<u>Capacity</u>
No. 1	Prestwick	290
No. 4	Ansty	60
No. 6	Staverton (Gloucester)	120
No. 11	Watchfield	60

(2) A.M. File S.75988.

(3) A.C.6(41), January 1941.

Millom, which began observer training in February 1941. On the other hand, Prestwick was due to reduce its pupil population of observers from 300 to 180 in order to make room for a coastal operational training unit. The possibility of converting Little Rissington from a Service flying training school to an air observer navigation school was considered, but dropped, and the shrinkage of Prestwick was postponed until an additional air observer navigation school could be brought into operation. These changes, when they were complete, would raise the United Kingdom output of observers up to 3,900 per year, of which Prestwick would train only 650.

This was a considerable change from Prestwick's previous dominant position of producing nearly 1,100 observers out of a total annual output of 2,000, and the operating company (No. 1 A.O.N.S., Scottish Aviation Ltd.) protested against the reduction, urging that the school had in the past shown itself able to handle as many as 390 pupils, using three Fokkers and 32 Ansons for their flying, and suggesting that it would be better, if an increase in the observer output were wanted, to raise Prestwick's number of pupils to 390 rather than reduce it to 180. Nonetheless, the proposals remained unchanged. It was considered that the use of such big aircraft as Fokkers at an air observer navigation school would result in a lower standard of output; that the replacement of Fokkers by Ansons would produce air congestion with the larger pupil population; and that the addition of an operational training unit to an air observer navigation school containing 390 pupils would cause crowding.

Aircraft were a difficulty in all plans for expanding observer training. The shortage of Ansons was serious and world-wide, while their supply to overseas training theatres had priority: none were available for navigation training in the United Kingdom. The possibility of using more large aircraft had been considered in the autumn of 1940, and the Albatross and Ensign (i.e. civil types) were investigated, but the project was dropped. This left only the Botha, an 'operational reject', available for equipping new schools and replacing the Fokkers.⁽¹⁾ The schools at Millom and Bobbington were given Bothas when they opened.

(1) Bothas were used for training purposes. At first they were intended as attack aircraft for armament training, but they were later employed (in spite of reports that they were unsuitable) for navigation training. (S.D.155 958/40).

Dissatisfaction with Navigational Competence of Observers

While these transfers and changes were going on the Air Officer Commanding-in-Chief Bomber Command remained seriously dissatisfied with the navigational competence of observers. (1) In November 1940 Air Ministry (D.T.F.) investigated the shortcomings which operational training units found in their training. Considerable emphasis was laid on the interposition of a bombing and gunnery course between an observer's basic navigation training and his arrival at an operational training unit: it was thought that during the armament course a pupil forgot a good deal of the navigation he had been taught. The absence of night flying training and of 'astro' instruction was criticised, and so was a lack of practical, as opposed to theoretical, teaching about compasses, wireless aids, and maps and charts.

In December 1940 the Air Officer Commanding-in-Chief Bomber Command stated that three out of every four aircraft lost on operational sorties were lost in and around England from causes other than enemy action. (2) He put this down to lack of supervision by captains, who were unable to check the observer's work because they had not been given enough navigation training, and asked that pilots should be given more navigation instruction somewhere (3) in the training sequence.

Observer training underwent some minor changes. Efforts were made to commence night flying at the air observer navigation schools and their internal organisation was altered in November 1940 by adding one or more specialist 'N' officers to each school's establishment, to act as chief instructor and relieve the operating company of responsibility for training.

(1) A.M. File S.69236.

(2) These figures referred to the period April-December 1940. (A.M. File S.47667).

(3) Providing a special navigation school for training bomber pilots was, however, quite impossible because there were too few facilities available to set up all the schools needed for more essential work. The most that could be done was to increase the attention given to navigation at I.T.W.s and E.F.T.S.s, increase the S.F.T.S. ground instruction on it from 50 to 62 hours, and urge that pupils should have 15 hours' navigation flying in the back seat of Oxfords at the S.F.T.S.s. The figures quoted by Bomber Command for losses were not agreed by the Air Ministry, who said that of 548 operational aircraft lost between April and December 1940 only 97 might have been caused by bad navigation. (D.D.T. Nav. Branch Jacket 13).

The company's representative was to remain commanding officer of the school, but he was not responsible for training: that fell entirely to the specialist 'N' chief instructor. (1) New 'master mariner' instructors (2) at air observer navigation schools were given courses and some experience of air navigation at No. 2 School of Air Navigation, while in February 1941 it was decided that the education officers who taught navigation at initial training wings should also have a course (including flying) at Cranage.

The criticism that observers grew rusty on navigation during their armament training was met by trying an experimental combined course, with navigation, bombing and gunnery taught concurrently, when Millom opened. (3) This combined course was of eighteen weeks' duration (i.e. the twelve weeks of the navigation course plus six weeks for bombing and gunnery training).

Navigation and Piloting: Policy and Doctrine

The changes at air observer navigation schools and Service flying training schools were attempts to improve the existing system of navigation instruction, but the policy and organisation of the existing system were by no means generally accepted. In December 1940 the Air Member for Training suggested that a Navigation Group might be formed, and advanced the following arguments in support thereof:-

- (a) True air navigation involved both flying and finding the way.
- (b) The School of Air Navigation was the only unit dealing with this true navigation.
- (c) The Air Observer Navigation Schools did not benefit by the School of Air Navigation's experience.
- (d) The Service Flying Training Schools could not deal successfully with more than elementary pilot navigation.

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- (1) This dual system led, by the beginning of 1942, to a curious position where the commanding officer of Staverton was answerable to No. 50 Group, while the chief instructor of Staverton was responsible to No. 25 Group. (A.M. File S.75988).
 - (2) Transfers and changes had made it necessary to recruit some additional instructors. (A.M. File S.47667).
 - (3) Millom had originally been intended as an armament school. (A.M. File S.75988).

- (e) A common control for all navigation training units (including the School of General Reconnaissance) was desirable in order to ensure the general teaching of true navigation.⁽¹⁾

There was a lack of enthusiasm for these arguments. The Air Officer Commanding No. 23 Group did not see anything wrong with the existing system of navigation schools, and disliked the proposal to mix Service and civilian schools in one group. The Air Officer Commanding-in-Chief, Coastal Command considered that the work of the School of General Reconnaissance and of the Operational Training Unit were closely akin. The proposal for a Navigation Group was dropped, but T. Nav. became a Deputy Directorate of D.T.F. at the end of 1940, with Group Captain Kelly-Barnes (formerly D.D.T. Nav.) in charge.

The Air Officer Commanding-in-Chief Bomber Command⁽²⁾ objected to⁽³⁾ relying on observers for 'N' specialists and 's.n.' instructors. He said:

'It cannot be accepted that a man trained purely in navigation is as good an air navigator as the man who trained in both piloting and navigation. The arts of piloting and navigation are very closely allied, and it is more important for senior navigators to have piloting experience than for any other specialist.'

He also blamed the separation of navigation from piloting for a substantial reduction in the standard of navigation, and stated that captains' efficiency was reduced by their ignorance of navigation. The standard of navigation

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- (1) The policy of training pilots to a lower navigational standard than observers, and expecting them to be capable of supervising the navigation of the aircraft, was put forward as an explanation of the navigational ineffectiveness which was troubling Bomber Command. D.D.T. Nav. was of the opinion that it would be wise to divert more resources to training pilots, at the expense of a reduction in operational effort, and make up for the reduction by a lower rate of loss. Putting more resources into training, however, would mean that first of all more really suitable men would have to be trained as specialists or instructors, but the operational commands - chiefly Bomber Command - were reluctant to let good men go. In fact, it became necessary to cut down the number of specialists 'N' being trained (at No. 31 A.N.S. Canada) and to examine the posts established for specialists to see whether any could be filled satisfactorily with less well qualified men. The attempted economy was a failure: it was not possible to make do with fewer navigation specialists. (T. Nav. Branch Jacket 13 and A.M. File S.47667).
- (2) A.M. File S.47667.
- (3) The policy of employing observers as specialists or instructors was introduced in April 1940, and the general shortage of pilots later in the year caused a high proportion of those selected for these duties to be observers.

was already so low as to have an adverse effect on the bombing effort, and employing observers in specialist and instructor posts would lower it further. Observers were not produced from such good raw material as pilots, and lacked a pilot's background of general Service experience.

In fact, (Bomber Command said) the standard of navigation throughout the R.A.F. was too low. Co-ordination between the various types of school dealing with navigation had been poor because of a lack of specialist higher direction for inculcating a common doctrine of air navigation. Navigation and piloting had been separated, with the result that navigation languished because the men chiefly concerned with it (observers) had not full all-round experience. The standard of men selected to be trained as observers was not high enough, most of the pupils being deficient in mathematical ability. Their periods of training were too short for the existing syllabus, and the syllabus was not adequate to produce the fully competent men wanted by Bomber Command. In addition, there were the well-known difficulties of poor facilities, operational restrictions, and 'master mariner' instructors.

Proposals for Improvement

Most of Bomber Command's points were covered in a comprehensive paper by the Deputy Director of Flying Training (Navigation).⁽¹⁾ He stressed that concentrated 'cramming' instruction was not enough: experience and practice were needed to produce instinctive working and skill, and the courses then running were too short either to cover all that should be learned or to give an adequate understanding of what they did include. Though the separation of navigation from piloting had produced a lower standard, it was not possible to set matters right by giving all pilots full navigation training: neither the time nor the facilities could be spared. The next best way of tackling the low standard was to start a vigorous drive for improving the quality of the pupils - probably by preliminary education - and for raising the observer to equal status with the pilot.

D.D.T.F. divided the whole process of navigation training under five headings:-

(1) Paper on Training of Aircrews in Navigation dated 11 April 1941. (A.M. File S.47667).

- (a) Preparatory general education;
- (b) General education closely linked with navigation;
- (c) ground training in navigation;
- (d) air training in navigation; and
- (e) non-navigational matters.

The first two, he said, might be dealt with by selection of men, by education, or by a non-flying stage of training. The third and fourth had hitherto been done concurrently: this had always been accepted practice and was probably best, but it was leisurely. Air exercises in 1941, however, were strictly limited by lack of facilities, and so the idea of treating all ground training and air training together at one stage must be abandoned. Hence he proposed a re-division of navigation training into three stages - ground training, synthetic training and air exercises.

From this paper developed, in May, a plan to introduce a 'six weeks preparatory course at initial training wings for those observers who would continue their training in the United Kingdom'. The difficulty was accommodation. Somewhere to handle 800 pupils in classes of 20 - 25 was wanted: splitting up into smaller units was considered undesirable because it would require an extravagant number of instructors and because strict discipline and supervision of the pupils was necessary. The search for a site went on fruitlessly throughout the summer. In July this additional training stage was named the 'Elementary Air Observers School'.

Combined Training in Service Schools

By the middle of April 1941 the experimental combined navigation and armament course at Millom was judged successful. 'Better observers were being produced in a shorter time', while the experiment seemed to indicate that elimination of the civilian element and commercial background of the air observer navigation schools had raised the quality of the training. (1)

Combined courses were introduced generally between June and September. This meant starting navigation training at the armament training stations, and six of them were earmarked for the purpose. (2) Each of the six had 240 observer

(1) A.H.B./IIM/a9/1A and A.M. File S.70633.

(2) West Freugh, Penrhos, Jurby, Dumfries and a new station being built at Wigtown, in addition to Millom. West Freugh and Penrhos began navigation training in June, Jurby in July, Wigtown and Dumfries in September.

pupils, so that the output was some 3,500 per year. (Schools doing combined training of observers had to have facilities for dealing with bombing and gunnery, and so had to be located at armament training stations). The change was gradual, the full pupil population of observers at each school being built up by successive intakes, and the schools carrying on with a diminishing armament training commitment until they were completely converted to combined training (except Wigtown, which was a new station). When the change was finished, some four months after it began, these schools were renamed air observers schools. As navigation training was taken over by the combined schools most of the air observer navigation schools closed. The instructors from the civil schools went, in many cases, to the new combined schools. So did some of their staff pilots, but not their staff wireless operators. Their Ansons also went to the combined schools.

Comparison between Civil and Service Maintenance

The civilian element in navigation schools did not, however, disappear entirely. The civil maintenance staffs who had serviced aircraft at the air observer navigation schools were available; there were contracts in existence with the operating companies; civil maintenance probably was cheaper both in money and manpower than Service maintenance; and civil maintenance staffs would in general set less of an accommodation problem than

- (1) No. 1 A.O.N.S. at Prestwick (which was now wanted as a Transatlantic airport and a Radar School) closed in July, and so did No. 11 A.O.N.S. at Watchfield. No. 4 A.O.N.S. at Anstey closed at the end of August. No. 3 A.O.N.S. at Bobbington was converted to combined navigation and armament training at the beginning of November. Only No. 6 A.O.N.S. at Staverton remained of the original civil schools. The navigation training units in the United Kingdom at the end of 1941 were:-

No. 2 S. of A.N. Cranage	No. 4 A.O.S. West Freugh
No. 3 S. of G.R. Squires Gate	No. 5 A.O.S. Jurby
No. 1 A.O.S. Wigtown	No. 9 A.O.S. Penrhos
No. 2 A.O.S. Millom	No. 10 A.O.S. Dumfries
No. 3 A.O.S. Bobbington	No. 6 A.O.N.S. Staverton

(S.D.155, 653/41 and 905/41).

- (2) The use of Bothas was abandoned at Bobbington in the summer of 1941 because they were too dangerous for the aerodrome. They could not be used at Penrhos (where the aerodrome was too small), and No. 9 A.O.S. was equipped with Ansons and Blenheims. No. 5 A.O.S. at Jurby was also equipped with Blenheims. No. 1 A.O.S. had Ansons, and the other schools Bothas. One of the corollaries of introducing combined training was the production of a multiplicity of aircraft types at the schools; target towers (usually Battles) and armament training aircraft (at schools where Ansons were used for navigation training) had to be established. In addition, since the other types were not suitable for night training, six Ansons were established at each school to deal with the syllabus requirement for night flying.

Service maintenance. In May 1941 the possibility of entrusting maintenance at some of the combined schools to a civil company, as had been done in the case of No. 3 School of General Reconnaissance at Squires Gate, was discussed. It was opposed by Air Ministry (D.S.M.) and by the Air Officer Commanding-in-Chief, Flying Training Command. D.S.M. pointed to the experience of Squires Gate, which showed that the system produced criticism, bickering, and competitive fault-finding. The Air Officer Commanding-in-Chief, Flying Training Command based his objections on the complexity of the equipment to be serviced at air observer schools and the doubtful availability of skilled labour for such things as armament equipment, the undesirability of mixing civil and Service staff because of comparisons between living conditions and pay, and the advisability of training pupils as far as possible under Service conditions. The arguments of economy and existing contracts, however, prevailed, and at the end of May, the Air Member for Supply and Organisation decided that three of the air observer schools should have their aircraft (1) maintained by civil companies.

At all the combined schools navigation training and flying were done by the Service, which then had to cope with the same difficulties that had handicapped the former schools. Wireless services had been practically non-existent when the schools had been bombing and gunnery schools, while no more direction finding stations were available for the combined schools than the air observer navigation schools had been allowed to use, so that flying in bad weather and at night was still almost impossible.

Difficulties in providing teaching staff

The combined schools had three more difficulties from which the former schools had been comparatively free. Except at the schools equipped with Ansons they had troublesome aircraft; they had practically no experienced staff pilots; and they had no staff wireless operators. Nothing could be done about aircraft until some more suitable type than the Botha became

(1) These arrangements did not start until later in the year. Service maintenance continued at Dumfries and Bobbington until October 1941. Wigtown did not open until September 1941. Wigtown was entrusted to Airwork Ltd., Dumfries to Scottish Aviation Ltd., and Bobbington to Marshalls Ltd. When Staverton was eventually converted to an A.O.S. its maintenance was to be done by Airwork Ltd. (who were operating it as an A.O.N.S.).

available. The civil schools had not employed a large number of staff pilots, and the largest of them, Prestwick, had made a considerable saving in pilots by relying on the Fokkers to provide flying time. The Service flying training schools were working at high pressure and with short courses to turn out large numbers of pilots, and Bomber Command was asking insistently for the best men they turned out: the pilots available for the combined schools had therefore been quickly trained and were not the best of the output from Service flying training schools. Wireless operators did not become competent to work in the air on cross-country flights until they had been trained at operational training units and of course it was impossible to spare any of such output for air observer schools or to transfer experienced civilian staff wireless operators from the air observer navigation schools to the Service air observer schools.

By the end of 1941 the combined air observer schools were also training pilots and wireless operators as well as dealing with their primary commitments of training in navigation, bombing and gunnery. Pilot training (which soon had to include considerable attention to night flying) and signals training were done to uniform syllabuses under the supervision of No.25 Group. (1)

Wireless Services

Before any great improvement could take place in the flying side of navigation training the wireless services of the air observer schools had to be improved. It was still laid down in the summer of 1941 (as it had been since October 1939) that wireless communication was allowed only once per hour from each aircraft, and that only coded messages giving the pilot's opinion of his position might be passed. During the autumn a wider use of medium frequency direction finding was allowed and each air observer school was allowed a M.F. D/F station for homing. These homing D/F stations came into use during the winter, and reasonable training flights at night and in bad weather became possible. The greater number of navigation-training aircraft and the longer range of their exercises set more signals problems,

(1) A certain amount of signals training was also done experimentally at Penrhos to see whether the Air Crew Wing bottleneck could not be relieved to some extent.

and it became necessary to increase the number of wireless channels and to re-arrange their frequencies.

Navigational Standards: Further criticisms and suggestions

While the air observer schools were building up their staffs and getting under way, criticism of the navigational standard of observers continued to come from the Air Officer Commanding-in-Chief, Bomber Command. ⁽¹⁾ Generally, there was too much theoretical instruction and too little practical experience, while men trained overseas lacked knowledge of the European problems of map-reading and were, of course, unfamiliar with blackout. Suggestions came from two Commands that certain observer-training schools should be earmarked for certain Commands and specialise in particular requirements. These suggestions were turned down by the Air Ministry, which stoutly maintained that air observer schools should give a satisfactory basic training, and that no part of basic training (however much might have fallen on operational training units in the past because of earlier defects in basic instruction) should be regarded as specialisation for a particular Command.

Formation of the Elementary Air Navigation School (E.A.N.S.)

In October 1941 the Elementary Air Navigation School was at last opened at Eastbourne, to give a six-weeks' ground navigation course to observer pupils between the initial training wing and the air observer school stages. After some discussion, it was made clear that the Elementary Air Navigation School was not an advanced kind of I.T.W., but a preliminary part of Service flying training. ⁽²⁾ Its function was to extend the time spent on navigation training without the waste of aerodrome capacity involved by lengthening courses at air observer schools, and it was hoped that by covering the navigation syllabus fairly thoroughly at the Elementary Air Navigation School it would be possible to leave the course at the air observer schools free for the practical digestion of what had been learned, and for gaining experience.

(1) A.M. File S.75988.

(2) A.M. File S.72830 and S.D.155, 991/41.

'The New Deal'

By the end of 1941 the 'New Deal' proposals for a drastic improvement and lengthening of basic training in the combined air observer schools increased flying hours from 98 to 130 (25 of them by night) during the 18-week course.⁽¹⁾ The flying commitment became formidable - 4,300 hours per month per school - and the need for better staff pilots, better wireless facilities, and properly organised flying control became urgent. Until all these items were provided, the commitment could not be achieved in 18 weeks, and the duration of the course was extended to 24 weeks as a temporary measure. Part of the 'New Deal' planned to rely almost entirely on overseas schools for basic observer training, and to convert the air observer schools (as their current courses came to an end) to advanced flying units (observer)⁽²⁾ for acclimatising and refreshing men who had been trained overseas.

The Empire Aircrew Training conference in January 1942 agreed to provide elementary air observer schools in the various training theatres overseas.⁽³⁾ Until such arrangements had been made, the school at Eastbourne went on working at its full capacity of 2,000 pupils per annum.

Training Overseas

Overseas the variations of navigation training did not follow its changes in the United Kingdom. In Canada the combining of navigation and armament training at one school was considered in April 1941, but was not introduced because of practical difficulties. The armament training stations were generally remote, with their ranges in deserted places, while the navigation schools (civil operated and working from ex-civil aerodromes)⁽⁴⁾ were near large towns. Uprooting the civil schools and transferring them

(1) A.M. File S.75988. See also R.A.F. Monograph, 'The History of Flying Training', Volume I, Chapter 10, pages 161-3. (A.P.3233).

(2) Millom, Dumfries, Wigtown and Penrhos changed over to (O) A.F.U. training in the early part of 1942 (Millom's change started late in December 1941), West Freugh went on to the basic training of W/T observers, and Staverton dealt with W/T observers and radio observers. Specialised types of observers began to be trained about this time for certain types of aircraft. The W/T observer combined the qualifications of an observer and a wireless operator, and was destined for long range fighters. The radio observer was qualified in navigation and radar (A.I.) and was destined for night fighters.

(3) A.M. File S.72830.

(4) E.T.S.258/41 and 266/41.

to remote places was hardly practicable. An alternative way of achieving the same end was adopted in May 1941. The course at air observer schools was revised to include bombing instruction, so as to get the advantage of concurrent navigation and armament instruction, and the period at Bombing and Gunnery School (which included the bomb-dropping practices) was reduced to four weeks. Owing to increasing supplies of sextants and other instruments it became possible at the same time to decentralise 'Astro' training from the schools of air navigation to the air observer schools where it rightly belonged.⁽¹⁾ The last named course extended to 14 weeks, and the stage of observer training at the School of Air Navigation was dropped.

The basic training of observers in transferred schools increased during 1941. No. 31 Air Navigation School, Port Albert, Canada started to build up a population of 120 observers on basic courses in January, and the Air Observer Navigation School which moved to Queenstown, South Africa increased from 120 to 180 pupils in February. Two newly-formed schools in Canada, No. 32 Air Navigation School, Charlottetown, and No. 33 Air Navigation School, Hamilton, also trained observers.⁽²⁾

Civilian Maintenance at Air Observer Schools

Towards the end of 1941 some difficulties arose in the air observer schools in the United Kingdom concerning civilian as compared with Service maintenance, and the question was revived by the Air Officer Commanding-in-Chief, Flying Training Command. In February 1942 a special investigation into the whole matter was carried out by an impartial authority, Sir Harold Howitt, who reported to the Air Ministry that while the total cost was about equal, the civilian maintenance scheme had not proved a failure.⁽³⁾ He advocated a further trial for three months during which the Service side of the stations concerned should co-operate in the system. Finally on 2 April 1942 the Air Ministry decided to end the civilian maintenance system at the three air observer schools and also at the Air Observer Navigation School, Staverton. The reasons for this decision were division of responsibility,

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- (1) In the United Kingdom 'astro' training was also introduced at the A.O.S. stage.
- (2) No. 33 A.N.S. Hamilton at first trained Hampden pilots.
- (3) A.M. File S.70633.

lack of discipline among civil employees of the firms, and disparity in pay and conditions between civil employees and airmen, which could not be explained away to persons in the Service. The general principle was laid down that civil maintenance was possible where there was civil control of operation as well as of maintenance, but that in other cases there must be Service maintenance, i.e. control of a school's functional operation should not be divided from control of its aircraft maintenance.

Navigators and Air Bombers - Navigation Aids and Technique

Between September 1939 and December 1941 a few instruments of real value to navigators were produced for the operational squadrons; gradually as the year 1942 advanced they were supplied to operational training units and later to other training units in Great Britain, when the flow of manufacture permitted.⁽¹⁾ The astrograph and the integrating sextant improved the accuracy of astro navigation but unfortunately this method was not a target finder. The influence of radar began to be felt in the realm of air navigation, and Coastal Command squadrons were equipped with submarine detecting devices (A.S.V.) which also could be used for navigation purposes. Bomber squadrons were not so fortunate. Despite the strenuous efforts of the navigation staff to obtain the new radar equipment in the form of 'Gee' which promised real help as a target finder, production weighed against its rapid introduction into the Service. However, a blind belief in the effectiveness of bombing operations was rudely shaken when in December 1941 a statistical analysis of night photographs revealed that only a very small proportion of bombs was falling within five miles of the point aimed at. One result of this analysis was to give priority in the production of navigating instruments which would enable the bomber aircraft to reach and to bomb the target in all but the worst weather conditions. Within a short space of two years radar aids to navigation appeared.

⁽²⁾
In addition to 'Gee' special radar apparatus was fitted to large aircraft known as 'Oboe' by means of which the craft could keep touch with two widely separated wireless stations on the ground, dubbed respectively the

(1) Flying Training Command File: FTC/A.OCC/42.

(2) C.B.O. paper, CAS 5065 dated 17 September 1942.

'Cat' and the 'Mouse'. The former guided the track of the controlled aircraft travelling at a constant range, while the latter, through knowing the pre-arranged height and airspeed of the aircraft, gave a signal to indicate the point at which the bombs must be released.

A second device was known as 'H2S'. This was a radar transmitter and receiver carried in the aircraft. It radiated pulses covering a wide area below and forward of the aircraft, which were reflected from the earth in varying strengths that showed on a screen a sort of map distinguishing the main features in the surrounding countryside. By constant comparison between the screen and an ordinary map the navigator could recognise exactly the track of his aircraft.

These two instruments increased the precision of navigation and of bomb aiming to an almost incredible degree: they also had the effect of augmenting the aeroplane's crew and of altering the methods of training navigators and air bombers.

Unfortunately, the slow production of these instruments, the long time needed to modify the design of aircraft in order to incorporate them, and the high degree of secrecy surrounding their development and use in the Service, militated against their being supplied to the training organisation until the war was nearly over. The secretive tendency in particular reached such proportions that none of them were supplied to overseas training units, and even those responsible for the direction of navigation training were unable to keep themselves up-to-date with the progress of the new techniques. Training lagged so far behind invention in this matter that its products had to be re-trained at the Operational Training Unit in the United Kingdom.

Another line of development that followed the statistical analysis of night photographs, referred to previously, went far towards achieving the correct use of the air weapon. Of paramount importance was the acceptance in 1942 of the 'pathfinder' principle, which in turn resulted in navigation tactics becoming an integral part of any bombing operation. The navigation tactics enabled the bombing offensive to reach a point of concentration and to saturate the enemy's defences, thereby inflicting the maximum damage for a minimum rate of loss.

Effects of Technical Advance: Introduction of the Air Bomber

One result of the 'New Deal' plan prepared by the Air Member for Training and of the navigation aids was the introduction of an additional member of the air crew for medium and heavy bombers who was subsequently styled the 'air bomber'. The new category represented a further stage in the process of specialising the various air crew functions. By March 1942 the technique of flying a heavy bomber had advanced a long way from the 'pilot airforce' days in pre-war policy to the highly specialised era which the 'New Deal' introduced.

The observer had taken over navigating and bombing duties from the pilot in May 1939 and the position remained static until the time when new radar inventions greatly facilitated the observer's task. The new devices had the result, however, of keeping the observer at his table devoting a most concentrated attention upon tracing accurately the air plot while manipulating various instruments. The great improvement in the direction of track - and time-keeping and of target-finding is recorded in the appropriate operational narratives. There remained to be solved the problem of the actual bombing to be done when once the target was in sight. The bomb aimer's duties demanded a high degree of skill and of resolution at a most critical time in the aircraft's mission. He had to guide the final run-in to the target and to identify the aiming point while using the new greatly improved bomb sight; and in addition he had to manipulate a rather complicated system of switches that fused the bombs and selected their order and their placing when dropped. To units of Bomber Command many different tasks were allotted in addition to bombing sorties, such as laying mines in the sea, low level missions supporting 'underground forces' in enemy-occupied territory, and inter-Service co-operation. These tasks all called for some person skilled in map reading and general airmanship. Therefore the introduction of modern equipment into aircraft induced a trend compelling its users to 'keep their heads in the office', or, in other words, these new aids demanded concentrated attention which left little time or opportunity for looking around the night sky, especially when remembering that the human

eye needs time to accommodate itself to the darkness. There was a sub-stratum of truth in the aircrew jargon used at this time in the cynically humorous designation of the pilot of a heavy bomber as a 'driver-airframe'. The stage had been reached when accurate flying demanded from the pilot complete concentration on his instruments and gave him little time to handle a map in order to locate objects on the ground. Even the manipulation of many engine controls and the inspection of gauges was taken from the pilot and entrusted to the flight engineer. There was an obvious need for another crew member who would be free to concentrate on bomb aiming, map reading, and manning the forward gun when necessary.

The first line of thought led to finding someone who could relieve the navigator at his desk during the final run-in to the target. The Air Member for Training felt concern over the difficulties inherent in a scheme of training for a new aircrew member that necessitated a split in observer training. A close link existed between navigation and bomb aiming, but the training course for observers could not be shortened to any appreciable extent by cutting out the portion relating to bomb dropping. Moved by ideas of economy in the training plan, the Air Member for Training at first felt inclined to recommend that the wireless operators/air gunner ought to be trained as relief navigator for the run-in to the target. This proposal however, did not find much favour at the Chief of Air Staff's conference on 11 March 1942, but the conference agreed to try an experiment in Bomber Command on the lines suggested.

So far little attention had been given to the problem of bombing, which was liable to develop into blind bombing. Owing to the shortage of aircraft in squadrons, flying time could not be made available to give the bomb aimer sufficient practice before the squadron went out on sortie. When the crews were interrogated on return from an operation, the old hands reported how they spent a considerable time in locating the target, complaining how hard it was to find in 'black-out' and seldom claiming a direct hit; whereas an inexperienced crew would generally report no difficulty

in locating and bombing the target. The solution appeared to lie in redistributing the duties among the crew so that the front gunner did not have to leave his gun-turret in order to pin-point the aircraft's position and adjust the bomb sight, when approaching the target; and to train the wireless operator in the rudiments of navigation and map reading with a view to his relieving the observer during the short time while the latter was acting as bomb aimer. This proposal would have involved the addition of two or three weeks to the course of training for wireless operators, which Bomber Command did not consider feasible. As in most squadrons the front gun was not manned unless ground-strafting was included in the operation, the Air Officer Commanding-in-Chief, Bomber Command, supported the view that the right solution to the problem was to train the front gunner to be the bomb aimer.

The problem was again considered by the Chief of Air Staff's conference on 29 March 1942⁽¹⁾ when the Air Member for Training explained that, if it was decided to train a bomb aimer distinct from the observer, the training capacity required could only be met within existing planned training resources by transferring from the observer syllabus the subjects of air bombing and air gunnery, and giving this instruction to the bomb aimer. Even if this step were taken, the amount of training in the air available to the bomb aimer would be much less than that received by the observer, because in the latter case training in navigation and bomb dropping was combined on the same practice flights. During the previous year the training staff had combined those practices in order to raise the standard in both subjects and as a means of making full use of available aircraft. To separate these two types of training without increasing the air training capacity in the schools and without lowering the standard of navigation might prejudice the standard of bomb aiming. The Air Member for Training deplored this latter possibility because the accurate dropping of bombs was the culminating point in the whole operation and in the effort of the bomber crew. He also foresaw a further disadvantage in employing a

(1) A.M. File S.79362.

special bomb aimer. Unless the airman possessed a strong character with great resolution, on occasions he might be unable to resist pressure from both pilot and navigator to drop the bombs before he was satisfied that the aircraft was in a position suitable for him to take accurate aim.

On the other hand it was possible to train an assistant navigator who could relieve the observer for bomb aiming without lowering the existing standard of observer. This was possible because the greater part of the assistant navigator's work could be learnt on the ground and he would not need preparatory air training as the air experience gained during the operation training unit stage would suffice. For such reasons the Air Member for Training supported the case for training an assistant navigator, who would be of similar basic quality to the pilot and the observer, in preference to splitting the functions of the existing type observer between a navigator and a bomb aimer.

Opposing these arguments, the Air Officer Commanding-in-Chief, Bomber Command, could not agree to the navigator leaving his post some fifty miles in advance of the target so as to undertake bomb-aiming. He foresaw no difficulty in training a bomb aimer to use the new Mark XIV bomb sight. The Chief of Air Staff supported this opinion, saying that with modern navigational aids it was not advisable to relieve the navigator as proposed; he preferred giving the bomb aimer the best ground training available and considered that all bomb-dropping practices should be carried out at the air observer school and the operational training unit. Such training could be provided by reducing the equivalent amount of instruction in the syllabus for air observer.

After further discussion, the Air Member for Training agreed to inform the Air Officer Commanding-in-Chief, Bomber Command how much training in air bombing and air gunnery could be given to the bomb aimer assuming, firstly, that such training was transferred from that given to observers in the pre-operation training unit stages and at the operation^{al} training unit and, secondly, that no additional capacity for air observer or air gunner schools would be needed to carry out the proposal. On receiving the information, the Air Officer Commanding-in-Chief, Bomber Command would consult his group⁽¹⁾ commanders and would prepare his final recommendations to the Air Ministry.

(1) These discussions did not refer to air observers destined for light bombers who continued to complete the full syllabus of bomb dropping as already established.

To avoid confusion in terms the conference agreed first to change the title of 'observer' to 'navigator', and second to call the bomb aimer 'bombardier'.

(1)

Effect on Training of splitting the Observer's Task

The air observer syllabus included a total of 130 hours flying time made up as follows:-

	<u>Hours</u>
Bombing course	18
Air firing course	12
Navigation and combined exercises (including bombing)	<u>100</u>
Total	<u>130</u>

The bombing syllabus was limited to two grouping practices, four high level application practices, and two low level (3,000 feet) practices with bombs, and a number of preliminary exercises in finding wind/speed and direction. The experience gained on the bombing course was regarded as an introduction to the combined exercises which were undertaken during the navigation flying for 100 hours. The pupil spent half of the latter time in position as first navigator, in charge of navigating the aircraft, and half as second navigator, carrying out map-reading practice, taking 'drifts', using the sextant and plotting the position from dead reckoning. If the observer confined his work to navigation alone, and if the bomb aimer concentrated on his own tasks, the training period, lasting 130 hours in the air, should be divided as follows:-

Navigator	80 hours (including 50 hours as first navigator)
Bomb aimer	(30 hours bombing and air firing 20 hours map reading)

The figures show that the navigator would lose 20 hours in air experience, and that the bomb aimer would not gain as much bombing practice as the existing air observer. This applied especially to bombing at night. From this calculation the Air Member for Training inferred that the two individuals would reach the operation training unit less skilled in their respective roles than the present air observer, and that as a

(1) A.M. File S.79362 (5 April 1942).

corollary, to achieve the present standards of skill additional advanced training would be required.

When the question was discussed at a meeting of the Air Council on 14 April 1942,⁽¹⁾ the Air Member for Training accepted the plan to introduce a new aircrew member as bomb aimer although he still had a problem in devising how to provide the additional member from the existing capacity of the training organisation without lowering the standard of skill. Until early 1941 observers had been trained in two stages, a course of eighteen weeks at an air observer school and a six weeks' course at a bombing and gunnery school.⁽²⁾ The air observer schools were re-modelled between June and August 1941 so as to combine the bombing and navigation training on each flight in the air. The fusion made possible a saving of six weeks in planning the training for air observers. The only way to meet the new proposal for supplying navigators and bomb aimers was to revert to the former system, allocating eighteen weeks to navigation and six weeks to bomb aiming. Such a plan involved an increase by one (observer) advanced flying unit in Great Britain in 1942 but no more in 1943. No additional school was needed in Canada during 1942, but it was estimated that five bombing and gunnery schools would be required there in 1943.⁽³⁾ On the basis proposed a good enough bomb aimer and as good a navigator could be provided. The proposal meant relinquishing the saving of six weeks on the observer's course. Finally, the Air Member for Training recommended that the proposal for providing a navigator and an air bomber should be accepted by the Council.

The Air Council decided that the title 'bombardier' should be dropped because it already indicated a rank in the army, and that the new member of aircrew who would specialise in bomb dropping should be styled the 'Air Bomber'.

(1) A.C. Conclusions 7 (42).

(2) In June 1941 the seven bombing and gunnery schools which then trained both air observers and air gunners were reorganised. Five of them were named 'Air Observer Schools' for training observers only, while the remaining two schools specialised in training air gunners: the latter were called 'Air Gunner Schools' in Great Britain, but in Canada continued to be known as 'Bombing and Gunnery Schools'.

(3) This calculation had not then been agreed with the staff of the Air Member for Supply and Organisation, and it depended on the supply of Anson aircraft, both the United Kingdom type and the Canadian type with Jacobs engines, being able to carry five persons.

On the matter of status, pay, and conditions of service, a small separate meeting of members of the Air Council particularly concerned, held on the following day, decided firstly that the air bomber should be given the same conditions as the pilot and the navigator; secondly, that these three members of the crew performed the higher functions in operating the aircraft; and thirdly that the rate of pay and the percentage of commissions applying to air bombers were to be the same as those applying to pilots. ⁽¹⁾

Steps to supply Air Bombers immediately

The decision of the Air Council to introduce a new member of aircrew in order to improve the efficiency of bomber operations led to various measures being put in hand to supply a stock of air bombers with the least possible delay. The Director of Flying Training at once raided a store that was ready to hand. ⁽²⁾ In the Aircrew Reception Centre at Bournemouth was a pool of trained personnel from the overseas air training schools, chiefly Canadians, who awaited vacancies in the advanced flying schools in Great Britain. During the space of three months, observers were posted from the pool for training at double the normal rate, one to act as navigator and the second as air bomber. Also to speed up the stock needed by Bomber Command, suitable airmen were selected from the initial training wings in the United Kingdom and posted for training as air bombers in the air observers schools, instead of being sent to Canada under the Empire Air Training Scheme. A third source of supply was used by taking pupils who had been eliminated from pilot training in this country owing to unsuitability and sending them to train for the new aircrew category. These three sources were expected to provide 600 air bombers in the ensuing three months, which number could very nearly satisfy the requirements of Bomber Command during the intervening period until the flow of trained air bombers could reach the United Kingdom from Canada. The R.A.F. mission in Canada was informed by signal of the changes in grade and status of aircrew members so that plans could be put in hand at once to supply them in the requisite numbers and categories. ⁽³⁾ Thereafter air bombers graduated

(1) S. of S.1250, 16 April 1942 and A.M.O. A.505/42.

(2) A.M. Folder DTF/T/951.

(3) A.M. Signal OG.3500, 27 May 1942.

from the Empire Air Training scheme at the rate of 284 every two weeks. On arrival in the United Kingdom they went to advanced flying units (observer) for a course in the new wireless aids to navigation so as to ensure that they reached the required standard of map reading and target identification, especially over industrial areas.

To render the new aircrew category attractive to personnel undergoing training for trades other than pilot who had volunteered to serve as air bombers, many of these who proved really proficient and outstanding in their duties on operational tours were selected for advanced courses as bombing leaders, with the eventual possibility of being given commissioned rank.

Basic Training for Air Bombers

The primary function of the air bomber was to guide the aircraft over the target, to identify the aiming point and to place the bombs accurately on it. When not in the close vicinity of the target he was needed as a member of the navigation team, which also included the pilot and the navigator. With the latter he worked in the closest collaboration, providing him with visual pinpoints, and with astro or radar observations on the journey, in this way acting as the 'eyes of the navigator'. In addition to this secondary function, the air bomber helped to complete the meteorological report during the flight, and it was his job to set up (and read) the astro-compass. If attacked by enemy aircraft he manned a gun; usually in the forward turret, and became part of the defence team. In order to carry out these varied duties the air bomber had to understand the principles of dead reckoning navigation, to possess a rule of thumb method for taking astro sights, and he had to be able to read maps competently by day and night. Therefore, to meet these requirements, the programme in basic training given to aircrew was revised to include, for air bombers, a navigation section which entailed 84 (1) hours' instruction applied to practical work in the air. As much practical work as was possible, having regard to weather conditions and interference by the enemy, was included in the syllabus of instruction, which was planned to last 14 weeks on a straight-through course, the time being allocated as follows:-

(1) A.P. 1388 E.

	<u>Hours</u>
Ground Training	413
Air Training	156
Miscellaneous (including examinations)	<u>50</u>
	<u>619</u>

Besides other Service matters the course comprised work in bombing, air gunnery, pyrotechnics, navigation, elementary meteorology, aircraft recognition signals morse practice and some photography. In view of the many different types of medium and heavy bomber aircraft and of the constantly changing situation, further elements in the training of the air bombers were left to later stages in the operational training unit or heavy conversion unit, e.g., learning how to operate the radar instruments, details concerning the gun turret, and air firing practice.

These air bombers who were lucky enough to get all this training overseas under the Empire Air Training Scheme had a straight run through the syllabus under more pleasant conditions than those which prevailed in schools in the United Kingdom.

Another development in the policy for improving the effectiveness of air attack on the enemy occurred during the summer months of 1942, when the Air Council prepared plans of production and training that reached maturity the following year.⁽¹⁾ Meantime these plans had important effects on the supply of navigators and other aircrew members.

Revision of Aircrew Categories

The next stage in the evolution of a full aircrew team followed very closely on the Air Council's decision to adopt the one-pilot principle⁽²⁾ and to increase the crew by adding a specialist air bomber in medium and large aircraft. Also the arrival of improved types of aircraft and equipment, such as the Mosquito, into the Service during the third year of war, tended to intensify the process of specialisation in aircrew duties. In July 1942 three new types of aircrew were introduced into the Service. The duties of each member of the crew were briefly outlined in A.M.O. A.746/42 as follows:-

(1) A.C. Paper 27 (42).

(2) A.C. Meeting 6 (42).

Category	Duties
(a) Pilot	Flying.
(b) Navigator	Navigation. Operation of gun in an emergency.
(c) Navigator (B)	Navigation, bombing and gunnery.
(d) Navigator (BW)	Navigation, bombing, wireless operation and gunnery.
(e) Navigator (W)	Navigation, wireless operation. Operation of gun in an emergency.
(f) Navigator (Radio)	Radar operation. Navigation.
(g) Air Bomber	Bombing. Map reading. Operation of gun in an emergency. To act as pilot's assistant where no flight engineer is borne, to the extent of being able to fly the aircraft straight and level and on a course.
(h) Wireless Operator (Air Gunner)	Wireless operation and air gunnery. Wireless operators (air gunner) in general reconnaissance units have to be qualified in radio in addition to their normal qualifications).
(i) Air Gunner	Gunnery.
(j) Wireless Operator) Mechanic (Air Gunner)) Air Gunner (Flight Mechanic(A))) Air Gunner (Flight Mechanic (E)))	Duties of their trade in heavy aircraft of Coastal Command: operate gun in emergency.
(k) Flight Engineer	In addition to the duties with engines and instruments (as laid down in A.M.O. A.262/42) he is required to act as pilot's assistant to the extent of being able to fly straight and level, and on a course. Operates a gun in emergency.

The regulations quoted in the preceding paragraph recognised a practice that had been developing during the summer of 1942 as larger aircraft were brought into use. It will be noted that no less than ten members of the team were available for defending the aircraft if need arose. The importance and growth of the science of air navigation are shown by the division of navigation between five different specialists. To keep pace with the progress in radio development five members of the team were trained to operate the special instruments provided for long distance communication. And finally, this Air Ministry Order marked a definite stage in the development of the aircrew team

through omitting all reference to the Observer category, which gradually disappeared from official use in the Service. Observers re-categorised to one of the types of navigator on completing the proper conversion course to qualify for the new aircrew trade.

Two months later new badges for aircrew were authorised and introduced immediately. ⁽¹⁾ The pilots 'wings', which had long been treasured as an award and honoured by those who gained the distinction, remained the same as formerly. For the other aircrew members a single wing branching from a laurel wreath was devised, carrying in its centre the suitable capital letter to denote the category of the wearer namely, 'N', 'B', 'AG' or 'E'. A soothing balm to old-type observers was administered in paragraph 4 of the Air Ministry Order by the concession:-

'The existing air observer badge (O) and observer (radio) badge (RO) may continue to be worn by personnel who have qualified for them in the past but who are no longer available by reason of age, medical standard, or otherwise, for posting for the duties of one of the new categories of air crew.'

To tradesmen members of the aircrew team listed in category (j) above no badge was admitted in respect of their basic trade; but they could qualify for the air gunner's badge by a full course of training in air gunnery duties, and by volunteering for that air category.

The 'P.N.B.' Scheme: Effect on Training Organisation

In order to avoid wastage of manpower in the production line for aircrew a new method of classifying recruits for aircrew duties, known as 'P.N.B.' grading, was applied in August 1942 to all aircrew candidates in the United Kingdom, including not only those from 'deferred service' but also those ⁽²⁾ entering the Royal Air Force direct from civil life. Under this scheme the Aviation Candidates Selection Board classified each man who proved medically sound and otherwise suitable into either 'P.N.B.' category (pilot, navigator or air bomber) or 'non-P.N.B.' category (wireless operator/air gunner, flight engineer or air gunner).

(1) A.M.O. A.1019/42.

(2) The 'P.N.B.' scheme has been dealt with in detail in Chapter 1. A similar method of testing and classifying cadets had been used for several years by the Dominion and the United States Air Forces (AMT/2597 dated 10 September 1943).

In order to conserve all possible aircrew material modifications were introduced into the training organisation particularly with a view to preparing navigators for their special roles in the different types of aircraft required by different operational commands, namely:-

- (a) Those pupils who were graded navigator, navigator (B) or air bomber were sent to Canada or South Africa where their basic training was continued on courses lasting 20 weeks, 30 weeks or 14 weeks respectively. They returned to the United Kingdom six or eight weeks afterwards to complete their training by courses at the Advanced Flying Unit (O) and the Operational Training Unit in a particular Command.
- (b) Navigators (W), being destined ultimately to serve in Beaufighters of Coastal Command, were posted to a long signals course (14 weeks) in the United Kingdom and then via an aircrew despatch centre to Canada for training in navigation (20 weeks). Most navigators (W) and some navigators (B) who were required for employment in Coastal Command were given a course lasting five weeks at a school of general reconnaissance in the United Kingdom or overseas before the last stage of training at an operational training unit.
- (c) The longest course of all basic training for aircrew was that organised for navigator (B.W.) because this category combined the duties of navigator and air bomber in high speed bomber Mosquitos. The cadet first passed the long signals course of 14 weeks at No. 1 Radio School, Cranwell; then he went to the Elementary Air Navigation School at Bridgnorth⁽¹⁾ for eight weeks, and followed that with a 22 weeks course in navigation, bombing, gunnery, pyrotechnics etc., at No. 5 Air Observer School, Jurby (Isle of Man).

(1) The Elementary Air Navigation School moved from Eastbourne to Bridgnorth on 12 October 1942. The category of navigator (BW) was deleted in October 1943.

- (d) The navigator (radio) received all his instruction in the United Kingdom because the synthetic trainers and the secret radar instruments could not be spared for overseas schools during the war. His basic training consisted of eight weeks at the Elementary Air Navigation School, Bridgnorth, followed by eight weeks at the Air Observer School, Jurby and ending with five or six weeks (depending on flying hours) on air interception work at No. 6 (0) Advanced Flying Unit, Staverton where he learnt details of the operation and management of the secret radar devices in fighter aircraft before he reached the operational training unit in Fighter Command.

Modifications in the Control and Direction of Air Navigation

The changes in selection methods and training were accompanied by changes in the control and direction of air navigation which contributed its quota to the increasing power of the air weapon. The expansion of the air forces during the year from May 1942 until May 1943 based on plans for Target Force 'G', which aimed at a first-line strength of above 9,000 aircraft made this a highly crucial period from the aspect of training. Its repercussions were felt in the navigator training organisation.

In a comprehensive survey of the problems associated with the inaccurate bombing by night of enemy targets the Air Officer Commanding-in-Chief, Bomber Command, submitted to the Air Ministry a proposal for forming a new directorate which should be responsible for policy in view of navigation's growing importance in operations.⁽¹⁾ Although this proposal received support from the other operational commands the Air Staff did not favour the idea of adding to the number of directorates.⁽²⁾ The Air Member for Training feared that the scheme 'might encourage the impression that air navigation was black magic'. Through the posts already created for navigation specialists in the three branches chiefly concerned with these matters, namely the Deputy Director of Air Tactics, the Deputy Director of Operational Requirements and the Deputy Director of Flying Training, a very close co-ordination of policy was preserved within the Air Ministry.⁽³⁾ To strengthen the influence of

(1) Bomber Command letter BC/S.21156/Nav., dated 24 March 1942.

(2) Air Ministry letter CS/12261/VGAS, dated 23 May 1942.
(A.H.B./III/C1/15).

(3) A.M. File CS/12261 - A.M.T. minute 1095, dated 11 May 1942.

these officers he recommended the formation of a 'navigation policy committee' under the chairmanship of the Assistant Chief of Air Staff (Operations) who was in a position strong enough to balance the claims to priority as between the various branches. The committee should be assisted by two sub-committees to link up the work, one for radio aids having the Director of Telecommunications as chairman, and the second for non-radio aids. The first of these sub-committees started work at once, but the matter of the other sub-committee and the main committee hung fire until December of that year, by which time the latter was given wider powers than those originally envisaged by A.M.T. For nearly two years there had been posts established at Command and Group Headquarters in the operational commands, and, of course, in Flying Training Command for navigation specialists who held the long course qualification, 'N' symbol. The Air Member for Training also recommended that the chain of organisation should be extended. Posts for officers qualified by the short navigation course, ('s.n.' symbol) were additionally established in stations and in each squadron of Bomber and Coastal Commands in order that these officers could raise the standard of navigation among operational crews. (1)

Thus during the summer months of 1942 a tidy organisation was instituted to manage all navigation matters at each level from the Air Ministry to the first-line squadron. Related to this theme, and developing concurrently with it, was the need to supply aircrew teams in ever larger numbers and to achieve a much higher standard than formerly of teaching in, and of graduation from, the navigation schools. (2)

Need for Extra Navigators: Difficulties encountered

The trend of the war at sea created a large demand for navigators (W) and (BW) who were required in Bomber and Coastal Commands, and for employment in Mosquito aircraft of the Photo Reconnaissance Unit. (3) The war situation called for rapid action by the Air Ministry to provide by January 1943 an output in this category of 230 per month. (4) To meet this need four emergency methods were set in motion. The number of navigators sent to Canada was

(1) A.M. File CS.12261.

(2) A.M. File S.82405.

(3) A.M. File S.73754.

(4) A.M. File S.73754.

increased by fifty per cent, and the pupil population at two air observer schools in the United Kingdom was raised to 360 at each school.⁽¹⁾ In addition, for a few months the elementary air observer course (eight weeks) was omitted, navigator cadets being pushed forward from initial training wing direct to the air observer school or to the signals stage in their training⁽²⁾ according as vacancies become available week by week. Lastly, in order to find accommodation and instruction for the extra navigator cadets, a reduction by thirty per cent had to be made in the quota of wireless operators/air gunner sent from overseas for the refresher course at No. 1 Signals School, Cranwell, not more than 400 being taught at one time. The larger intake at No. 9 Air Observer School, Penrhos, also was only made possible at the expense of wireless operators/air gunner; their school at Llandwrog being closed and converted to a satellite of Penrhos so as to make room for training 180 navigators. Some of these temporary expedients only lasted until autumn 1942, by which time more schools were built in Canada.

Many difficulties were encountered in implementing the plans worked out at Air Ministry and Command Headquarters for increasing the output of navigators and air bombers in preparation for an all-out offensive. The problems which arose were not entirely due to the siting overseas of so large a part of the production line, although this factor did complicate the flow of trainees in a quite unpredictable manner.

In the training establishments, usually built in a hurry amid remote fastnesses of the United Kingdom, where electric current, instruments, books and other essential needs were either lacking or hard to acquire, the 'man on the spot' was presented with many obstacles to training. Synthetic trainers as a type depended on electric power, and air navigation in its mushroom growth could only make progress by means of instruments based on a stipulated supply of electric current. Bad weather not only interfered with flying but also with ground instruction at some satellite airfields that lacked any form of artificial lighting in the lecture rooms.⁽³⁾ In the case of training

(1) Flying Training Command letter FTC/S.60400/Org.1 dated 6 May 1942. The schools were Jurby and Penrhos.

(2) A.M. File S.73754.

(3) As at Moreton Valence the satellite for No. 6 A.O.S. Staverton. (A.M. File S.73754).

navigators (W) for very long range aircraft and navigators (radio) for night fighters, a large demand for whom existed at this period, a further obstacle was liable to occur when the cadets were being tested in the decompression chamber for their ability to endure flying at 35,000 feet without suffering 'the bends'. If one man out of the batch of six failed the test the remaining five had to go through the process again for four hours. (1) In overcoming these hindrances the school staffs displayed ingenuity and patience; but when too many adverse circumstances happened to one course of trainees an extension of time up to a fortnight had to be granted by the Air Ministry (2) before the pupils could pass on to the operational training unit.

Plans to improve Instruction: Provision of new Navigator Grades

Concurrently with the plans for expanding the organisation for training navigators and air bombers, the Air Ministry started a drive to improve both the quality of teaching in navigation subjects and the standard of knowledge (3) required from members of the branch. Although the developments cannot be separated in a precise time-sequence, since progress overlapped, three distinct phases are discernible. Phase one opened in July 1942, giving place to phase two in November and December 1942, while phase three of the attack, though starting in August, took a long time to get under way and it was launched in full strength only in December, when it gained impetus, enough to carry on until the end of the war, and beyond it, into the post-war constitution of the Royal Air Force.

The drive opened with a letter from the Air Ministry to the Air Officer Commanding-in-Chief, Flying Training Command, repeated to operational commanders-in-chief and to Royal Air Force delegations overseas, introducing a revised syllabus for courses for instructors in navigation. (4) In a course lasting twelve weeks graduates would henceforth reach a level not materially different from that of the former specialist navigator who had taken the long course ('N' symbol). This general course 'aimed to furnish instructors

(1) No. 4 A.O.S. West Freugh and No. 6 A.O.S. Staverton were specially equipped in August 1942 to train and test these types of navigator.

(2) A.M. File S.73754, Encl. 142A.

(3) See Appendix 34. 'Memorandum on Navigation Training' issued by D.D.T. Nav., 27 July 1942. (A.M. File S.82151).

(4) A.M. File S.82405 (10 July 1942).

competent to handle any stage of the highest basic training in navigation' and to qualify individuals for certain staff appointments: awarded the symbol 'S.N.I.' on their documents, they were considered for posting action in the same category as persons qualified by the previous long navigation courses. In order to hasten the supply of instructors to meet the need for expanding the bomber force, courses were located at the Central Navigation School, Cranage (re-named from No. 2 School of Air Navigation) and overseas in Canada and South Africa under the Empire Air Training Scheme. Two distinctive features of the courses were (a) the varying length from twelve to eight weeks according to the pupil's experience in the science of air navigation, and (b) ⁽¹⁾ the inclusion of instruction (18 hours) for all pupils in methods of teaching. Under the guidance of education officers each pupil gave six practice lectures of one hour which were afterwards discussed by his fellow pupils. Although the former feature gave way under the difficulties of administration, the latter remained as an integral part of all instructor and specialist courses in navigation. As a bar to the full implementation of this plan, reasons of security prohibited sending overseas that portion of the syllabus which dealt with the latest radar discoveries; moreover the special apparatus was not available in Canada or South Africa. Therefore pupils who were trained as short navigation instructor in those dominions could only qualify for the symbol 'S.N.I.' after passing through a final course lasting fourteen days at ⁽²⁾ the Central Navigation School on returning to the United Kingdom. The last course in the United Kingdom ended on 23 November 1942 and those overseas closed as soon as possible after that date. They were replaced by the second ⁽³⁾ phase in the plan, a course entitled 'Staff Navigators', which was developed as a result of experiment and discussion between the Air Ministry and the operational commands.

(1) Course Lengths

- | | | | |
|-----|---|---|----------|
| (a) | Navigators direct from basic training | - | 8 weeks |
| (b) | Pilots direct from basic training, all ex-operational navigators and G.R. trained pilots. | - | 10 weeks |
| (c) | Pilots - more than 12 months since completion of basic training. | - | 12 weeks |
- (A.M. File S.82405).

(2) A.M. File S.82405 (17 September 1942).

(3) Aircrew Training Bulletin No. 7 (December 1942).

While the short navigation instructor courses served their purpose by supplying within a period of four months the teaching staff which was urgently needed in the equivalent of nine extra schools in overseas training centres, they were only an interim measure. If the general standard of navigation was to be raised to accord with Air Ministry policy for increasing the air offensive something more was needed. Some idea of the very large number of highly skilled navigators required to maintain a flow of reliefs for instructors, some of whom had been employed on the same duties for two years, as well as to fill the additional posts in operational commands and units, can be gained from a glance at the provisional training requirements for the second half of 1942.⁽¹⁾ After prolonged discussions with the staffs of the commands concerned, the Air Ministry introduced a new grade of navigator, called 'Staff Navigator' (abbreviated symbol 'S.N.') which was intended to absorb in due time all the subordinate types of navigator who had been trained for staff or instructional duties, i.e. those persons qualified 's.n.' or 'N' under the old syllabus, and to provide better qualified men for such posts in future.⁽²⁾ The standard of graduation from the new course was raised so that it became in every way equal to that of the specialist navigator as formerly constituted, though it did not confer on its trainees the title of specialist because the numbers qualified would have been so great as to degrade the significance of the name of specialist.⁽³⁾ That award was reserved for the graduates who passed the new series specialist navigation course lasting eight months at the Central Navigation School, Cranage.⁽⁴⁾ Those already qualified 'S.N.I.' by the short navigation instructor courses retained the qualification until, by refresher courses lasting four weeks, they were brought up to the higher standard of staff navigators. The first full course opened at Cranage on 16 November 1942, intakes of twenty-four pupils continuing thereafter every fortnight. Courses in the Dominions began as soon as copies of the revised syllabus could reach the schools, but they suffered the usual disability in not being able to instruct their pupils in the advanced section of the

(1) See Appendix 35.

(2) A.M.O. A.1220/42.

(3) A.M. File S.82151.

(4) A.M.O. A.817/42.

syllabus dealing with secret radar aids until their graduates returned to the United Kingdom, where they gained the full qualification by passing special short courses.

It soon became apparent that the new syllabus could only be adequately covered by extending the period by a fortnight in all cases, and on 1 February 1943 the Air Ministry approved the length of course at ten weeks for navigators, twelve weeks for pilots (both categories direct from advanced flying units) and fourteen weeks for pilots whose basic training ended twelve months or longer before attending the course.⁽¹⁾ With minor modifications in the syllabus due to advances in technology and standardising the length at thirteen weeks the course for staff navigators continued as organised until the war ended.

The Specialist Navigator (New Series)

The third phase of the plan was a new series of long courses for officers who specialised in navigation; the standard required was greatly in advance of any previous navigation course and it reflected the progress in the science of navigation during the war years. The course aimed to provide a small number of officers possessing a high degree of theoretical as well as practical knowledge of navigation so that the Royal Air Force should have available specialists who could collaborate with the scientists engaged in developing the astronomical, radio and other aids. 'Academic attainments of a high order⁽²⁾ were therefore necessary in those recommended for the course'. Located at the Central Navigation School, Cranage, this first advanced course lasted almost nine months, from 23 November 1942 to 13 August 1943, and it superseded the specialist courses of 15 weeks' duration (symbol 'N') which had been transferred from this country to schools in Canada: after a last intake in⁽³⁾ October 1942, the latter's capacity was used for training staff navigators. The instruction embraced the fullest detailed theory about the science of air navigation with the object of 'advancing technique and of devising means of simplifying its practical application so that reliability and accuracy would be

(1) A.M. File S.82405.

(2) Air Ministry (S.8) letter to Commands dated 21 August 1942 (A.M. File S.82151).

(3) The Central Navigation School, Rivers and No. 31 Air Navigation School, Port Albert.

within the competence of the ordinary navigator and pilot'.⁽¹⁾ In order to attain this high standard on graduation, the intake was limited to twelve officers selected from pilots or navigators of wing commander rank and below who had had full training in and wide experience of air navigation and who either held a good honours degree of a British University in mathematics, physics and allied subjects, or who passed the qualifying examination designed⁽²⁾ on original lines that tested the candidate's capacity for thought.

The studies prescribed for the specialists covered a wide field and gave scope for individual or team work in preparing theses on technical aspects of air navigation, on instruments or radar aids, cartography, astro-navigation, meteorology and so forth. Within three weeks of assembling, No. 1 Course held a discussion on 'the technique most suited to flying in polar regions' based on theories propounded by one of the pupils, an officer of the Royal Canadian Air Force. The conclusions reached led to further research and preparation of the exploratory flights over the North Pole which were undertaken two years afterwards by the Empire Air Navigation School (the direct descendant of the Central Navigation School). Supplementing instruction by the permanent staff, the Astronomer Royal, the Director of the Meteorological Office, lecturers from the R.A.F. Staff College and scientists from the Telecommunication Research Establishment, the Aircraft and Armament Experimental Establishment and the Royal Aeronautical Establishment (to name but a few) visited Cranage, to describe the latest developments in their particular⁽³⁾ sphere. From operational commands and special development units in the R.A.F. came also occasional lecturers with up-to-date information.

Instructional visits for the students were arranged to these places, and to the Nautical Almanac office and factories in England.

In March 1943 the Director of Flying Training agreed to a practical test to be done by the students, i.e. to fly the Atlantic as navigators in Ferry Command aircraft. Two instructors led the party of eleven students who were conveyed by fast ship to Canada on 20 April 1943. Six days later they

(1) Quotation from the inaugural speech by the Air Officer Commanding-in-Chief, Flying Training Command, on opening the first course (A.M. File S.82151).

(2) Aircrew Training Bulletin No. 6, October 1942.

(3) A.M. File S.82151, Encl. 119A.

reported to Headquarters Ferry Command at Montreal, whence they split into small groups for liaison visits whilst waiting for aircraft to make a non-stop crossing to England for the purpose of gaining experience of long distance navigation. Meanwhile they visited Canadian training units and navigation centres in the United States, factories and places of interest, (1) until the last members departed by air on 27 May 1943. Information thus collected provided the basis for profitable discussion, and the reports of these specialists helped Air Ministry (D.D.O.R. Nav.) in the continuing effort to improve air navigation.

During the early stages of planning difficulties arose in getting together a suitable staff, particularly for the post of chief instructor. Moreover formations were unwilling to release their best officers (2) and few existed. As the Air Member for Training wrote to the Air Member for Personnel, 'there are literally so few officers at present of high calibre in the navigation world that we are forced to think in individual names'. (3) Progress was also hampered by the slow delivery of essential equipment, delays in provision of works services and the unsuitability of Cranage as regards flying conditions. (4)

Quality of Material for Training

Early in the period of planning a maximum offensive the Air Council considered how to attract the best type of man to come forward for the navigator category, (5) and by offering the inducement of captaincy of aircraft to navigators and air bombers they hoped to recruit to the grades some former pilots. (6) This policy gathered impetus when the Secretary of State, in his second report to the Prime Minister concerning the co-ordination of the bomber offensive, indicated the chief set-back in training navigators:-

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- (1) Signal No. S.2921 dated 26 May from Dorval. (A.M. File S.78917, Encl.99A)
 - (2) Cypher from C.A.S. Ottawa No. X.9494, dated 22 October 1942.
 - (3) A.M. File S.82151, Minute 164.
 - (4) See also page of this monograph.
 - (5) A.C. Meeting 10 (42)
 - (6) A.M.O. A.756/42.

'There has been a steady improvement in the standard of navigation training over the past eighteen months but there is still room for further improvement. Among other measures to achieve this we are discussing with the Board of Education the possibility of improving the basic educational standard of recruits which has shown a tendency to fall to a level which imposes a considerable strain on the R.A.F. training organisation.' (1)

This very mild statement scarcely disclosed the gravity of the problem that faced the Air Members for Personnel and for Training with varying degrees of intensity during the ensuing few years. Caught in the meshes of the manpower shortage these two members of the Air Council found their plans jeopardised by this deficiency in general education evinced by many aircrew recruits. (2)

A survey covering three months showed that thirty-four per cent of those selected for training in the navigator category had had no more than elementary education. (3)

Owing to the complex nature of the equipment produced for aircraft since the war began, the courses of instruction proved to be beyond the comprehension of men who lacked an adequate general education with the result that the wastage rate at the initial training wings had shown a steady upward trend. (4)

By dint of hard work and sheer perseverance some young men in spite of this handicap managed to get through the earlier stages of training though their knowledge was rather superficial, only to fail at a later stage or when serving on operations. (5)

A sub-committee of the Council investigated the matter and proposed a plan to the full Council meeting on 5 January 1943, which was accepted because it was evident 'that a higher intellectual standard was needed in navigators than in pilots', one member adding 'we were reaching a stage when more and more complex equipment was being handled by less and less competent people'. (6)

Preliminary Aircrew Training Scheme

Arrangements were made with the Board of Education, the Scottish Education Department, and the Ministry of Labour whereby aircrew volunteers

(1) C.B.O. Paper dated 17 September 1942.

(2) A.C. Papers 80 (42), 86 (42) and 89 (42).

(3) Appendix 'C' to 'Account of Navigation Training' prepared by A.M.T. for the Secretary of State's Committee (BJ/91/DDT Nav.).

(4) A.C. Paper 89 (42).

(5) A.C. Paper 86 (42).

(6) A.C. Meeting 1 (43).

who, when medically fit and otherwise acceptable, were found to be below educational standard could be called for service in the Royal Air Force six months in advance of their calling-up date, i.e. at age seventeen years nine months. Accommodation and teaching staff were made available in many schools and colleges at twenty-one centres in England, Wales and Scotland, where these enlisted airmen attended for full-time instruction in mathematics, science, technical drawing, English, and other general subjects. The courses, lasting six months, were designed to improve the recruits' capacity to think clearly and to express their ideas lucidly.⁽¹⁾ Administration, drill, physical fitness and billeting were managed by R.A.F. staff at the centres or at the headquarters of the nearest station. After having obtained a certificate of competence the cadet passed to normal flow into the initial training wing. Designed to handle one thousand trainees a month this new educational plan, known as the P.A.C.T. (preliminary aircrew training) scheme, replaced gradually the two existing schemes for helping backward aircrew aspirants, namely (a) the volunteers on deferred service in civil occupations who attended evening classes under a local education authority, and (b) the aircrew cadets who received special instruction in mathematics and morse in the Aircrew Training Wing, Brighton. During two years 9,676 cadets were enabled by this scheme to pass into the next stage of training; they were extremely keen, co-operative and alert; but, although their academic attainment was raised by this continued study, a dull uniformity in classwork was noticeable without that sprinkling of cadets possessing outstanding intelligence who act as a leaven within the mass.⁽²⁾

A Check to Expansion

The plans for expansion relied on an increase in schools for navigators and air bombers in Canada and South Africa, but by November 1942 it was clear from congestion in the Aircrew Despatch Centre, Heaton Park, that a hold-up existed in the flow of trainees. Shortages of lumber, building materials and engine spares combined to delay the additional schools for air navigation by nearly six months in Canada; and the increase in the size of drafts to South Africa had to be postponed temporarily for political reasons.⁽³⁾ Also the

(1) Flying Training Command letter FTC/S.60735/Org.1 (19) dated 22 February 1943.

(2) Summarised final report on the P.A.C.T. scheme (A.M. File S.88530).

(3) A.M. File S.83798, Encl. 27A.

irregular convoys aggravated the hold-up that caused some modification in plans for training. In consequence, the grading course was lengthened to four weeks and followed by four weeks' leave for all cadets before they reported to the Aircrew Despatch Centre. All-through training for navigators, navigators (B) and air bombers was resumed in the United Kingdom at (observer) advanced flying units so as to conserve shipping space and to ensure the supply of trained crews which had been planned for the following summer.⁽¹⁾ Meanwhile, overseas-trained navigators and air bombers had to be retained in the personnel reception centres until vacancies not taken up by basic courses at (observer) advanced flying units permitted them to start their acclimatisation courses. One further change due to the irregularity of sailings was the decision by the Air Member for Training to hold a month's stock of P.N.B. cadets at the aircrew despatch centre. The reduced commitment in basic training gave five months' grace during which the navigation schools in Canada could be completed although it tended to increase the surplus of pilots in the personnel reception centres.⁽²⁾

Effects of War Offensive on Training Organisation

So sensitive was the air force war machine, so responsive in its parts, that events on the battle fronts caused immediate re-actions in the training organisation. This was demonstrably true in the case of keeping an even balance in the output of the numbers and kinds of navigator to team up with the other crew elements and to provide competent crews to match the production of aircraft. Changes in the war situation occasioned by the victory at El Alamein, the landings on the coast of North Africa and by the Casablanca conference⁽³⁾ increased the burdens of the planning staffs of the Air Ministry and Headquarters Flying Training Command. Also additional alterations to the aircrew flow were compelled through the out in the R.A.F. requirements for 1943, amounting to 225,000 men, which the shortage of manpower enforced.⁽⁴⁾

(1) Normally these categories received straight-through training in either Canada or South Africa.

(2) See Appendix 36.

(3) El Alamein, 3 November 1942; landings in North Africa, 8 November 1942; conference at Casablanca between the Prime Minister and the U.S. President, 14 - 24 January 1943.

(4) A.C. Meeting 20 (42), 1 December 1942.

Aircrew production programme No. 5 prepared by Flying Training Command on 10 November 1942, planned the intakes to basic courses of various types of navigator and other categories in accordance with expansion programme (1) (2)
C.W.E/E/46. The output for the months of January and April 1943 was:-

	<u>January 1943</u>	<u>April 1943</u>
Navigator	274	156
Navigator (B)	181	212
Navigator (W)	85	176
Navigator (BW)	15	15
Navigator (Radio)	108	123
Air Bomber	306	388

Plan No. 5 was superseded by programme No. 6 on 12 December 1942 which in turn was replaced by No. 7 on 20 January 1943 owing to the new requirements of the Air Staff conforming with the improved tactical situation. (3) Under the new expansion programme C.W.E/E/47 to provide for target force 'H', the output needed in the United Kingdom for the months of April and June 1943 was (4) changed as follows:-

	<u>April 1943</u>	<u>June 1943</u>
Navigator	278	655
Navigator (B)	343	52
Navigator (W)	149	205
Navigator (BW)	Nil	Nil
Navigator (Radio)	140	140
Air Bomber	312	462

(1) A.M. File S.86084, Encl. 1A. See Appendix 37.

(2) Totals extracted from Provisional Training Requirements, T.P.43/1, main table VIII. They include Dominion and Allied personnel for home war as well as Royal Air Force.

(3) A.M. File S.86084, Encls. 8A and 10A.

(4) Summary of Training Requirements T.P.43/2. The outputs from basic training in Canada, Australia and Africa that were posted to O.T.U.s in Middle East or India have been excluded from these totals, which are reduced to the actual requirements for O.T.U. or special courses in the United Kingdom. Figures extracted from Balance Sheets III, IV, V and VI; those for Navigator (R) from Main Table IV.

The comparison between these two tables can only be evaluated in the light of the new factors which influenced the preparation of the second. While the first table shows the totals for all purposes, i.e. including those members of the Dominion Air Forces who were retained for local defence in Canada, Australia and South Africa respectively, the second relates solely to aircrew elements needed in the Metropolitan Air Force. The full increase in navigator personnel was greater than appeared on the surface. Moreover, during the three months that separated the two training plans the composition of crews was undergoing change due to improved aircraft, to new weapons and radar aids as well as to the offensive phase that the war had entered by the beginning of the year 1943. Owing to the extra training in air gunnery that navigators (B) received they were needed in large numbers in squadrons employed on twelve different tactical duties; ⁽¹⁾ on the other hand the use of navigators (radio) was limited to anti-interceptor night fighting, and that of navigator (BW) declined almost to nothing save for the meteorological flights and for a few light-bomber Mosquito squadrons overseas. In fact, the category of navigator (BW) was deleted in October 1943 and aircrew so classified were employed as either navigator (B) or as (W) according to requirements. ⁽²⁾ There was a steadily increasing demand for straight navigators in the heavy bomber and transport squadrons, also for navigators (W) in Beaufighters and Mosquitos fitted as long-range fighters or intruders or engaged in photographic reconnaissance. The last named work became of supreme importance when the offensive phase of the air war opened. A third feature in the comparison of the two tables which was not readily apparent was the establishing of operational training units in the Middle East and in India. A proportion of the trainees therefore instead of returning to the United Kingdom on completing basic courses moved to overseas commands. Adding to the complications in plans for training was the insistence by Headquarters Coastal Command that all their navigators (B) must pass the course in general reconnaissance before entering a Coastal operational training unit. ⁽³⁾

(1) See Appendix 38.

(2) A.M. File S.73754, Encl. 169A.

(3) A.M. File S.64371.

The victory in North Africa in May 1943, radically altered the complexion of the battle with Germany. After being denied to our use for over three years the Mediterranean was opened throughout its length for the movement of ships and aircraft with fighter cover. The effect of this strategic success immediately changed training plans. Navigators and navigators (W) were called for in very large numbers as crew for the long range aircraft employed in the Metropolitan and Mediterranean Air Forces, ⁽¹⁾ and an additional requirement arose for seventy-five navigators per month (and an equal number of wireless operators/air gunner) for employment in the recently created Transport Command. ⁽²⁾ To meet these urgent calls the Air Ministry allotted the full capacity of two air observer schools to concentrate on training navigators and navigators (W), and one half of the output from No. 10 (Observer) Advanced Flying Unit, Dumfries was reserved for service in the new Command, ⁽³⁾ the remaining half being destined for the Tactical Air Force.

Speed in production being most important, the voyage to Canada for these cadets was eliminated by the measures taken. A new Air Observer School (No. 7) was opened on 31 July at Bishops Court in Northern Ireland with the object of training 300 navigators on basic courses lasting 20 weeks and 60 wireless operators/air gunner on their four weeks' finishing course. ⁽⁴⁾ The second school included in this production drive was No. 5 Air Observer School, Jurby whose composition was altered gradually as each of its five miscellaneous courses terminated; navigators and navigators (W) were posted in their stead until the whole capacity amounting to 360 was filled by these categories. One further means for accelerating the supply was used at this school. ⁽⁵⁾ Because no more navigators (BW) were needed in the Service a

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- (1) T.P.43/2, June 1943, Appendix IV shows the increased squadrons of Liberators, Lancasters and Halifaxes for these forces.
 - (2) Letter to Flying Training Command dated 2 July 1943 in A.M. File S.86084. The formation of Transport Command was discussed by the Air Council at Meetings 4(43), 5(43) and 8(43): at the last noted on 18 May 1943, the title was agreed. The function of Transport Command was to provide air reinforcement, ferrying aircraft, international air communications and to convey by air stores, medical supplies and other things needing quick passage for all fighting and civil services of H.M. Government.
 - (3) Letter to Flying Training Command dated 2 July 1943 in A.M. File S.86084.
 - (4) Letter to Flying Training Command dated 2 July 1943 in A.M. File S.86084.
 - (5) Memo CS.11989 dated 30 September 1943 stopped further output of navigators (BW). Owing to radio development the crew for Mosquito aircraft became one pilot and one navigator (B). Aircrew declassified by the change were employed as (B) or (W). (A.M. File S.73754, Encls. 169A and 181A).

course comprising 40 cadets who had been under instruction for only five weeks at this school was converted forthwith to navigators (W), thus graduating in October 1943 instead of January 1944.⁽¹⁾ By such methods training was geared to the special need for mobility in future phases of the air war and crews were prepared in time to match the vast numbers of new large aircraft coming off the production line.

A Navigation Team

The task of navigating a heavy bomber at night, out of sight of the ground, at high speed, high altitude, under varying and adverse weather conditions, and complicated by continual evasive action, demanded special qualities. The navigator's standards of personal integrity and intelligence needed to be above those of possibly any other category aircrew. With the advance in operational technique his responsibilities increased, and he had to make his calculations more rapidly than before, relying on data supplied by other members of the crew. The staff of Bomber Command criticised the basic training of their navigators, contending in a paper sent to Air Ministry on 5 June 1943 that a lower professional standard had seriously affected the operational effort.⁽²⁾ Also they averred that the training of air bombers was designed merely to assist the navigator in map reading and to take over in the target area to drop the bombs. In existing operating conditions, however, the role was obsolete, because map reading became impossible at high altitude and the new Mark XIV bomb sight, together with the system of establishing aiming points by the Pathfinder Force, did the work for him. Therefore the air bomber should receive training just sufficient to enable him to undertake specific tasks such as 'Gee' fixes, 'astro' and drift calculations and to use H2S to the best advantage.

The proposals were considered by the Air Ministry, representatives from operational commands and groups being called to a conference on 18/19 August 1943 to discuss these points and cognate matters.⁽³⁾ Divergent views were held by the Commands, though a certain amount of agreement was reached about the progress of air navigation and on operational needs. Bomber Command

(1) A.M. (T.P.) flying training statistics for October 1943, Table VC in Folder Training 3 - Basic Aircrew Policy.

(2) D.D.T. Nav. Branch Jacket 73.

(3) A.M. File S.47667/II, Encls. 137A to 152A.

representatives asserted that the manipulation of all the navigating instruments was more work than one man could undertake efficiently. They wanted to change the basic training of the air bomber and of the wireless operator (air) to the end that they could form with the navigator a (1) 'navigation team'. The proposal implied a much longer training for both categories who usually were weak in map reading. The Pathfinder Force representatives were satisfied with the system of training; they used the air bomber to manage H2S while the navigator plotted the course and cross-checked observations from the rest of the crew. By enlisting the aid of all members of the crew they gained a very high standard of accuracy and navigation was made as simple as possible. Nautical miles and knots were used exclusively; clocks with centre second hands were installed for the use of navigators who worked to the closest decimal of a minute for all purposes; and pilots, navigators, air bombers and flight engineers were encouraged to take sextant (2) sights through open windows rather than through the astrodrone. The problems of Coastal Command were met in a similar manner. On ranges of one thousand miles only a forty per cent success was achieved in meeting convoys; there was practically a straight line correlation of failure to meet with distance from base. The actual work of navigation in this Command had changed in two respects, viz (a) the higher altitude of operations to an average of 5,000 feet, and (b) the greater duration of sorties, which were anything up to eighteen hours. The second factor had induced a condition of fatigue during which the navigator was often dangerously inaccurate. Including the time spent on briefing before flight and afterwards for interrogation, the period of strain lasted nearly twenty-four hours. To mitigate the strain an assistant navigator was used in the person of one of the other crew members. Their chief difficulty lay when operating over the Bay of Biscay where, owing to increased fighter opposition, the astrodrone was permanently occupied by the fire controller who was unwilling to leave it even

(1) Bomber Command had instructed their groups and O.T.U. two months before the conference to give teaching in navigation to wireless operators/air gunner sufficient for this purpose. (A.M. File S.88285, Encls. 34A, B and C).

(2) Aircrew Training Bulletin No. 14, November 1942, page 22.

for the three minutes required to take an 'astro' sight. Fighter Command's chief concern was to teach pilots to read a map when flying at very high speed and very low altitude. Also the employment of twin night-fighters in support of the bombing force to greater distances within enemy territory and in darkness prohibited any form of map reading, and left both the pilot and the navigator entirely dependent on radio aids and compass. They wanted a lightweight remote-reading compass and an air position indicator that gave a true reading. Both instruments were available a few months later. (1)

While commands agreed that, owing to the number of stages through which a navigator passed before reaching an operational squadron, the long time spent in training was detrimental to keenness and efficiency they nevertheless accepted its inevitability under war conditions. The main remediable weakness in training was the navigator's inability to combine intelligently all navigation aids. In sum, this failure was attributed to his becoming acquainted with new instruments only at a very late stage in his career (the Advanced Flying Unit or Operational Training Unit) because all output from industry of such appliances had to be sent with urgent priority to operational squadrons, thus reaching schools a year or more afterwards. A recommendation of the conference that was soon fully implemented, since the movement had already been begun by the Air Ministry, was the healthy circulation of navigators between operational and instructional work. The Air Ministry experts in navigation were very uneasy about the omission of the pilot from the navigation team and the deep issues for the whole training plan; discussion with Bomber Command continued until October when, as an experiment, the former issued amendments to the training syllabus for air bombers. (2)

More Schools and Realistic Teaching

To augment and improve the flow of navigators and air bombers two additional schools were organised because 'the all-out bomber offensive would not permit a smaller backing'. (3) Mention has been made of the opening of No. 7 Air Observer School, Bishops Court. The search for a second suitable

(1) Aircrew Training Bulletin No. 15, January 1944, page 19.

(2) A.M. File S.47667/II, Encls. 170A and B.

(3) A.C. Meeting 15(43).

location went on for several months until one was made available by transferring an air gunnery school from the Isle of Anglesey to Scotland. On 15 November 1943 the second new school opened as No. 8 (Observer) Advanced Flying Unit at Mona, with a first intake of twenty each navigators, air bombers and wireless operators (air) and a total capacity of one hundred and eighty cadets (until such time as works services were finished, when capacity reached the normal three hundred).⁽¹⁾

A principle was introduced into training which brought the 'crew' element into all (observer) advanced flying units; henceforth they provided teams of three for medium and heavy bomber forces and teams of two (straight navigator or navigator (B) with a wireless operator (air)) for those of the light bomber or the transport class. This principle tended to lower the importance of this stage in basic training, which subsequently was treated by the Air Staff and the commands as an interim pool for posting, between the impatient delay at personnel reception centres and final instruction for 'the real war' given at operational training units.⁽²⁾

These measures were insufficient to supply the ever-growing needs for crews in the autumn of 1943, so a temporary expedient was used. Those of the three navigation-trained categories who had gained 'above average' assessment on passing-out from basic training and who in personnel reception centres were awaiting vacancies in (observer) advanced flying units for acclimatization courses, omitted the latter stage and were posted direct to an operational training unit.⁽³⁾ The fallacy of this move soon appeared: within three months Headquarters, Allied Expeditionary Air Force complained vigorously concerning the standard of recently posted air bombers and navigators.⁽⁴⁾

A change in the organisation of two air observer schools was made, No. 4 (West Freugh) and No. 6 (Staverton) being designated (observer) advanced flying units. They ceased basic training and took a full load of acclimatization courses for navigators, air-bombers and wireless operators (air).⁽⁵⁾

(1) L.M./2755/D. of O. dated 4 November 1943 and A.M. File S.95581, Encls. 75A to 79A.

(2) A.M. File S.83798, Encl. 61A.

(3) A.M. File S.83798, Encls. 58B to 61A.

(4) A.M. File S.83798, Encl. 83A.

(5) A.M. letter S.90691/O.P.2 dated 1 May 1943 and D.D.T. Nav. Branch Jacket 73.

Hoping to raise the standard of navigation throughout the Royal Air Force by bringing a realistic tone into the teaching, the Air Ministry in the summer months adopted the policy of replacing those who had been employed as instructors for longer than eighteen months (particularly the younger men who had been 'creamed off' on completing their basic training) by ex-operational personnel, who were rested at the staff navigators course and then posted to school staffs. As well as releasing eager young men to take a longed-for part in the bomber offensive or in the fighter role, this circulation infused new blood into the schools to their great benefit. ⁽¹⁾

The force of the measures described in the preceding paragraphs can be understood only when one remembers the twelve major aids to navigation that were used in aircraft during 1943, in addition to three aids to recovery when lost over the United Kingdom. A list of the navigation aids is as follows:- ⁽²⁾

- (a) Three W/T services - high and medium frequency for direction finding, and loop beacon systems.
- (b) Two other wireless aids - 'J' beam and standard beam approach.
- (c) Two radio direction-finding aids - Gee and H2S.
- (d) Astronomical navigation.
- (e) Two dead reckoning instruments - air position or ground position indicators.
- (f) Two methods of visual navigation - by map reading and by instrumental drift observation.

New devices such as 'Rebecca', 'B.A.B.S.', 'Oboe' and 'Loran Chain' were added when radar inventions reached production in 1944. ⁽³⁾ It is to the credit of those responsible for the policy and organisation of aircrew training that they were not misled by the elaborate system of aids which existed only in Europe; they continually insisted that sound basic navigation was essential in all flying, even on operations. ⁽⁴⁾ At all schools up to the stage of operational training, instruction in the principles of air navigation was unaltered, but by reducing the amount of training in gunnery and

(1) A.M. File S.47667/II, Encls. 102A, 127A and 131A.

(2) From a paper by Bomber Command, June 1943. D.D.T. Nav. Branch Jacket 73.

(3) See R.A.F. Monograph, Signals, Volume III, "Aircraft Radio". See also A.H.B./IIIC1/15.

(4) Aircrew Training Bulletin No. 11.

photography, instruction in the principles of radar and the cathode ray tube formed part of the syllabus from January 1944 for navigators and air bombers. Twelve months later the length of basic courses for these categories was increased by four weeks to admit extra radar subjects. (1)

Reorganisation of Navigation Training Units

Conforming to requirements for the new 'Target Force J' which were decided in November 1943, a major reorganisation of training occurred that modified the (observer) advanced flying units and disbanded the air observer schools in the United Kingdom. (2) Their capacity was adjusted to 2,550 and their function was changed so as to supply a smooth and regular flow of navigation teams. Except at one school, viz Jurby, all basic training in navigation was located overseas and the schools in this country became (observer) advanced flying units, and were so named. (3) A new formation was constituted at Jurby, Isle of Man, entitled the Air Navigation and Bombing School, where basic navigation courses continued, serving as a 'model' for trying out experiments in the syllabus and as a guide to the standard of attainment by which the product from overseas training could be measured. Besides the basic training for 80 navigators, 40 each navigators (bomber) and air bombers, the Elementary Air Navigation School was moved there from Bridgnorth with 75 cadets on a course lasting eight weeks. The latter move made possible all-through training in the one unit, which had proved successful in Canada. The pupil population at Jurby was made up to a strength of 300 by transferring the elementary compass adjuster course from Bridgnorth and the advanced one from Cranage in February 1944. (4) To meet the needs of the Tactical Air Force squadrons whose role during and after the landings on the Normandy coast demanded very great skill in map reading at low level both by day and night, many fully trained navigators (B) were employed as air bombers, though normal posting for the majority was usually to Bomber Command. (5)

(1) A.M. File S.47667/II, Encls. 185A, 195A, 195B and 222A.

(2) Overseas air observer schools continued in being until Germany was defeated. T.P.43/3 Main Table V and A.M. letter to Flying Training Command S.96846/D.T.F. dated 29 November 1943.

(3) See Appendix 39.

(4) A.M. Files S.86084, Encls. 37A, 41A, 48A and 51A and S.95581, Encl. 85A.

(5) A.M. File S.95591, Encl. 83A.

The last step that removed all basic training in navigation out of this country was taken in January 1944. From then, after the long wireless course (16 weeks) at No. 1 Signals School, Cranwell, every navigator (W) was posted overseas for the next stage in his training - a course in navigation lasting twenty-two weeks.⁽¹⁾ Thus the special staff at Air Ministry and Headquarters Flying Training Command lost a large measure of control of the basic training of navigators and air bombers. As the year moved on more and more time at (observer) advanced flying units had to be given to revision of basic subjects; and still in December 1944, Bomber Command complained about the low standard reached in navigation by aircrew sent to their operational training units.⁽²⁾

The production plant for aircrew ran at its greatest capacity during the first half of 1944, yet two types of brake prevented navigation training from reaching its optimum output, viz the shortage of money and manpower. Financial stringency, though an inescapable result of the long war, limited the efficiency of training in several ways. Works services such as extra hutted accommodation, concrete runways and the installing of radar appliances, were denied to training units if the estimated costs exceeded £5,000.⁽³⁾ This turn of the screw had a detrimental effect on pupil navigators whose air experience, in all stages preceding the operational training unit, was restricted to the Anson with its inflexible speed of 125 m.p.h., its low rate of climb and an altitude never above 10,000 feet. Limitation of fuselage space and engine power in the Anson made it impossible to install modern navigating instruments such as 'Gee', the distant reading compass, or air position indicator.⁽⁴⁾ Yet even as late as April 1945 when the Air Ministry (D.D.T. Nav.) attempted to obtain Wellingtons as the trainer type for navigation schools in Flying Training Command, it was found that the airfields were unsuitable and the cost of adapting them to take heavier aircraft proved to be prohibitive.⁽⁵⁾ In the face of these crippling conditions for

(1) A.M. File S.73754, Encl. 180A.

(2) A.M. File S.95581, Encl. 161B.

(3) A.M. File S.95279, Minute 10.

(4) A.M. File S.47667/III, Encl. 1A.

(5) A.M. File S.47667/III, Encl. 7A. Note that even the equipping of the C.N.S. with up-to-date aircraft for its advanced courses postulated a change of station to Shawbury in February 1944 (A.M. File S.95279, Minutes 7 and 10 and Encl. 35A).

learning, the outstanding fact was, not that too many who passed through navigation courses were below standard in professional skill, but that so many of them succeeded in adapting themselves and their basic training to the altered circumstances usual on operational sorties.

Training Plans for 1944

Concurrently with the extensive preparations for 'D-day', the Air Council studied the problem created by the multitude of aircrew stagnating for months in personnel reception and aircrew despatch centres in the United Kingdom at a time when the shortage of manpower reached its most acute stage. ⁽¹⁾ In a memorandum for the Air Council, the Air Member for Training proposed several measures designed to take up the slack in the pipe-line and to reduce to manageable proportions the population in those holding units. ⁽²⁾ Except for Bomber Command, by January 1944 the expansion of the Royal Air Force was virtually completed. Training plans thereafter were framed with the object of backing the known forces. ⁽³⁾ As a first step the Air Member for Personnel had already stopped for three months ending 31 March 1944 all P.N.B. intakes into the Service, except for the small trickle that entered via the preliminary aircrew training scheme. The success of the anti U-boat campaign had resulted in a marked improvement in the regularity of sailings; therefore the margins at all stages in the training organisation could be eliminated. These margins at home and overseas had proved their value in meeting unforeseen demands for rapid expansion, or in providing insurance against delays to ships or losses of aircrews at sea. Because air superiority over the enemy had been achieved a substantial proportion of crews, save in Bomber Command, was available for a second tour of operations, thereby reducing the numbers required for training. And, in addition to these economies, the wastage rates within the aircrew flow had been revised on the basis of experience during the previous twelve months. Further postulates of great significance in this presentation of plans by the Air Member for Training were:- (a) the allocation of manpower to the Royal Air Force was calculated on the assumption

(1) A.M. File S.73754, Encl. 215A.

(2) A.C. Paper 90(43) 28 December 1943.

(3) A.C. Conclusions 1(44) planned on a basis of 490 squadrons in 1945.

that Germany would be defeated at the latest by October 1945; (b) the air power of the United States would progressively increase; and (c) as allied air superiority grew losses would increase, thus making available margins of fully-trained personnel either for an intense air effort if required in 1945, or for policing Europe. Events subsequently showed the closeness of A.M.T.'s forecast and they proved that the plans for training stood on solid foundations. He ended with a note of warning: 'Once training capacity has been closed down it can only be revived after a considerable lapse of time'.⁽¹⁾

The Empire Air Navigation School

During the latter part of 1943 experience showed that the Central Navigation School was most unhappily located at Cranage. The airfield was badly drained; it had no permanent runways, and it was frequently unserviceable for long periods in winter. But the chief drawback was bad weather, accentuated by surrounding industrial haze at all times. Besides these disadvantages, the temporary hutments were inadequate on both the domestic and technical sites.⁽²⁾ Financial stringency during the fourth year of war prohibited any improvement of the conditions and prevented either the installation of modern equipment or a supply of four-engined aircraft, with the result that the Director of Flying Training felt bound to recommend its closing down as a school in the winter of 1943/44 unless a better site could be found.⁽³⁾ A long search for a fresh location received some impetus when five serious accidents to Wellingtons occurred on the airfield within a few weeks in December 1943.⁽⁴⁾ Eventually the school moved in February 1944 to Shawbury in Shropshire, where it was established permanently in a modern station possessing fine brick buildings, adequate instructional facilities, latest type runways and a large mess. Shorn of its odd courses, the number of staff navigator courses was increased to eight and the issue of Wellingtons was expanded proportionately to forty-nine, so that longer and more suitable

(1) A.C. Paper 90(43).

(2) A.M. File S.82151, Encl. 171A.

(3) A.M. File S.95279, Minute 10.

(4) A.M. File S.95279, Encl. 32A.

exercises could be planned for the students. (1) In March the Air Council gave approval for the up-grading to 'Empire' status and for the appointment of an air commodore as Commandant, a rank more in keeping with the world-wide importance of the school and its new dignity. (2) Five months later the Air Ministry gave the school a fresh charter and title as the Empire Air Navigation School (E.A.N.S.). Among other duties the school was directed 'to study the whole science of air navigation so that knowledge might be increased, development stimulated and advice given to guide research'. (3) In the spring of 1944 the specialist navigator course carried out a long-distance exercise to India by way of North Africa, which gave useful practice and encouraged liaison on navigational matters with overseas units. (4)

With minor modifications in its charter and a change in control from the Headquarters, Flying Training Command, to immediate direction by the Air Ministry for all professional activities, the school continued to be the inspirational centre for all progress in the science of air navigation. (5) Through the meetings of experts that were held periodically, the monthly liaison letters exchanged with navigation centres in the Commonwealth and the United States of America and through its test and development sections as well as its courses of instruction, the Empire Air Navigation School filled a unique place in the realm of air navigation. (6) No doubt the high-water mark of its reputation was fixed by a flight towards the end of 1944 into the South Pacific area and back via Ceylon, Aden (non-stop) and Cairo, performed in a standard Lancaster bomber during fifty-three days. The distance covered was 36,000 nautical miles in 202 flying hours. (8) Experimental

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- (1) A.M. File S.95279, Encls. 34A and 35A. The advanced compass adjusters courses were transferred to A.N. & B.S., Jurby.
- (2) A.C. Conclusions 3 (44).
- (3) Appendix III to A.M. letter S.102723/D.T.F., dated 31 August 1944.
- (4) Aircrew Training Bulletin No. 17, April 1944, page 35.
- (5) A.M. File S.95279, Encl. 40A.
- (6) Monthly liaison letter E.A.N.S./S.362/Nav., dated 7 February 1945.
- (7) Loose minute to C.A.S. from A.M.T., No. 3559 dated 18 January 1945 (B.J. Training 3 : 5). Period of the flight, 21 October to 14 December 1944. See Appendix 40.
- (8) See E.A.N.S. Report No. 45/1.

flights in the Polar region, subsequently carried out, added lustre to its name, but they did not eclipse the magnificent success of that demonstration⁽¹⁾ by pioneers to the New Zealand and Australian Air Forces.

The run-down begins

As soon as the Air Staff had estimated the probable date of victory, a mission went to Ottawa to work out a new programme of training under the British Commonwealth Air Training Plan. The Power-Balfour agreement of 16 February 1944 drastically reduced future intakes into all navigation schools in Canada, tapering the entries through twelve months until those schools finally closed on 31 March 1945.⁽²⁾ Whilst the training organisation was being reduced, the Air Council approved measures to delay P.N.B. classification until the end of the cadet's ground instruction.⁽³⁾ In April 1944 the Air Member for Personnel declared in a paper on the subject that 'it was impossible to absorb all the candidates awaiting call-up within a reasonable time'; further that intakes of P.N.B. volunteers 'could not be resumed until September, when men would be recalled after twenty months' deferment'.⁽⁴⁾ It was therefore decided to weed out thirty per cent of those who had been provisionally classified P.N.B. and, of the volunteers not then graded (including men on the deferred list or undertaking preliminary aircrew training), to fix the limit of Service requirements at the proportion of fifty per cent of all recruits for aircrew. Cadets who declined the classification into non-P.N.B. or ground trades were released to serve in the Navy or the Army. By this rigid rule it might have been possible to absorb all candidates on the deferred list by the end of the year. In the outcome, owing to the successful Allied strategy causing a rapid collapse of the German fighting machine, these hopes were not fulfilled, and in consequence many plans had to be devised for re-allocating, re-training and releasing to other Services the surplus aircrew personnel.⁽⁵⁾

- (1) The plan for the first Polish research flight received the approval of the Air Ministry on 3 February 1945 in a minute reference 1385/D.G.T.
- (2) Final report of the Chief of the Air Staff (R.C.A.F.) to the members of the Supervisory Board, British Commonwealth Air Training Plan, 16 April 1945.
- (3) A.C. Conclusions 4(44).
- (4) A.C. Paper 15(44).
- (5) A.C. Papers 42(44) and 8(45). In March 1945 the movement began whereby 20,000 R.A.F. enlisted men were transferred to the Army and 17,200 to the Fleet Air Arm, the latter at a rate of 1,000 men per month. The defeat of Japan in August terminated this process.

In June 1944 the Air Ministry (D.G.O.) decided to reduce capacity at (observer) advanced flying units, gradually during that year but gathering momentum in 1945.⁽¹⁾ In the same month No. 6 (Observer) Advanced Flying Unit Staverton was segregated from a normal kind of training in order to concentrate on a special syllabus for navigators and air bombers who were wanted for operational training by No. 38 Group (Transport Command). The pupils received intensive practice in map reading at low level in close liaison with Nos. 42 and 81 Operational Training Units which prepared crews for service with airborne forces.⁽²⁾ The school at Staverton and its satellite Moreton Valence continued with this special work until they were closed down on 12 December 1944.⁽³⁾

The plans outlined above for reducing the numbers of entrants into air-crew training came too tardily, and they proved to be inadequate to stem the tide of trainees sweeping into advanced training units in the United Kingdom from overseas. During the summer months schools became congested with qualified aircrews awaiting posting to the final stage of instruction. From the beginning of September onwards reserve pools amounting to twenty per cent of the total under training were formed at (observer) advanced flying units. This proportion was quickly exceeded, and by November many courses had been kept at those schools for fifteen weeks (normally four) before passing on to training for operations.⁽⁴⁾ Owing to the supremacy of the Allied Air Forces even round-the-clock bombing of German targets incurred extremely light casualties, resulting in small and fluctuating demands for individual replacements to operational commands. All vestiges of the 'crew element' had to be discarded. Alarmed by the glut of trained men who were marking time

(1) A.M. File S.86084, Encl. 59A. The rate of reduction is indicated in the following extract from letter ref. S.90691/555/O.P.2, dated 12 June 1944.

<u>Date</u>	<u>Nav.</u>	<u>Nav. (B)</u>	<u>Air Bomber</u>	<u>W.O. (Air)</u>	<u>Total</u>
December 1944	800	60	700	700	2,260
April 1945	750	46	700	700	2,196
June 1945	450	46	420	350	1,266

(2) A.M. File S.95581, Encls. 111A, 134A and 138A.

(3) A.M. File S.83798, Encl. 98A.

(4) A.M. File S.83798, Encls. 86A and 104A & B.

in the observer schools, the Air Officer Commanding-in-Chief, Flying Training Command, was constrained to take resolute action when the discrepancy between trained men available and the number posted on 15 November 1944 became:-

<u>Available</u>	<u>Posted to O.T.U.</u>
435 navigators	17 navigators
394 air bombers	11 air bombers
485 W.O. (air)	60 W.O.(air)

He decided to disband No. 6 (Observer) Advanced Flying Unit on 12 December and to distribute its remaining courses among other units whose period of instruction was extended to eight weeks, i.e. twice the duration. He warned the Air Member for Training that the schools would soon be overcrowded beyond the limits of capacity and that no further intakes would be accepted. ⁽¹⁾ All intakes into (observer) advanced flying units except the special crews from Staverton ceased on 21 November, and were not resumed until January 1945, by which time the pressure on accommodation had been relieved through posting ⁽²⁾ action. Until the end of the war the over-production of navigator and air bombers persisted, sometimes in acute form, and it frequently placed those responsible for training plans in a dilemma as the market contracted.

The run-down gathers momentum

When the year 1945 opened seven advanced flying units (observer) and one school for all-through basic training at Jurby still supplied, though in smaller numbers, the requirements in navigators, air-bombers and wireless operators (air). The inception of these schools having followed that of pilot training after some experience of war had been gained, the control of intakes had been more closely matched with the needs of operations. Accordingly when the end of hostilities came in sight there was not such a large surplus of these categories as in the case of pilots. A second factor that accelerated the run-down in training was found in the large proportion among those categories who had been born in the Dominions. In accordance with plans approved by the Air Council many of them were repatriated during the winter 1944/45 on completing their tour of operations. ⁽³⁾ Their places in squadrons were filled by compatriots from the training flow, thus leaving room for the last dwindling batches of Royal Air Force trainees from Canada. The departure in bulk of so many Dominion personnel caused a shortage of navigators that

(1) A.M. File S.83798, Encl. 98A.

(2) A.M. File S.83798, Encl.107A.

(3) A.C. Paper 15(44).

strained the resources of the schools to the limit during January and February. (1)
The vacuum had to be filled by posting away to operational training several (2)
courses of navigators before the third stage had been completed.

When planning for the period between the defeat of Germany and the deployment of air forces against Japan (briefly designated Phase II of training) the Director General of Training reduced the capacity to six hundred (3) each of navigators, air bombers and wireless operators (air). The reduction made No. 2 (Observer) Advanced Flying Unit at Millom redundant. The unit was closed on 9 January 1945, instructors being released to operations where possible or distributed as reliefs among other units to replace staff (4) posted for operational work. The strength under training in the remaining (5) schools at the end of January was 1,990 made up as follows:-

Navigators (R.A.F.)	520
" (French)	26
" (B)	120
" (Tactical Air Force)	40
" (Radio)	60
Air Bombers	560
" (French)	26
" (T.A.F.)	40
Wireless Ops. (Air) (R.A.F.)	540
" (French)	26
Pilot Navigation Instructors	20
Meteorological Air Observers	12
Total	<u>1,990</u>

Amidst the rush of events in the early spring many conflicting ideas were put forward with the purpose of economising manpower and reducing the types of aircrew needed for Phase II, but they were not fully implemented because the Japanese surrender came suddenly. Two such plans that were fruitful were:- (a) enlarging the syllabus for navigators (W) by giving

(1) A.M. File S.95581; Encls. 167A and 193A.

(2) A.M. File S.83798, Encl. 109A.

(3) A.M. File S.95581, Encl. 173A.

(4) A.M. File S.83798, Encls. 106C and 107A.

(5) A.M. File S.83798, Encls. 116A and 118A.

(1)
greater emphasis to radar aids, and (b) discontinuing the category of air bomber and recategorising the best products of the schools to the status of navigator (B) by a special course in navigation. (2)
With the shut down of the Canadian schools and the concentration of navigation training in the United Kingdom, the Air Ministry could equip the units with Wellington aircraft instead of Ansons. Those (observer) advanced flying units whose runways and hangars could not take the bigger aircraft had to be closed. After discussions with Headquarters Flying Training Command a wholesale reorganisation of the units was completed in June and July. Three schools were disbanded, viz:- No. 4 at West Freugh, No. 8 at Mona and No. 9 at Penrhos: three others were converted to all-through basic training and renamed air navigation schools; while two continued advanced training with less trainees than before the reorganisation. (3)
The reduced set-up for Phase II therefore became:-

Unit	Course	Capacity	Course Length (Weeks)	Date of Effect 1945
No. 1 (O) A.F.U. Wigtown	Navs (B)	200	5	1 June
No. 3 (O) A.F.U. Halfpenny Green	Navs and W. Ops (Air)	200	5	1 June
No. 5 A.N.S. Jurby	Navs (B) Conversion }		14 }	18 July
	Allied Navs }	240	28 }	
	Air Bombers }		14 }	
	Eventually Navs (B) Basic Training	240	34	
No. 7 A.N.S. Bishops Court	Navs (B) Conversion	200	14	31 May
	Eventually Navs (B) Basic Training	280	34	
No. 10 A.N.S. Dumfries	Navs (W)	240	32	11 June

- (1) A.M. File S.73754, Encls. 204A and 207A. The training of navigators (W) stopped at the end of May 1946, the highly specialised category whose training took altogether a period of 50 weeks being no longer needed.
- (2) A.M. Files S.47667/II, Encl. 231B and S.95581, Encl. 211A.
- (3) Extract from A.M. File S.95581, Encl. 212A (F.T.C./S.80587/Org.1 (55)).

Half the aircraft established at Nos. 5 and 7 Air Navigation Schools comprised Wellingtons fitted with distant reading compass, air position indicator and 'Gee'. Trainees also received practice in the use of oxygen apparatus.⁽¹⁾ As the airfield at No. 10 Air Navigation School Dumfries was unsuitable for large aircraft the pupils were denied these advantages until a year later when the unit moved to Swanton Morley. Thus, when the war against Germany had ended, most of the basic navigation training was brought up-to-date with modern appliances and contemporary flying conditions.

Proficiency tests introduced

Another improvement in training which Headquarters Flying Training Command had been advocating for a long time was introduced under the plans for reorganisation. This was a method of assessing the standard of trainees progressively during the course instead of at its conclusion. Whilst training was scattered among Dominion countries the administrative difficulties of such a system had been insurmountable, but in July 1945 when all navigation training was restored to this country, the opportunity was taken to eliminate sub-standard pupils by means of proficiency checks on their absorption of instruction from the fourth week of the course onwards to its finish. In addition two written examinations were held: the first, set by the unit, occurred in the middle of the course (13th week for navigators and 15th week for navigators 'W'). Those trainees who passed the checks and examination continued training: those who failed either of them were put back to a later course or sent for training in a ground trade. Three weeks before the end of the course a final examination was set and marked objectively by the Central Examination Board at Headquarters Flying Training Command.⁽²⁾ Thus a definite standard of attainment was preserved and the quality of instruction improved.

The last stage

In December 1944, recognising at length the importance of unified direction and control of air navigation in modern war the Air Ministry created in the Air Staff a Directorate of Navigation. This occurred almost three years later than the strong plea for such an organisation which was proposed by the Air Commander-in-Chief, Bomber Command and supported by other operational commanders early in 1942.⁽³⁾ The new Director of Navigation took

(1) A.M. File S.95581, Encls. 205A to D.

(2) A.M. File S.47667/III, Encl. 34A.

(3) Minute from A.M.T. to A.C.A.S., dated 15 September 1942 (BJ/91/D.D.T.Nav.)

steps to revive the Air Navigation Committee, which had lapsed two years previously and to enlarge its scope. The Standing Committee was reformed 'to decide the best method of implementing navigation policies so as to ensure economy in manpower and equipment together with the maximum possible degree of standardisation.⁽¹⁾ Under the guidance of the Assistant Chief of the Air Staff for Operations the first meeting of the reconstituted committee (third meeting of the series) was held on 24 April 1945, when representatives from all commands, the Ministry of Aircraft Production, the Admiralty and the Department of Civil Aviation attended.⁽²⁾ The War Office was represented at subsequent meetings. Thereafter, assembling at approximately two-monthly intervals, the committee studied, and initiated action upon, many technical and administrative problems relating to the science of air navigation, particularly from the angle of the common user, which benefitted the Royal Air Force and advanced the cause of civil aviation during the years of uneasy peace.

With only minor modifications, such as a course of refresher training for former prisoners of war or courses in navigation for surplus aircrew, the system of training remained as recorded until towards the end of 1945.⁽³⁾ As with dramatic swiftness on 16 August hostilities against Japan ceased, Air Ministry began a thorough investigation into every phase of navigation training and invited the operational commands to examine the weaknesses in the methods of instruction so as to profit from mistakes and help to fix as policy in the future the essential elements of training. Commands were instructed to give due attention to the mechanical aids to navigation through progress in radar inventions, and to send their reports to the Empire Air Navigation School whose research section would collate them and would confer with the Director of Navigation and with Headquarters Flying Training Command as need arose.⁽⁴⁾ The ideas provided agenda for a conference to hammer out the peace-time policy.

(1) A.M. File CS.17752/I, Encl. 15A.

(2) A.M. File CS.17752/I, Encl. 19A.

(3) A.M. File S.95581, Encl. 218A.

(4) A.M. File S.47667/III.

As training gradually lessened Headquarters Flying Training Command sought to acquire some inland stations vacated through the closing of operational training units which had received preferential treatment while the war lasted: they sought locations wherein navigator trainees on flying exercises would not be condemned to stooging over the Irish Sea. The Air Ministry was not unaware of the struggles of that Command to organise sound practice in map reading and dead reckoning amid areas like those given to all the schools which were grouped on the West Coast and in Northern Ireland. The sites had been thus allotted so as to guarantee that trainees avoided all contact with mountains or with the areas specifically reserved to the use of Fighter and Bomber Commands. The search for suitable stations for navigation training took a long time; and the first move to an Air Navigation School was not accomplished until May 1946. By that date the requirement for training in navigation was a small matter by contrast with its amplitude during the preceding six years.

CHAPTER 4.

BASIC TRAINING OF AIR GUNNERS, WIRELESS OPERATORS/
AIR GUNNER AND FLIGHT ENGINEERS IN THE UNITED KINGDOM

Tradesmen/Air Gunner

Co-ordinated plans for training air gunners, wireless operators/air gunner and flight engineers (who in 1943 became grouped together as non-P.N.B. aircrew), were only effectively made after the war began. In point of time the straight air gunner arrived first in the Service (1921), the combination of a wireless operator and air gunner followed five years later, while the first suggestion of a flight engineer in the team of aircrew was discussed in November 1939.⁽¹⁾ During most of the inter-war years training in gunnery and bombing for air gunners and wireless operators/air gunner was given in the squadrons, that developed their particular techniques as fighters, or bombers or on general reconnaissance, and in co-operating with the army. The terms of service were stated in A.M.O. 271/21 which called for volunteers among regular tradesmen to act as 'aerial-gunners' in their squadrons.⁽²⁾ Aircraftmen mustered in all trade groups were eligible provided they were medically fit for flying and recommended by the commanding officer; but in practice, Group I tradesmen were preferred, especially wireless operators for obvious reasons. In addition to the pay of their trade they were offered crew pay at two shillings per day (reduced to 1/- from 1 February 1926) and sixpence per day non-substantive pay as air gunners so long as they remained proficient in those duties.⁽³⁾ They accompanied the pilot on all flights to 'learn by doing' gunnery, map reading, and (where applicable) bombing. During the summer period April to September inclusive, each squadron in the Home Command was attached for a month to one of the practice camps, at North Coates Fitties, Catfoss or Sutton Bridge, where an intensive course took place in air-to-air firing and in bombing practice on targets towed in the sea.

(1) A.M. File S.40289/I.

(2) This order remained in force until 1945, when it was cancelled.

(3) K.R. & A.C.I. paras. 508, 3455 and 3457 (1926 Edn.).

Besides the incentive of extra pay, the air gunner carried some distinction in the squadron; the few posts (eight or ten according to its role) were eagerly sought after. When needed, these skilled tradesmen made up by work at the bench any time used on flying, because the establishments for personnel did not allow additional airmen to compensate for such absence. Where morale was high and the 'squadron spirit' was encouraged - this was almost universal during the inter-war period - no man felt aggrieved at having to do an extra job owing to the absence of a member of the workshop team on a cross-country flight, or at range practice with 'his' pilot. Officer and airman pilots took some trouble to acquaint the air gunner with map reading and they encouraged him to pass the examination for promotion to sergeant in his trade. Under the method of individual training considerable variation existed in the qualifications and standards of proficiency among air gunners. During the years of disarmament the imperfections were accepted as unavoidable because economical, but as soon as the possibility of war became apparent everyone concerned with training realised that the part-time system for tradesmen/air gunner would disrupt to a baneful degree the maintenance work in squadrons. So many other and more imperative problems of training claimed the attention of staffs in the Air Ministry and the Commands that it was impossible to tackle this particular problem for some years.

Recruitment of Air Gunners from Civil Life

Early in 1934 an attempt to meet the problem was made by endeavouring to attract young men to enlist for training as straight air gunners for a period of service lasting four years. ⁽¹⁾ On a course lasting two months (extended to three months in 1937) thirty recruits entered each month. At a school set up at North Coates ⁽²⁾ they were taught the rudiments of gunnery and bombing, some pyrotechnics and the care of weapons, and also received there some practice in air firing. On passing out from the course they were mustered in the new trade of 'air observer', promoted to the rank of corporal and employed as full-time air gunners.

But arrangements proceeded at a leisurely pace and eighteen months elapsed before the first course started on 1 January 1936. The scale of training had been expected to produce two hundred 'air observers' per year, a number equal

(1) Intended as a temporary policy. (A.M.O. A.196/34).

(2) At that time called No. 2 Armament Training Camp. (A.M. File S.38529).

to that of the tradesmen/air gunner whom they were intended ultimately to replace. The numbers trained were quite inadequate to meet the expansion scheme 'F' by its estimated date, 1 April 1939; therefore the locally trained air gunners and wireless operators/air gunner were still needed to form crews for medium and heavy bombers during the next four years. By the summer of 1936, when the first batch of school-trained 'air observers' had reached operational squadrons, new types of aircraft with increased range enforced a change in their duties, which thereafter centred more on navigation and bombing than on gunnery. Thus they formed a nucleus for a fresh aircrew trade, and in no way lessened the training commitment in squadrons for straight air gunners who were still provided entirely from within the Service. ⁽¹⁾

Gunnery Training in 1937 and 1938

During 1936 and 1937 technical developments proceeded rapidly. Not only were power-operated turrets being introduced into Service aircraft and the Browning was replacing the Lewis and Vickers gas-operated guns, but also the greater speed of aircraft and changing operational conditions altered the tactical conception of air gunnery. Partly because the issue of new equipment was confined to operational units, progress in training did not keep pace with the technical advance. Such innovations did not reach training units until two years afterwards, when 45 Blenheims (with turrets) were released from storage to assist instruction at bombing and gunnery schools. ⁽²⁾ At an Air Ministry conference held in February 1937 all the Command representatives emphasized a further cause of inefficiency among air gunners. They complained that there was not enough time to train these airmen to a good standard in squadrons before they were posted away as tradesmen by the A.O. i/c Records. The latter authority therefore undertook not to post tradesmen borne on establishments as air gunners until they had served at least eighteen months in their units. As a result of the conference the Chief of the Air Staff made the following decisions which influenced considerably other aircrew employment:-

(1) E.P.M.156(38).

(2) Loose minute by D. of T. to A.M.P. dated 7 October 1939.
A.M.P. Folder No. 7.

- (a) That the crew of all bombers must include at least one wireless operator/air gunner and one air gunner.
- (b) That flying boats (Singapore and Sunderland at that time) should carry two wireless operators/air gunner and two fitters trained in air gunnery.
- (c) That in order to ease the strain on maintenance work in squadrons one of the two wireless operators needed as aircrew should be borne on the station establishment during peace, and in war should be replaced by a ⁽¹⁾ reservist on mobilisation.

These decisions created a demand for 900 air gunners a year, a number far beyond the capacity of the 'mutable and uneven local talent in each station with its inadequate training facilities'. ⁽²⁾ Nothing was done immediately to provide schools for the extra aircrew members, the Air Staff view being that the deficiencies must be accepted. In fact the changes in establishments due to the new crewing policy had not been finally agreed in December 1937, i.e. ⁽³⁾ ten months afterwards. More than two years after the conference the Air Officer Commanding-in-Chief Bomber Command returned to the theme in his 'Readiness for War Report' (July 1939) when emphasizing the need for better air gunners and for the direction of development by means of a central gunnery ⁽⁴⁾ school. He said:-

'At present, apart from the need for elementary training for air gunners at gunnery schools, we have no instructors and no instructions to guide us in the Service training of air gunners. Consequently, until we have a centre where the whole subject is studied our gunnery instructors remain in relation to the air gunners in the position of the blind leading the blind. Under these conditions we cannot possibly hope to reach a standard of efficiency which would permit of our crews facing the enemy with any confidence.'

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- (1) A.M. File S.40289/I.
 - (2) A.O.C.-in-C. Bomber Command's Training Report for 1938.
 - (3) A.M. File S.40289/I.
 - (4) A.M. File S.1574.

That severe condemnation of the absence of system in gunnery training eventually bore fruit; but only after war had started.

War Training Organisation for Wireless Operators/Air Gunner

The same failure to face the realities of the situation in 1937 hampered plans for training the wireless operators/air gunner. Direct entrants attended a recruits course lasting four weeks, followed by technical instruction in their trade for five months and then the air gunnery course at an armament training camp for three months. Under the war training organisation for tradesmen it was proposed to reduce their wireless course 'because they will presumably need to be key-tappers only' from whom a speed of twelve words per minute would have sufficed. After prolonged discussion, and an experimental course numbering 250 trainees at the Electrical and Wireless School, Cramwell, during 1938 the only saving in time found possible was by (1) incorporating the recruits discipline course with the ground training. In the way typical of matters relative to the training of tradesmen/aircrew before the war, to settle this point covered the period from April 1937 to September (2) 1938. At the time the pressing need for expanding the operational squadrons demanded that the training of pilots should take precedence over that of all other aircrew categories and units engaged in gunnery training had to be content with such aircraft and equipment that could be made available after meeting operational demands e.g. Battles, Whitley II's and a small number of Demon aircraft. The first two had no power-operated turrets and the last named had the prototype of all turrets: for air-gunnery training it had to (3) be accepted that operationally obsolete types had to suffice. As a result the air gunnery portion of the W.T. operator's training did not produce efficient members for aircrew employment, nor even those in quantity enough to meet immediate requirements.

(1) A.M. File S.41026.

(2) A.M. File S.41026.

(3) Memo by D.G.T. (Air) dated 15 May 1944. Training Folder 3:6.

Under expansion scheme 'L' of April 1938 there was a deficiency of more than 2,000 wireless operators/air gunner. The Air Member for Personnel therefore prepared a plan to attract large numbers to the aircrew trades.⁽¹⁾ Employment as aircrew was to be regarded in future as full-time duty. The basis of recruitment for the aircrew trades other than pilot was to be restricted to boy entrants who enlisted for nine years as wireless operators, from whom by central selection at the end of their year's course the Air Ministry would choose men for training in air gunnery. After experience in this aircrew role (about three years) a progressive career was opened to them as air observer, and a limited number of commissions in the G.D. branch as observers or pilots.⁽²⁾ The principle of full-time employment proved of all-round benefit and helped to increase the numbers who volunteered for pilot training; but the response from boy entrant wireless operators and Group II tradesmen fell far short of requirements.

In the main the elements of other aircrew categories were supplied from one or two sources during the two years preceding the outbreak of war. Either they were skilled tradesmen within the Service who preferred airborne to ground duties, or they were recruits who wanted to become wireless operators and air gunners. A start had been made to provide some formal training for both classes of air gunners at two practice camps where instruction in ground subjects was given by armament instructors to an intake of thirty pupils at each school. Practical training in air firing followed after they were posted to squadrons, since armament instructors were not competent to teach the flying side of air gunnery. As the force expanded more practice camps were built on the west and south coasts, their location⁽³⁾ being governed to a large extent by the possibility of sites for ranges. The camps were designed for occupation throughout the year in order to improve the bombing and air firing of squadrons in operational commands and of the advanced training squadrons in Service flying training schools that visited

(1) E.P.M. Paper 156 (38). The requirements for Scheme L were:

Observer	2,069
Wireless Op./Air gunner	3,867
Air gunner	554
Total	<u>6,490</u>

(2) Full details were promulgated in A.M.O. A.17/39.

(3) A.M. File S.56180.

on attachment for periods varying between ten days and five weeks according to the nature of the exercise or to the weather.⁽¹⁾ To the three camps already mentioned were added:-

Armament Training Camp	Location	Date opened
No. 4	West Freugh	Jan. 1937
No. 5	Penrhos	Feb. 1937
No. 6	Warmwell ⁽²⁾	June 1937
No. 7	Acklington	April 1938
No. 8	Evanton ⁽³⁾	Aug. 1937

Regular tradesmen/air gunners and direct entry trainees to the trade of air observer were posted to courses at West Freugh and Acklington, the remaining camps being equipped to accommodate only those formations which brought their own aircraft. Between February and April 1938 these units were renamed Armament Training Stations (A.T.S.). To conform with the preliminary deployment of the Metropolitan Air Force further changes in name and function followed rapidly for some of these units. Sutton Bridge was released at once to Fighter Command.

During the first half of the year 1939 the Air Ministry made a determined drive to increase the output of air gunners and of wireless operators/air gunner who were much needed by Bomber Command. Four A.T.S.s at North Coates, Acklington, Aldergrove and West Freugh were converted into air observer schools and numbered 1, 2, 3 and 4 respectively. Under the war training organisation issued in April 1939 each school was staffed and equipped to give ground and air training to 120 pupils of whom 30 were air gunners who took a short course lasting four weeks that included twelve hours in flying time.⁽⁴⁾ On completing

(1) Unit O.R.B.

(2) Until 30 June 1938 the name of this unit was Woodsford. As the first home of the Central Gunnery School, and as a fighter station during the war it had a long and notable career in the name used in the text above.

(3) This unit had been known for several years as Novar Camp. Coastal Command and F.A.A. units were attached when exercising with part of the Home Fleet. Under peace plans it should have been handed to the Admiralty in March 1940. When war started a compromise enabled the two Services to share it.

(4) S.D.138(1) Part I.

this course they passed to units in operational commands or to group pools. Even this plan did not produce the numbers needed: the position in Bomber Command on 17 June 1939 was typical for the commands. Against an establishment for 1,576 air gunners the strength was 366 trained wireless operators/air gunner with 491 under training, and 256 other trades/air gunner qualified with 200 under training. (1) The deficiency of the order of 40 per cent Air Ministry hoped would be made good in due time from the ranks of the Volunteer Reserve which had been calculated to provide under 'Scheme L' 6,750 wireless operators/air gunner and 1,000 plain air gunners. (2)

For two years the Air Officer Commanding-in-Chief, Bomber Command, had repeatedly warned the Air Ministry that the limited facilities for air armament training and the serious shortage of air gunners would have grave consequences. To thrash out these problems the Air Ministry held a conference on 24 August 1939 which was attended by the Air Officer Commanding-in-Chief as well as by the Assistant Chief of the Air Staff and the commanders of the groups concerned directly with operating and training aircrew. The Air Officer Commanding-in-Chief Bomber Command 'warned the Air Ministry once again that the bombers were not fit to cross the line'. (3) He was willing to forego for a time even the gunnery training of operational units at armament stations provided that through this renunciation production could be speeded to the point of furnishing for his command 500 wireless operators/air gunner and plain air gunners in the shortest time. Air Ministry representatives stated a few of the difficulties that obstructed expansion under conditions of peace, such as finding suitable locations for airfields near enough to sites for bombing ranges, (4) obtaining target-towing aircraft, cine camera-guns, release hooks and other special gear that would be needed in large quantities from industry if air armament training were to be accelerated, but the commands pressed the urgency of their case. After discussion a scheme prepared by

(1) A.M. File S.56180.

(2) A.M. File S.44572.

(3) A.M. File S.56180.

(4) Protests against ranges were sent to Air Ministry. As one example, an entry in the O.R.B. for Warmwell under date July 1937 records the suspension of air firing owing to many objections by local inhabitants in the vicinity of Chesil Bank to low flying and to the dropping from aircraft of drogues having attached to them a ten pound weight that fell near buildings on the edge of the range. A dilemma existed. Though the complaints seemed not unreasonable, the trainees could only improve their accuracy by practice.

No. 25 Group was accepted which could produce 5,000 trained air gunners in twelve months by forming on existing stations administered by that group a number of air gunnery schools without interfering too much with the attachments from Service flying training schools.⁽¹⁾ It was also agreed that one special school, to be known as the Central Gunnery School, should be formed at once, being given first priority before all other plans, for the purpose of training instructors in tactics and the technique of air gunnery, including a new development in the use of turrets.

Twenty-four hours before the expiry of the ultimatum to Germany the Air Member for Supply and Organisation reporting to the Chief of Air Staff on the situation in the Metropolitan Force as regards aircraft and personnel should war commence in the immediate future, stated:

'The most serious limitations (to a sustained effort) is imposed by shortages of W/T operators (A.G.) or by Air Gunners and W/T Operators combined.'⁽²⁾

Supported at this level, plans for their training were pushed forward as quickly as the disturbed conditions allowed. But these efforts to improve air gunnery training on a big scale, framed in the eleventh hour, were nearly strangled at birth. (The 25 Group scheme emerged from the mangle of events much shrunken in 1941). The first and biggest curtailment came on 3 September 1939 when all training units situated on the East Coast had to be evacuated and crowded into unyielding accommodation on western stations.

~~Scheme of~~ Reorganisation, 1939

In the early days of September 1939 air gunnery courses at air observer schools were shortened to four weeks for air gunners and six weeks for observers whose syllabus comprised more subjects.⁽³⁾ The organisation having lost five centres and construction work being delayed on three others, there was over-burdening for a few weeks in the remaining four schools that continued air armament training.⁽⁴⁾ There still existed a pressing need to supply as

(1) See Appendix 41.

(2) A.H.B./III/31/1.

(3) S.D.138(1) Part VI.

(4) See Appendix 41.

soon as possible enough other aircrew to complete the manning of squadrons. (1)
But plans prepared by the Director of Training were invalidated by the
shortage of suitable aircraft. In a memorandum to the Air Member for Supply (2)
and Organisation on 13 September he reviewed the effects of this deficiency.
After detailing the requirements, he wrote:-

'As far as I can gather there will be a mixed bag of some
200 Wallaces, Battles, Demons, Hinds or Hart variants to
meet this requirement For a twin-engine attack
trainer the Anson is not suitable but the Blenheims would
do. Unless the Air Staff can be persuaded to give up
some reserves the striking force will be reduced soon
through lack of trained personnel.'

The Air Staff eventually agreed, on 7 October to hasten the provisioning of (3)
400 Battles for use as target towers in aircrew training.

In order to overcome the shortage of air gunners and to accelerate
immediate production, Air Ministry (T. Arm) made a temporary arrangement with
Bomber Command in September to accept for training about twelve pupils at each
group pool and non-mobilising squadron in the command. The response to
enquiry by signal gave capacity for 237 trainees up to the end of November over
and above those passed out from courses at the air observer schools (estimated
480 air gunners). As the air observer schools could not undertake any basic
training in navigation for air observers they were renamed Bombing and Gunnery
Schools (B. & G.S.) from 1 November 1939 which more accurately denoted their (4)
function.

Formation of the Central Gunnery School

The inception of a central school for improving the standard of air
gunnery was mainly due to the unremitting efforts of the Air Officer Commanding- (5)
in-Chief Bomber Command who pressed the matter for many months before the war.

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- (1) Intake of 30 every fortnight for air gunners and 30 every three weeks
for air observers giving a maximum of 120. (A.M. File S.56458/I).
 - (2) A.H.B./III/31/1.
 - (3) A.H.B./III/31/1.
 - (4) A.M. File S.56458/I. See Appendix 42.
 - (5) A.M. File S.56180.

Its conception resembled in some respects the design of the Central Flying School; many senior commanders hoped that air gunnery would benefit therefrom to the same degree as had aviation generally through the inspiring doctrine propagated by that institution. In giving first priority to the formation of this school the conference on 24 August 1939 had laid down the following essentials:-

- (a) It must be staffed by the most experienced personnel.
- (b) It must be equipped with the newest types of aircraft.
- (c) It must be located near to the Aircraft and Armament Experimental Establishment at Boscombe Down and to the Bomber Development Unit, at both of which research was proceeding at great speed.

Sites fulfilling the third condition were hard to find, some of the obstacles encountered being the need to discover a ready-made airfield with accessible ranges; the vested interests of the Army in Salisbury Plain; and, if Manby were considered, the avoidance of interference with the R.D.F. system of Fighter Command. The Navy objected to night firing on the Chesil Bank ranges and prevented such practice, but despite this the Central Gunnery School was set up eventually at Warmwell on 6 November 1939. ⁽¹⁾

The functions of the school were defined as firstly, to assist in the development of air gunnery tactics applicable to types of aircraft other than single-seater fighters; ⁽²⁾ secondly, to train fighting controllers for operational units; and thirdly, to train gunnery instructors who would be employed in group pools, bombing and gunnery schools, and advanced training squadrons of flying training schools. The new school was placed in No. 25 Group, to whose Commander the Air Ministry gave 'a free hand to experiment in any way that experience suggests is desirable or in order to meet the needs of operational commands with whom you will keep in close touch'. ⁽³⁾ The syllabus aimed to train 'gunnery leaders' by inculcating sound ideas about drill,

(1) A.M. File S.56180 and S.D.155/39/108.

(2) The evolution of tactics for single-seater fighters was the business of the Air Fighting Development Unit.

(3) A.M. File S.56180.

discipline, gun and turret manipulation, morale, leadership and physical fitness. Already thus early in the war experience had taught how much these attributes were needed by the air gunner in particular. 'He had to be trained to the point of becoming mechanically as nearly perfect as possible until the movements of hands in the event of stoppages and for loading were as instinctive as walking. Such a degree of efficiency saved those valuable fractions of a second which in nearly all air combats decided the issue'.⁽¹⁾

The first course began on 13 November 1939 with an intake of fifteen pupils, four of whom were direct entry officer air gunners straight from a special course at No. 1 Air Armament School, Manby. Subsequent intakes rose to thirty, vacancies being allotted to operational commands and to the British Air Component of the Field Force in France every four weeks. To cover the time lag in issuing aircraft and equipment, Bomber Command lent to the school aircraft, aircraft crews and maintenance personnel until the middle of December.⁽²⁾

Supplementary Wireless Schools

The production target for wireless operators/air gunner fixed by C.W.E./2/7 required 3,800 in 1940, 4,140 in 1941 and 6,070 in 1942. As already stated, the output during the first year of war appeared to be lamentably deficient. To bridge the gap in some measure, Air Ministry as a temporary expedient arranged courses for certain airmen in the Volunteer Reserve at civil aviation schools. Wireless tradesmen employed in the industry and in the G.P.O. to the number of 1,921 had enrolled prior to war in the R.A.F.V.R. for training as aircrew, and they mobilised on 3 September 1939. But no facilities for their training could be made available until contracts had been agreed with two firms which undertook to provide morse practice and ground wireless instruction up to a capacity of 240 and 360 trainees during a course lasting ten/twelve weeks. In view of the civilian occupation of these volunteers (who reclassified L.A.C. on the day following call-up) the course appeared suitable to prepare them for air training in bombing and gunnery schools. Towards the end of November 1939 Nos. 1 and 2 Supplementary Wireless Schools run by Air Service Training, Hamble

(1) Extracted from a paper on 'Selection and Training of Air Gunners' issued in November 1939 by the Director of Training. (A.H.B./III/31/1).

(2) A.M. File S.56180.

(1)
and Scottish Aviation Ltd., Prestwick respectively, accepted intakes, but the aim to produce 5,000 wireless operators/air gunner within six months was not reached.

The Supplementary Wireless Schools (S.W.S.) were placed in Reserve Command but technical training matters were controlled by the Ministry. By the end of January 1940 seven hundred wireless operators were passed out as ready for the next air training. This rate of production proved much greater than the Bombing and Gunnery Schools (B. & G.S.) could absorb. In the period from 1 January to 31 March 1940 the total number of places in six B. & G.S.s plus No. 1 Air Armament School Manby only reached 990 which had to be divided among all types of air gunner, including officers. Therefore about fifty per cent of the monthly output of these V.R. aircrew trainees from the S.W.S.s had to be posted supernumerary to a variety of units, chiefly in Bomber Command, in which they were employed on A.C.H. or aerodrome defence duties until such time as they could be allotted places in B. & G. schools. The delay, in some cases protracted for several months, caused a deterioration in manual skill which in turn formed the basis of criticism by commands. Air Ministry lengthened the course at S.W.S.s to sixteen weeks and instituted as from 29 March 1940 a special finishing course lasting eight weeks (intake 100 per month) at the Electrical and Wireless School, Cranwell to ensure that these V.R. airmen were proficient in Service wireless procedure before they moved forward to gunnery training. (2) When the supply of pupils dwindled the S.W.S.s were closed: the last intakes to No. 2 S.W.S. Prestwick entered on 1 July 1940, and that to No. 1 S.W.S. Hamble entered on 19 August 1940, the latter school closing when the last course passed out on 10 February 1941. (3)

The method of preliminary ground training for wireless operators was evidently satisfactory, for, in December 1940, Air Ministry requisitioned two properties in order to open two more supplementary wireless schools, No. 3 at Theobalds Park, Waltham Cross and No. 4 at White Waltham, Berkshire, which were placed in Technical Training Command. Commanded and staffed by Service personnel the schools trained entrants direct from civil life up to a capacity

(1) A.M. File S.58474.

(2) A.M. Files S.56755/40 and A.41061/39.

(3) A.M. Signal P.371 dated 1 February 1941.

(1)
of 400 pupils each for the trade of wireless operator, whence they passed to No. 2 E. & W. School, Yatesbury. Those who satisfied the Aircrew Selection Board thereafter followed the normal sequence of air training.

Attempt to form a Corps of Gunnery Officers

By September 1939 the Air Officer Commanding-in-Chief Bomber Command was convinced that a better type of man was needed in the tail turret of a heavy bomber. He wanted those accustomed to handling guns such as experienced big-game hunters who 'would supply leadership, example, and influence, which the air gunners of this command at present lack'. Supporting action followed immediately. By a signal to formations the Air Ministry called for volunteers from officers other than pilots to begin short courses on 2 and 9 October; and the Air Officer Commanding Reserve Command was asked to furnish a list of volunteers from among airmen suitable for commissioning in his command who awaited training as observers. In response to some 200 letters directed to known marksmen many enlisted. The Air Staff planned appointments for commissioned air gunners in each group headquarters, squadron, and flight in the operational commands. (2)

For men of mature years (25-52) who possessed the fighting spirit and the skill to shoot well, a course lasting four weeks in turret manipulation and fire control was deemed enough to fit them for duty. Speedy results seemed vital but discussions within A.M. directorates and with Treasury regarding the proposed establishment were rather protracted. The latter wished to fix the minimum age of these officers at not less than 25 years so as to avoid risk of re-actions on pay of other flying personnel. At that date some officers resented a revolutionary change in personnel policy that would certainly create repercussions in other Services. Differences of opinion arose about the proportion of officer to aircraftman air gunner, and over their better prospects of reaching the rank of flight lieutenant, when compared with the total establishment permitted in the G.D. branch. (3)

About three months after acceptance of the first ninety recruits a hitch occurred. The rate of pay for officer air gunners on equal footing with the G.D. branch could not be granted. Discussions brought a compromise. As a

(1) A.M. File S.56755/40.

(2) A.M. File S.57999.

(3) A.M. File S.57999.

special wartime measure only finance for the scheme was approved on condition that the total of officer air gunners did not exceed six hundred. Thereafter an order was promulgated defining the field of recruitment, in addition to regular airmen, as:- airmen entered in the volunteer reserve for training as observers, direct entrants from civil life, and retired or non-regular officers who could be spared for this employment. ⁽¹⁾

Treasury were not alone in viewing unfavourably a scheme that in effect gave to certain plain air gunners preferential treatment over other kinds of aircrew. The Air Ministry therefore arranged the training of these newly-joined officers in small batches of about ten with airmen on alternate entries at three schools where accommodation could be provided. ⁽²⁾

By 27 April 1940, 424 officer air gunners had been appointed, of whom 274 came direct from civil life, 11 from other Service branches, 79 from airmen under A.M.O. A.476/39 and 60 from airmen recommended on completing training. In addition a further 133 from civil life had been selected provisionally. The authorised quota having been filled, almost eighty per cent with direct entrants, a conference held on 19 May 1940 by the Air Member for Personnel decided to obtain Treasury approval for raising the maximum to 1,000 officers (which accorded with 14,000 aircraftmen air gunners) in line with expansion scheme 'M', and to restrict in future the offer of commissions in that section of general duties to trained and experienced air gunners. ⁽³⁾ Two motives prompted the second decision: one was the duty to give an incentive to serving airmen; and the other recognised the increasing requirement in new types of aircraft for air gunners who had been trained also in wireless operating. ⁽⁴⁾

Thereafter the suggested corps d'élite became submerged beneath the normal and current methods of commissioning from the ranks. Gunnery leaders were supplied from the Central Gunnery School; and a ladder to promotion provided some prospect of improved status to men serving in this aircrew category.

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- (1) A.M.O. A.62/40.
 - (2) At first officer air gunners went to Nos. 4 and 7 B. & G.S.s and to No. 1 A.A.S., but by March 1940 they attended all B. & G.S.s. (A.M. File S.56458/I).
 - (3) Except when qualified in a ground trade, in which he might hold N.C.O. rank, a plain air gunner could aspire no higher than L.A.C. On 27 May 1940 airmen mustered W.T./A.G. and A.G. were promoted Sergeant aircrew on the same basis as other categories. (A.M. File S.60457).
 - (4) A.M. File S.57999.

The problem of status and pay as aircrew (1940-41)

In the first three months of war began a third movement that concerned not only air gunners but in their wake flight engineers and other types that came into the air category subsequently. A consideration of pay and conditions of service might seem to belong rather to the administrative side than to the organisation of training: yet the changes in training that followed in 1943 and 1945 could not be understood correctly without reference to these matters since rank and pay affected not only the quality and supply of recruits but also the standard of training and, in any ultimate analysis, the power of the bombing offensive. The idea of increasing the prestige of air gunners originated from the Air Officer Commanding-in-Chief Bomber Command who received prompt support from the Air Member for Personnel.⁽¹⁾ The first step in December 1939 authorised the award to air gunners of a new brevet similar to that denoting the observer and worn like his above the left breast pocket of the tunic.⁽²⁾ Murmurs of dissatisfaction continued to be heard despite this emblem of aircrew status and the Air Officer Commanding No. 3 Group voiced what he called 'a legitimate moan' from wireless operators/air gunner who found direct entry observers (qualified on a shorter course of training than theirs) enjoying higher pay and better amenities as sergeants.⁽³⁾ When consulted by letter all the Air Officers Commanding-in-Chief agreed 'that the air gunners in war carried under very difficult conditions a heavy responsibility that was scarcely less important than that of the pilots and observers with whom they flew' and consequently that aircrew other than officers should be given equal status among themselves clearly marked as 'air' men who could mingle and mess together when off duty.⁽⁴⁾ The ideal of equality in comradeship thus quietly enunciated early in the war was later destined during the big offensive to reach unappraisable value.

(1) A.M. File S.60457.

(2) The winged bullet in gilt metal that had been worn on the sleeve by air gunners since 1923 was superseded by the single wing spreading from a circled laurel wreath containing the letters AG. (A.M.O.s A.547/39 and A.552/39).

(3) A.M. File S.40289/I.

(4) A.M. File S.60457, Encl. 26A.

There were many administrative difficulties to hinder the next step. Chief of these was the intractability of the financial system that fixed the pay of a sergeant pilot on the lowest rate at twelve shillings and sixpence per day while the comparable rate for his colleague air gunner was three shillings and sixpence as aircraftman second class in Group V. ⁽¹⁾ It took a long time to convince Treasury that this wide disparity was unjust and that it precluded all possibility of members of a crew working as a team. Air Ministry reiterated the theme that 'the safety of the aircraft in war depended on the efficiency and courage of the air gunners almost as much as on that of the pilots and observers'. Financial approval for the extra expense was notified ⁽²⁾ at the end of May. Aircraftmen mustered as whole time wireless operators/air gunner or as air gunner were promoted to the rank of temporary sergeant on consolidated daily rates (ceasing to draw flying and gunner allowances) of seven shillings and ninepence or seven shillings respectively. The improved conditions were soon extended to new entrants on completing the course in air ⁽³⁾ gunnery and, in conformity with aircrew status all candidates for this training, whether serving airmen or direct entrants, after June 1940 had to appear before aircrew selection boards who were instructed to pick men of ⁽⁴⁾ high intelligence for this work.

While negotiations between Air Ministry and Treasury were proceeding the Supervisory Air Board of Canada awarded the rank, as they termed it, of L.A.C. to all wireless operators under training within the Empire Air Training Scheme, except those from England. Backed by the authorities in Australia and New Zealand the Air Board took the strictly logical view that, as the benefit of reclassification without trade test had been enjoyed for a long time by trainees for pilot or observer trades, equality of status whilst under training was essential for other aircrew. Their action took away all significance from the technical trade test taken by wireless operators who volunteered for air gunner ⁽⁵⁾ duties and caused embarrassment to the Air Ministry, but the Air Board was

(1) See Appendix 43.

(2) A.M. File S.60457, Encl. 61A.

(3) A.M.O.s A.416/40 and A.537/40.

(4) A.M.O. A.466/40.

(5) A.M. File A.95138/40.

impelled to the policy through the serious diminution in volunteers from the Dominion for this aircrew trade. Not until March 1941 was it feasible to give a similar concession to British trainees and then they were reclassified for pay as L.A.C. only from the date when they began the course at a bombing and gunnery school when they drew in addition one shilling a day as flying instruction allowance. (1) Eight months afterwards (November 1941) the same rise in pay was given to airmen possessing basic trades in Groups I and II (chiefly fitters or wireless operator mechanics training for employment in squadrons of Coastal Command) when under training as air gunners. (2) Thus by the end of 1941 the aircrew portion of the Service took on an almost separate entity through their distinctive status. The process was observed keenly by the Navy as a new departure from custom and as a method of attracting recruits. (3)

Reorganisation of Training during 1940

After four months experience of war the course in air gunnery was extended to six weeks, partly because wastage proved less than expected and partly to raise the level of the graduate from bombing and gunnery schools. (4) The Air Member for Supply and Organisation warned the Chief of Air Staff that fifty per cent more bombing and gunnery schools would be needed if this change should become permanent, and it seemed in January 1940 as if they could not be provided within measurable time. (5) To relieve pressure in the bottleneck at recruit centres, recruiting of candidates for training as straight air gunners (except officers) was suspended during seven months, November 1939 to July 1940, because all places in the gunnery schools had been bespoken for u/t aircrew already enlisted and awaiting those vacancies. (6) The congestion emphasised the urgent need for rapid building. Moreover, calculations prepared in the Directorate of Manning showed that a sustained effort through six months would have caused a deficiency amounting to 1,516 air gunners, or 41.5 per cent of

(1) A.M.O. A.189/41.

(2) A.M.O. A.984/41.

(3) A.M. Files A.95138/40 and S.60457.

(4) See earlier in this chapter.

(5) A.M. File S.58474.

(6) A.M. Letter S.59395 dated 8 July 1940. (B.J.M.2/6).

strength, by 30 June 1940. The memorandum declared a need to double the existing output of 300 per month from bombing and gunnery schools. ⁽¹⁾

At a special meeting convened by the Secretary of State on 3 April 1940 to discuss the position of flying training the A.M.S.O. admitted a shortage of four bombing and gunnery schools: search for sites was continuing but it formed his biggest problem because of the need for range facilities. ⁽²⁾ It is significant that the location proposed for one school in France did not reach maturity owing to the unexpected occupation of that area by the Germans six weeks later. But three schools in the United Kingdom were made ready for occupation:-

No. 5 B. & G.S. at Jurby, Isle of Man, in July 1940

No. 7 B. & G.S. at Porthcawl, ⁽³⁾ coast of South Wales, in July 1940

No. 2 B. & G.S. at Millom, coast of Cumberland, in November 1940

During the first half of 1940 the internal organisation of bombing and gunnery schools was re-shaped in what was sometimes called (because of its origin) 'the Warmwell Scheme'. Under this method or organisation the armament training squadron and ground instructional personnel were amalgamated within the 'Armament Training Wing' under a wing commander who became responsible for all personnel matters concerning the pupils as well as for drawing up the flying programmes, including periods allotted to visiting squadrons. The wing contained three squadrons, each divided into operational and servicing flights and having a unity of purpose: No. 1 Squadron for bombing training, No. 2 for air gunnery training and No. 3 acted as towing squadron. The squadron commanders organised instruction in their particular department and they were responsible for maintenance of their aircraft up to 60 hour inspections. ⁽⁴⁾ By defining the responsibilities and training tasks under one wing commander, efficiency and speed of training were both improved.

(1) A.M. File S.59166. The Director of Training noted on 2 April 1940 that the basic weakness in plans for aircrew production lay in the fact that at that date the bombing and gunnery schools possessed only eighty per cent of the aircraft established for target towing, many of them very old, and with Nil reserves. (A.H.B.III/31/1).

(2) See Appendix 44.

(3) Name changed to Stormy Down in June 1941.

(4) West Freugh O.R.B. under date 24 April 1940.

At the end of 1939 the multiplicity of turrets used in aircraft tended to confuse armament instructors and their pupils. The following brief list of gun turrets used in the Service during 1940 illustrates the complexity of the problem of training wireless operators/air gunner and straight air gunners to a high standard of manual dexterity as well as to comprehend details of servicing,⁽¹⁾ harmonization, daily inspections and the loading of ammunition:-

- (a) Armstrong Whitworth - three types all centrally placed in the aircraft.
- (b) Boulton and Paul - four types for either centre, mid-under, nose or tail of the aircraft.
- (c) Bristol - three types for centre, nose or tail.
- (d) Frazer-Nash - 13 kinds depending on whether for Manchester, Whitley, Wellington, Stirling or Sunderland.
- (e) Vickers (having Frazer Nash parts) - for Wellington Mark I.

Starting from January 1940, in order to reduce within manageable limits the field of instruction on this brief course, bombing and gunnery schools prepared their pupils in handling turrets of certain aircraft. The cadets were posted to an operational training unit which was equipped with similar types of turret, as for example:-⁽²⁾

B. & G.S.	Corresponding O.T.U.s	Aircraft
No. 4 West Freugh	1, 4, 20, 54	(Hudson, Singapore, Wellington, Blenheim, Beaufighter, Defiant)
No. 5 Jurby	2, 3, 13, 17	Blenheim, Beaufighter, Anson
No. 7 Porthcawl	5, 10, 19	Whitley
No. 8 Evanton	14, 16	Hampden
No. 9 Penrhos	1, 4	Hudson, Singapore
No. 10 Dumfries (3)	11, 12, 15, 20	Wellington
No. 2 Millom	11, 12, 15, 20	Wellington

One virtue of this regulated training for a special posting was the close liaison between instructional staff concerned with each stage. A defect occasionally appeared when, owing to a quick change in requirement for

(1) A.M. File S.58564 (App. B to letter dated 17 December 1939).

(2) Appendix to A.M. letter S.58684 dated 21 December 1940. (B.J.M.2/6).

(3) The first course from Millom finished 22 February 1941.

operational need, some graduates from gunnery training (qualified wireless operator/airgunner or air gunner had to be supplied as crews for a type of aircraft not included in the syllabus at the bombing and gunnery school they had attended.

Although the Air Member for Personnel had approved in November 1939 the policy that both types of air gunner in common with aviation candidates should undergo training in the initial training wings, the useful scheme could not be carried into effect while the flow of pilots and observers filled all available accommodation. ⁽¹⁾ Besides, there was for months a serious shortage of suitable instructors. On 8 April 1940 the first batch of thirty aircrafthand u/t gunners arrived in No. 4 I.T.W., Bexhill, for a disciplinary course lasting four weeks. ⁽²⁾ Thereafter entries up to sixty continued at fortnightly intervals throughout the year. But Reserve Command could not accept wireless operators/air gunner in I.T.W., chiefly because of a shortage of wireless equipment to keep them in practice. It could not be produced by industry, which had of necessity to give urgent priority to manufacture for operational units. ⁽³⁾

The sequence of training during 1940 was therefore:-

<u>Straight Air Gunner</u>	<u>Weeks</u>
Reception and Initial Training Wing	6
Bombing and Gunnery School	6
<u>Total</u>	<u>12</u>
 <u>Wireless Operator/Air Gunner</u>	
Recruit Course	4
Electrical and Wireless School	24
Bombing and Gunnery School	6
<u>Total</u>	<u>34</u>

To supply the swelling need for trained aircrew in the operational commands six bombing and gunnery schools and No. 1 Air Armament School, Manby, were worked to capacity. In the ratio of four wireless operators/air gunner to one straight air gunner the planned intake reached 250 and 320 in alternate ⁽⁴⁾ fortnights. How nearly this planned figure was attained can be seen from the summary of the actual intake and output for gunnery training set out in the following table.

(1) A.M. File S.70637.

(2) A.M. Signal P.938 dated 2 April 1940 (B.J.M.2/6).

(3) A.M. File S.70637.

(4) A.M. File S.56458/I.

	Actual Intake				Actual Output			
	Officers	W. Ops./A.G.	A.G.s	Total	Officers	W. Ops./A.G.	A.G.s	Total
1 Sep.1939-1 Jan.1940	22	840	16	878	4	637	-	641
1 Jan.1940-1 Apl.1940	125	643	124	892	52	492	61	605
1 Apl.1940-1 Jul.1940	164	1,238	273	1,675	235	996	187	1,418
1 Jul.1940-1 Oct.1940	15	1,892	375	2,282	15	1,742	347	2,104
1 Oct.1940-1 Jan.1941	24	1,808	315	2,147	14	1,566	278	1,858
	350	6,421	1,103	7,874	320	5,433	873	6,626

Reference: Forms 408. B.J.M.2/3A

While these totals show that an average of 84.15 per cent successfully passed the course during the period, it cannot be established that the remainder failed to qualify because the numbers put back to later courses are not definitely known. As a general rule it was assumed that wastage on gunnery courses from all causes (sickness, transfer to other trades, failure etc.) was between ten and fourteen per cent of intake.

Progress of air gunnery training during 1941

The members of a conference at Headquarters Flying Training Command in August 1941 impressed on the Air Member for Training that:

'the main factors that restricted training in this country were aircraft and spares for them, serviceability of landing grounds, weather conditions in winter, maintenance under the rules of 'black-out', enemy interference with night flying training, dispersal of aircraft and their deterioration at dispersal points, travel between parent site and the reserve landing grounds, and inabilities in equipment and in works services to such an extent that difficulties which arose from the other (1) restrictions could not be overcome.'

The weight of these handicaps fell nowhere more heavily than on air gunnery training which also carried an extra burden in connection with instructors.

(1) A.M. File S.58474.

The capacity of the bombing and gunnery schools was limited by shortage of aircraft for target-towing: and it was seldom possible to provide the necessary fifteen hours air experience per pupil at the signals schools because there were not enough pilots who could fly Proctors. ⁽¹⁾ Few of the aircraft in B. & G. schools had turrets; so the majority of pupils had to practise air firing with hand-held guns. Browning guns were scarce during 1941 and instruction centred on obsolescent types not seen in the first line. Teaching lay in the hands of corporals (junior armament instructors) or sergeants (senior armament instructors) who had a far better knowledge of the mechanism of weapons than of their use in air combat. Little attention was given to fighting technique. As a remedy for these defects Flying Training Command proposed that gunnery (and bombing) leaders who had finished one operational tour should be posted to inspire trainees at No. 1 Air Armament School and the B. & G. schools. ⁽²⁾ Such non-commissioned officers were then instructing in the O.T. Units (being posted within the command); but Bomber Command could only send a very thin trickle of war-weary observers and air gunners. In consequence most of the air gunnery instructors were supplied from among men who had just finished basic training and having no more operational experience than the former armament instructors. It was found possible to allot only one gunnery leader and one bombing leader to supervise instruction in each school until June 1941, by when the output from newly organised instructor courses at No. 1 A.A. School, Manby (six weeks) began to provide at a rate of twenty every three weeks men who ⁽³⁾ could raise the standard of instruction in air gunnery.

Another feature of importance to non-P.N.B. training in 1941 was its eclipse during many weeks by a controversy over plans for 'combined training' (navigation and gunnery) for observers. The pressure of expansion demanded that preference should be given them over the needs of other aircrew, whose role appeared in the minds of many people to be subsidiary by comparison. At a pinch wireless operators and air gunners could obtain some gunnery training in squadrons, as they had for several years; and the meagre resources in the United Kingdom had to be parcelled out according to the most pressing claims

(1) A.M. File S.70637.

(2) A.M. File S.65438.

(3) A.M. File S.65438.

at a given time: also, production from the Empire Air Training Scheme could be expected in the summer. A surplus amounting to 1,250 wireless operators/air gunner who awaited employment in aircrew teams after completing their training, and a further 4,631 wireless operators who had passed out from signals courses but for whom in May no vacancies existed in B. & G. Schools, also weighted the decision. Consequently a reorganisation was carried through between May and September 1941 by which Jurby, West Freugh, Dumfries, Penrhos and Millem converted to Air Observer Schools (A.O.S.) for this 'combined' training and accepted no other trainees. Of the remaining B. & G. Schools four were allotted to training wireless operators/air gunner and one specialised in producing plain air gunners for tail turrets. The latter five schools were re-named Air Gunner Schools (A.G.S.) in conformity with their function.⁽¹⁾ By the end of the year basic air gunnery training was given in five and a half A.G.S.s as in the following table and in No. 1 A.A.S. Manby.

Air Gunners Schools in December 1941

No.	Location	Date opened	Capacity	Intake per fortnight	Notes
1	Pembrey	June	180	90 W.Op	Fighter Command reserved facilities for one fighter flight.
2	Dalcross	July	180	90 W.Op	Originally built for S.F.T.S.
7	Stormy Down	June	180	90 W.Op	Former B. & G.S. (called Porthcawl).
8	Evanton	June	240	120 A.G.	Former B. & G.S. straight A.G. only.
9	Llandwrog	June	90	45 W.Op	Satellite of No. 9 A.O.S. Penrhos.
10	Castle Kennedy	July	90	45 W.Op	Tentage at Castle Kennedy School transferred to building at Barrow.
	Barrow	December	180	90 Mixed W.Op./A.G.	

The re-arrangement of gunnery training in this form represented the last vestige of the scheme prepared by No. 25 Group in August 1939 though reduced to half its stature.⁽²⁾ The other half, immensely enlarged, was provided by the Joint Air Training Plan.

(1) A.M. File S.70633. See Chapter 3.

(2) Cf. earlier in this chapter.

In order to stem the flow of wireless operators from entering gunnery schools, whose capacity was for almost a year less than half its requirement, Technical Training Command agreed to extend the courses at signals schools from fourteen to twenty weeks and reorganised the 'aircrew wings' in Cranwell, Yatesbury and Madley so as to give special training on the lines of an I.T.W. to wireless operators under training as air gunners during the last eight weeks of the course and in conjunction with air operating practice.⁽¹⁾ After having been discussed at intervals during two years, accommodation in No. 14 I.T.W. (Hastings) was made available at the expense of an equal number of cadet pilots for straight air gunner cadets to a maximum of 400 (half a wing). They had been selected by A.C.S. Boards from serving airmen of every trade who had waited several months to start their aircrew career. The half wing⁽²⁾ opened on 25 October 1941. Besides helping to reduce surpluses in the two categories this process helped to raise morale among non-P.N.B. cadets because they felt sure about their status as aircrew, when a six weeks course in I.T.W. started their training.

The changes in organisation and the many disabilities mentioned previously lessened the output from gunnery training to an extent that Bomber Command accepted some wireless operators and flight engineers into operational training who had had no gunnery course at all, so pressing was the need to expand the force by manning the heavy bombers. The actual output from gunnery schools in the United Kingdom during 1941 was only two thousand more than in the first sixteen months of war.

(1) A.M. File S.70637.

(2) A.M. File S.70637. No. 14 I.T.W. moved to Bridlington in January 1942.

Summary of Air Gunnery Training
(1 January 1941 to 1 January 1942)

	Actual Intake				Actual Output			
	Officers	W.Ops./A.G.	A.G.s	Total	Officers	W.Ops./A.G.	A.G.s	Total
1 Jan. 1941-1 Apr. 1941	85	1,173	239	1,497	76	1,440	287	1,803
1 Apr. 1941-1 Jul. 1941	(a)	1,167	624	1,791	-	1,147	500	1,647
1 Jul. 1941-1 Oct. 1941		2,954	1,378 ^(b)	4,332		2,082	1,385 ^(b)	3,467
1 Oct. 1941-1 Jan. 1942		1,172	714	1,886		1,662	390	2,052
	85	6,466	2,955	9,506	76	6,331	2,562	8,969

Notes: (a) After 1 April 1941 officers were included in their respective category. Allied personnel not included in these figures.

(b) Actual output increased by cadets who had been held back from a previous course.

Reference: Forms 408. D. of M. B.J.M.2/3A.

It should be remembered when considering these figures that they were supplemented by the flow from Canada under the Joint Air Training Plan. The last gunnery school was opened on 15 December 1941 at No. 8 B. & G.S. Mont Joli, province of Quebec, which was the ninety-third school under the scheme.⁽¹⁾

The following bombing and gunnery schools were operating overseas at the end of 1941:-

Canada

No. 1 Jarvis, Ontario

No. 5 Dafoe, Saskatchewan

No. 2 Moss Bank, Saskatchewan

No. 6 Mountain View, Ontario

No. 3 Macdonald, Manitoba

No. 7 Paulson, Manitoba

No. 4 Fingal, Ontario

No. 8 Mont Joli, Quebec

and No. 31 B. & G.S. Picton, Ontario which was a transferred school from the United Kingdom. The total output from these schools up to the end of 1941 was 3,850 W. Ops./A.G. and 606 A.G.s.⁽²⁾

(1) A.M. File C.S.11200/41.

(2) E.T.S.431(42).

Australia

No. 1 Evans Head, New South Wales

No. 2 Port Pirie, Southern Australia

The total output up to the end of 1941 was 1,001 W. Ops./A.G. and 253 A.G.s. Forty per cent W. Ops./A.G. and 98 per cent A.G.s were posted to the United Kingdom and the remainder to the Middle East.

New Zealand

After initial course W. Ops./A.G. finished their training in Canada: included in Canada's output (above).

United States

Under the 'Towers' Scheme, a total of 900 W. Ops./A.G. were trained at Jacksonville and Pensacola, Florida.

Expedients to meet changes in policy (1942)

The year 1942 opened with a disturbing surplus of over 5,000 plain air gunners who awaited vacancies in training. A small contributory factor had been the authority delegated in September 1939 to group armament officers to qualify tradesmen who had been trained in units as air gunners or as wireless operators/air gunner. So that the flow of aircrew categories could be controlled, Air Ministry rescinded that authority in January 1942. After the order all types of non-P.N.B. aircrew were admitted only on qualifying by appropriate courses organised in schools.⁽¹⁾ The greater part of the surplus had accumulated from P.N.B. rejects, who, unlike aircraftmen having a trade, could not be usefully employed in units until such time as they could be accepted by air gunner schools. No room could be found for them in technical training. Eventually in March a preliminary course in the maintenance of weapons lasting twelve weeks was organised at No. 14 I.T.W. and called the Elementary Air Gunners School (E.A.G.S.).⁽²⁾ And as one result of the new crewing policy for heavy aircraft, settled at conferences in February and March, a surplus of wireless operators/air gunner accumulated.

(1) Postagram to all Commands dated 10 January 1942.
A.M. File A.642388/37. D. of M. B.J.M.2/3.

(2) A.M. File A.35669. The school moved to Bridgnorth in April 1943.

Since the previous autumn a practice had been adopted in Bomber Command of using the better wireless operator of two in the crew of a heavy bomber to manage all wireless equipment on sorties and of leaving the less experienced man employed solely as air gunner in the dorsal turret. The latter's wireless skill deteriorated through disuse. Therefore Air Ministry (D.B. Ops.) in agreement with the command reduced by one wireless operator/air gunner the crew for Stirling, Halifax, Lancaster and Liberator and fixed the establishment figure for that crew member in heavy bomber squadrons at 26 in lieu of the previous forty. The decision enlarged the surplus in this category and tended to lengthen the tedious wait before posting. Many of the second wireless operators/air gunner thrown up by the change in policy (and a few surplus air gunners) were employed in the new role of air gunner/bomb aimer⁽¹⁾ that was allotted to each heavy bomber crew at the same time.

Wireless Operator Mechanics/Air Gunner in G.R. Squadrons

Concurrently with the expansion of the bomber forces the number of general reconnaissance squadrons in Coastal Command increased rapidly as the Battle of the Atlantic ran to its climax during 1942 and 1943. The training requirement for wireless operator mechanics/air gunner needed in the G.R. squadrons more than quadrupled in twelve months. Whereas in January 1941 ten wireless operator mechanics/air gunner per month sufficed to fill establishment, five months later the average grew to thirty-eight per month and continued to rise in the following year. Part of the output of these highly skilled tradesmen was employed in high speed craft of the Air/Sea Rescue Service, but the greater⁽²⁾ demand came through the increasing production of flying boats. Their training in four stages was a long process:-

- | | |
|--|---------------|
| (a) To muster to Wireless Operator (Group II) | - nine months |
| (b) To convert to Wireless Operator Mechanic (Group I)
(A.C.S.B. procedure during last month) | - six months |
| (c) Air Gunnery course | - six weeks |
| (d) Operational training at Flying Boat training
squadron, Stranraer | - indefinite |

(1) A.M. File S.40289/III.

(2) A.M. File A.138665/40.

In most cases the airmen were posted to ground employment while waiting for the next stage in technical or aircrew courses. The first batch of ten wireless operator mechanics u/t air gunner completed the course at No. 9 B. & G.S., Llandwrog on 1 February 1941: succeeding entries were received at No. 10 B. & G.S. Dumfries. To meet wastage and a planned addition of eighteen flying boat squadrons during 1941 two hundred and twenty-five wireless operator mechanics/air gunner were required.⁽¹⁾ But the production of flying boats fell short of plan with the result that the number of this aircrew type actually serving in Coastal Command in June 1942 only reached one hundred and twenty-four.⁽²⁾

When in May 1942 the wireless operator mechanic conversion course was suspended through lack of volunteers Air Ministry (D. of M.) sought candidates for the aircrew role among wireless and electrical mechanics serving in units and hoped to broaden the field of recruitment by selecting some mechanically disposed wireless operators/air gunner who could be trained to maintain the wireless and radar equipment in a flying boat during a short course (fourteen weeks). Such training would only be of a practical nature and not enough

(1) A.M. File A.138665/40, Minute 24. On basis of one W.O.M./A.G. per crew and six flying boats per squadron W.O.M.s/A.G. requirements were calculated by T.P.:-

Month 1941	To meet wastage	To meet new formations	Total W.O.M./A.G.
May	6.96	8	15
June	7.54	16	24
July	8.70	16	25
Aug.	9.86	16	26
Sep.	11.02	16	27
Oct.	12.18	32	44
Nov.	14.50	32	47
Dec.	16.82	-	<u>17 = 225</u>

(2) A.M. File S.79994.

to reach the standard for remustering to the Group I trade of wireless operator mechanic; also regulations did not permit the changing of aircrew trade before the airman had completed one year in the aircrew role for which he had been trained. ⁽¹⁾ Coastal Command rejected the proposed substitute and insisted that the main point to consider was skill in servicing R.D.F. equipment, particularly when the flying boat operated on detached duty. Sorties frequently exceeded twenty-four hours. The command averred that several of these valuable craft would have been lost but for the efficient running repairs to wireless equipment when airborne. So conversion courses to wireless operator mechanic restarted at the end of August 1942; ⁽²⁾ and after a trail run for three months the maintenance course was dropped until 1944 when shortage of manpower forced its revival.

The requirement for training wireless operator mechanics/air gunner was estimated in the summer of 1942 to be sixty per month, increased to one hundred a month from 4 November. The numbers posted by Records to the conversion course at No. 1 Signals Schools Cranwell are shown below: ⁽³⁾

Accepted for training as W.O.M./A.G.

Month 1942	Aircrew entrants on Sigs: trg.	Cadets on W.Op. (Air) Maintenance Course	W.Ops. awaiting gunnery trg. on stations	Total
Aug.	20			20
Sep.	10		38	48
Oct.	23	15	1	39
Nov.	18	61	23	102
Dec.	40	66	10	116
Jan. 43	35	-	25	60
	146	142	97	385

(1) Under A.M.O. A.983/41.

(2) A.M. Files A.138665/40 and S.40289/III.

(3) A.M. File A.138665/40 Encl. 97B.

Expansion of air gunnery training (1942 and 1943)

In the early months of 1942 the output of plain air gunners was much below the needs of bomber expansion, nor could the schools as then existing absorb the large surplus waiting to start their courses. Within three months of opening No. 14 I.T.W. to air gunners, intakes had to be suspended because the strength (800) had reached double the number that could be catered for. ⁽¹⁾ No less than 2,350 direct entry aircrew cadets who had been withdrawn from training for various reasons as pilot, observer or wireless operator/air gunner, and who had been remustered u/t air gunner, awaited vacancies in air gunner schools. Also 3,000 serving airmen of all trades who had been recommended under A.M.O. A.466/40 as air gunners were growing impatient over the long delay before their turn in aircrew training. ⁽²⁾ The problem was tackled from two directions. First: by overcrowding five schools (the population of each was raised during the summer from 180 to 240 pupils), and by building two new schools. Secondly: after 25 May 1942 every aspirant for air gunner training, whether serving airmen or aircrew cadet suspended from other type training, had to pass through the sieve of the aircrew candidates selection boards which received special instructions to preserve a high standard when recommending potential air gunners. ⁽³⁾

While the siting and building of new schools in the United Kingdom proceeded, Air Ministry had to rely on Canada for immediate help to increase air gunnery intakes, since the demand for enlarged operational training was insistent.

Resources of the schools were further strained by having to provide 'refresher' courses for air gunners, who qualified under the Empire Air Training scheme, in preparation for teaming-up with the rest of the crews. Moreover, the change in crew policy for 'heavy' squadrons from forty wireless operators/air gunner and twenty air gunners per squadron to its reciprocal ⁽⁴⁾ resulted in considerable lack of balance in capacity of the air gunners schools.

(1) A.M. File S.85866. Intakes were resumed in May 1942.

(2) D.D.M.I. Loose Minute dated 2 March 1942. D. of M. B.J.M.2/6a.

(3) Details in A.M.O. A.373/42. Instructions to A.C.S.B. dated 20 May 1942 in B.J.M.2/6a. A higher standard than in May 1940.

(4) T.P.42/2 Subsidiary Tables (March 1942).

This was accentuated by the differing lengths of courses; that for wireless operators/air gunner lasting four or five weeks against six weeks for air gunners, working to different syllabuses. Two other factors that made the task of organising the training of non-P.N.B. aircrew an unenviable one must be noted. The fluctuating demands for operational training due to rapid expansion or heavy casualties were reflected materially in the intakes to basic training. An urgent call for extra flight engineers/air gunner or for more (plain) air gunners to complete crews of heavy or medium bomber squadrons modified the training programme prepared in the Directorate of Flying Training. Careful calculations of output were stultified through sodden airfields or through the safe arrival in port of a large draft of aircrew from Canada. Postings to gunnery courses had to be planned so as to simplify organisation, (1) and to keep some uniformity of instruction at the schools.

In November the commitment for gunnery training for flight engineers was transferred to Pembrey from Barrow, the latter concentrating on the air training for wireless operators/air gunner. As Coastal Command wished to form the new No. 2 Torpedo Training Unit at Castle Kennedy, Flying Training Command moved No. 3 A.G.S. to Mona in the isle of Anglesey during December 1942, where it stayed for eleven months until returning to its first station. This school opened in August. No. 4 A.G.S. formed in April at Morpeth, Northumberland, with an establishment for 180 pupils which increased to 240 within three months when enough Botha and target towing aircraft could be transferred from other schools in Flying Training Command. (2) Throughout the summer of 1942 No. 1 A.G.S. Pembrey worked to a pupil population reaching 300; but short daylight and bad weather in November forced a reduction to the established figure of 240 pupils under training.

Disregarding chronology, it is convenient at this point to record the accomplishing of the programme for new air gunners schools. This was not attained without dogged persistence by the Deputy Director of Armament Training and armament staff at Headquarters Flying Training Command, whose claims to airfield space always had to compete with those of Bomber and Coastal Commands. Moreover, training P.N.B. aircrew assumed prime importance for the majority of the staff.

(1) See Appendix 45.

(2) A.M. File A.891042/46.

The provision of new air gunners schools to accord with expansion was completed eventually in the summer of 1943. Fighter Command found it possible to hand over in May to Flying Training Command the station at Andreas, Isle of Man, merely reserving accommodation for one single-engined fighter squadron should need for it arise. Here No. 11 A.G.S. was formed. The last school, No. 12 was started in July at Bishops Court, Northern Ireland, where No. 7 Air Observer School had opened recently. ⁽¹⁾ Despite many handicaps, through construction work in progress on airfield and buildings, the first air gunners' course from No. 12 A.G.S. passed out in September. ⁽²⁾ Thus by mid-1943 nine and a half air gunners schools were operating in the United Kingdom, three of ⁽³⁾ them giving their full capacity to wireless operators/air gunner.

During the winter of 1942/43 some of those responsible for the practical training of air gunners felt misgivings lest under pressure of expansion the quality of their product should deteriorate through the demand for ever greater numbers. Two instances that gave colour to their disquietude may be cited. The refresher courses for air gunners from the Empire Air Training Scheme had to cease through lack of facilities and range-space, although these aircrew waited in personnel reception centres between four and fourteen months before ⁽⁴⁾ being posted to operational training units. Secondly: a few wireless operators/air gunner were passed out from A.G.S. and awarded the brevet as air gunner (the only badge for them in October 1942) without having had any air ⁽⁵⁾ firing practice owing to bad weather. The application for extension of that particular course had been turned down by the Aircrew Allocation Committee because the pipeline through the (observer) advanced flying units to the O.T.U., had to be kept full in the light of the current operational situation. In a memorandum surveying basic and operational training for straight air gunners the Air Officer Commanding No. 25 Group propounded the theme that the quality

(1) A.M. File A.891042/46. Described in Chapter 3.

(2) T.P. monthly statistics of flying training A.M.T.B.J. Training 3.

(3) See Appendix 46 for complete list of A.G.S.s. Wireless Operators/Air Gunner in 1943 who needed the full gunnery course (not 'emergency') attended Nos. 3, 8 and 10 A.G.S.s.

(4) A.M. Files S.90789 Encl. 22A and S.85866 Encl. 83B.

(5) A.M. File S.85866 Encls. 8A and 19A. The deficiency was partly made up at O.T.U.

(1)
of output was neglected in order to supply quantity. His main recommendations were:- improving the status of air gunners, doubling the time at A.G.S. to improve marksmanship, finding a means of keeping air gunners in practice while on voyage, at P.R.C., and during their operational tour, and the equipping of air gunnery schools with aircraft having modern installations. This constructive criticism, supported in principle by the Air Officer Commanding-in-Chief Flying Training Command and backed in many particulars by other commands having experienced the product, received serious study in the Directorate of Training. The Deputy Director of Armament Training placed his faith in the improvements in marksmanship that were anticipated from introducing a new gyro sight cine camera into the schools, although he admitted that 'The ideal length of training course for an air gunner has never been considered on its own merits. Ever since the outbreak of war the time available for air gunner training has been determined purely by the number required and the facilities available after those for pilot training had been met.' The Director of Operational Training considered that the picture was not so black as painted in the memorandum: he wrote:- 'In spite of the increase in the number of enemy night fighters and the improvement of their equipment, a very noticeable falling-off of casualties and an increase in enemy fighters brought down has resulted from the improvement in air gunners' training during the last half year.' The opinion of commands employing air gunners were sought and an investigating officer appointed to study the whole subject. In May 1943 D.D.T. Arm. issued to the interested commands a review of all stages through which the air gunner passed prior to operational tour that proposed reforms here and there, notably in the affiliation exercises carried out in the O.T.U. and Heavy Conversion Unit stages, and advocating (2) greater use of the group gunnery flights in operational commands. The review also emphasized the limitations of industry in the United Kingdom which prevented supplying a suitable trainer aircraft for air gunnery and accelerating production of sufficient gyro sight assemblies to spread around all training units. There was ample evidence that the Defiants and Blenheims then used in most air gunners schools (up to August 1943) were worn out and

(1) A.M. File S.90789 Encl. 1A.

(2) A.M. File S.90789.

could not stand the strain of being used for a purpose for which they were not designed. Re-equipping these schools with Ansons and Martinets proceeded through the summer and this measure resulted in some improvement in the flying hours per aircraft.

'Emergency' gunnery courses

Nowhere in the field of flying training did the pressure of expansion operate so ruthlessly as in air gunnery training: the quality of its product succumbed to the onslaught for quantity at any cost. At the end of March 1943 the Air Ministry acknowledged to all commands that limited training resources for air gunnery compelled a radical change in policy and accepted a proposal that Flying Training Command had advocated several times since the previous August. This proposal had been given a short trial run with wireless operators⁽¹⁾ air gunner destined to serve in heavy and medium bomber squadrons. The full six weeks course at the A.G.S. was given to all members of aircrew whose primary role was manning a gun position in an aircraft. Other members were trained to man a gun in the air or on the ground in case of emergency only, such as, through a casualty to an air gunner or to repel attack after a forced landing. The longer course included a minimum of twelve hours flying during which cadets fired nine exercises of 200 rounds each, exposed fifty feet of cine camera gun film in four air exercises and did three exercises of air-to-ground firing. This full training was reserved for:-

- (a) Straight air gunners.
- (b) Wireless operators/air gunner for flying boat, general reconnaissance and coastal squadrons, and light bomber squadrons.
- (c) Flight mechanics (E)/air gunner and wireless operator mechanics/air gunner for Coastal Command.
- (d) Flight engineers for flying boat and G.R. squadrons.
- (e) Air bombers and navigators (B).

The short course entailed two weeks of ground training only. Its scope was confined to basic instruction on practical knowledge of guns and turrets. No superfluous theoretical instruction was given: internal mechanism was not

(1) A.M. File S.85866.

taught. Extra time had to be given at O.T.U.s to enable these crew members (1) to become competent to handle the particular equipment in use. 'Emergency' training applied to:-

- (a) Pilots.
- (b) Wireless operators/air gunner for heavy and medium bombers.
- (c) Flight engineers for bomber squadrons.
- (d) Navigators, navigators (BW) and navigators (W).

The new policy brought several changes into the organisation of air gunnery training. No. 1 Air Armament School, Manby, ceased to provide a full course for plain air gunners and took emergency courses for a hundred wireless operators/air gunner per fortnight, thereby leaving resources available for reverting to its pristine role, training armament instructors. No. 1 Air Gunnery School, in addition to 120 plain air gunners per month for the full course, accepted an intake of 300 flight mechanics (E)/air gunner and flight engineers for emergency courses during a month. Likewise No. 7 A.G.S. held full courses per month for 240 plain air gunners running concurrently with short courses for 400 wireless operators/air gunner and 75 flight engineers. Nos. 3, 8 and 10 A.G.S.s each continued to produce 240 wireless operators/air gunner and wireless operator mechanics/air gunner on full courses per month, while the remaining gunnery schools were reserved for the large bulk of plain air gunners needed in squadrons equipped with Lancaster, Halifax, Stirling and Liberator aircraft. (2)

For the month of July 1943 the impressive totals of other aircrew passed out from gunnery training were:-

	<u>Full Course</u>		<u>Short Course</u>
A.G.	1,170	F.M. (E)/A.G. and F.E.	375
W.Op./A.G. and W.O.M./A.G.	660	W.Op. for Bomber Command	600

The marking of log books to differentiate between those who had passed the full course and those who had qualified only for 'emergency' gunnery became important; similar notation had to be included in posting papers and correspondence concerning the employment of individuals in the non-P.N.B. categories. For it was always intended that, as opportunity offered, those

(1) A.P.1388G.

(2) A.G.S.s taking plain A.G.s in July 1943 were Nos. 2, 4, 11, 12 and half No. 9 (O) A.F.U. D.T.F. programme 101 and A.M. Files S.85866 and S.40289/III.

who had 'emergency' training should take the full course after completing one tour of operations. This part of the plan proved impossible to attain before the war ended and when the hosts of partly-trained other aircrew became redundant. The administrative problems created by this split in gunnery qualification led to the introduction later in the year of another aircrew category, the wireless operator (air). No 'emergency' courses reached the aircrew schools in the dominions, which continued to give the full course, impervious to the need for improvisation.

Progress of the Central Gunnery School

The Central Gunnery School, which started off in November 1939 with such high hopes, was dogged by mischance during the formative years till 1943. Four stations in succession proved to be fundamentally unsuitable in their environment, accommodation and airfields. Warmwell was shared with No. 10 Bombing and Gunnery School until 15 July 1940, in spite of the prohibition of night-flying practice on account of the important research and construction work on 'ASDIC' well established by the Admiralty in Portland nearby. The addition of a fighter squadron to the station during the Battle of Britain did little to foster the improvement in methods of instruction or of experiment by the C.G.S., whose function narrowed solely to training gunnery leaders so urgently needed in Bomber Command.⁽¹⁾ The repeated bombing attacks on the station (an expected retort to the fighter operations) drove all personnel to live under canvas in Knighton Wood from 29 April 1941 and compelled the transfer on 28 June of the school to a half-prepared site at Castle Kennedy,⁽²⁾ Wigtownshire, where they continued living in a tented camp until late autumn. Though secure from the attentions of the enemy, flying was interrupted more frequently there than it had been at Warmwell in the previous six months, this time by bad weather and a water-logged airfield. During the four months August to November flying was impossible on no less than 60 out of the 122 days in the period (including Sundays).⁽³⁾ Arrangements for essential flying exercises for the pupils had to be made with the nearest station, West Freugh,

(1) A.M. Files A.953851/47 and S.56180.

(2) Unit O.R.B. and IG. Report No. 237.

(3) Unit O.R.B. - a calculation.

(twelve miles by road), when weather permitted, and courses had to be extended beyond the normal four weeks. Therefore, being literally flooded out, the school was moved on 4 December 1941 to Chelveston near Higham Ferrers, Northants, (a station being built for No. 8 Group of Bomber Command) while waiting for its 'permanent home' at Sutton Bridge to be made available through the transfer of No. 56 Fighter O.T.U.⁽¹⁾ The latter unit moved to Tealing in March and the C.G.S. entered into occupation on 4 April 1942. Protests against the inadequacy of airfield and accommodation for its new purpose or for any increase in pupils were made periodically throughout the twenty-three months of occupation. The sandy soil did not permit the laying of Sommerfeld track.⁽²⁾ The cost of works services both in money (£132,000) and labour in a time of scarcity appeared too expensive, so Headquarters Flying Training Command were told that the projected expansion of the school could not be approved.⁽³⁾

In Report No. 237 on a visit to the school on 26 March 1942 the Inspector General suggested that the discomforts and disabilities outlined above did not conduce to enthusiasm and keenness among the staff, nor to the smartness and efficiency of the pupils, all of which were necessary 'to raise the general level of air gunnery throughout the service to an expert level.' He recommended replacing instructors who had been too long at the school and particularly that armament instructors in this important central school should come from squadrons with recent operational experience. He also considered that among the staff pilots, the majority of whom entered direct from S.F.T.S., there ought to have been a leavening of up-to-date operational pilots. The school should also have been issued with more recent aircraft and the latest specialist equipment. The Air Officer Commanding-in-Chief, Bomber Command agreed in general with the points raised in the report and he 'admitted that the present standard of performance (in air gunnery) was deplorably low.'⁽⁴⁾ He averred that the school not having occupied the pride of place properly due to a central school and not having received the full confidence of the Service,

(1) A.M. File S.56180.

(2) A.M. File A.953851/47/I.

(3) A.M. File S.86371.

(4) A.M. File A.953851/47/I.

unit commanders had not released their best men for its courses, because (1) insufficient importance was attached to the attainment of pass standard. He recommended a stiffening of the latter and the merging of the Gunnery Research Unit with the C.G.S. The second proposal was impracticable because the former unit, located at Exeter, was within easy reach of other establishments also engaged in scientific research, (2) namely R.A.E., Farnborough, T.R.E., Malvern and A. & A.E.E., Boscombe Down. Nevertheless this prodding by competent observers moved departments of the Air Ministry to assemble a conference on 5 September that resulted in equipping the C.G.S. with more modern tools and in supplying a better stamp of pupil than formerly.

Since midsummer 1941 the C.G.S. had catered for two intakes per month of 32 pupils on gunnery leader courses which lasted four weeks in summer and five (or more) in winter. Subject to minor variations the allotment of vacancies was usually Bomber Command 18 or 16, Coastal Command 6 or 8, Fighter Command 4, Flying Training Command 3, R.A.F. Northern Ireland 1 and to Army Co-operation Command or Admiralty (for personnel of Fleet Air Arm) as required. (3) As the commands seldom filled their allotments - prior to August 1942 when the effects of Air Ministry drive began to bear fruit - places could always be found for pupils nominated by the last two authorities. With a view to raising the status of this central school two steps were taken during the second half of 1942. All commands were informed in August that every entrant arriving for a gunnery leader course must pass an initial test (of about the standard for passing out from A.G.S.) or return to unit forthwith. And secondly, the names of graduates from C.G.S. courses were published in Air Ministry Orders, Series 'N', categorised either 'A - distinguished pass' or 'B - pass' as gunnery leader. (4) Undoubted benefit to the general tone of the school followed the introduction of these strong measures; but for the next twelve months the average number of passes was only 20 out of 32 pupils on each course. (5)

(1) A.M. File A.373124/42.

(2) A.M. File A.953851/47/I.

(3) A.M. File S.56180.

(4) A.M. File A.373124/42.

(5) I.G. Report No. 275 para. 24. (A.M. File A.953851/47/I.).

The feature that contributed most to uplifting the C.G.S. was the addition in May 1942 of what was soon dubbed 'the fighter wing'. Started as a venture by Fighter Command at Wittering on 5 March under the leadership of a distinguished fighter pilot (Wing Commander A.A. Malan) who was keen on the work, the pilot gunnery instructor training wing (P.G.I.T.W.) set out to raise the skill of pilots in the tactics of attack with fixed guns.⁽¹⁾ This officer gathered round him a few pilots proven in combat who trained courses of ten pilots (fourteen from November 1942) to a high level of marksmanship and flying skill with which they could inspire their fellows in the squadrons. The month's course was eminently practical and very strenuous. It entailed about forty hours in flying time per pupil giving him practice in all aspects of attack, from using the GM2 reflector sight for estimating range to advanced forms of air combat.⁽²⁾ The pilot's procedure was recorded in thousands of feet of cine-camera film that was assessed by the flight commanders and points discussed with the pupils at the end of each day's flying. Intaking each fortnight, the allotment of vacancies was Fighter Command - 8, Coastal Command - 2 and Army Co-operation Command - 2. Repeated efforts to increase this population always failed because of the inadequacy of the airfield (500 yards in E.W. direction)⁽³⁾ and facilities possible at Sutton Bridge.

For ten months the P.G.I.T.W. suffered teething troubles. Twin-engine pilots had to convert to single-engined aircraft before they could start the course, using Masters and Spitfires.⁽⁴⁾ Pilots from army co-operation units had to bring their own aircraft and maintenance crew.⁽⁵⁾ Moreover, a perennial shortage of spares and new equipment proved a heavy handicap. Though the 'fighter wing' was part of Fighter Command for direction and control, its administration belonged to Flying Training Command. Owing to the dual allegiance some friction was discernible in the organisation, which remained unwieldy until in August 1944 the C.G.S. became a component of the Empire Central Armament School.⁽⁶⁾

(1) Unit O.R.B. and Aircrew Training Bulletin No. 25.

(2) After being installed in new station, Catfoss, in 1944 and having been supplied with more aircraft the flying times per pupil rose to fifty seven hours in a five weeks' course.

(3) A.M. Files S.86371 and A.953851/47/I.

(4) A.M. File A.953851/47/I (A.M.T. B.J. Training 3:6).

(5) A.M. File S.86371.

(6) A.C. Paper 10 (44) and A.M. File S.88540/I.

When the expansion of the air forces burgeoned into fullness it became imperative to increase the scope of the Central Gunnery School. After the winter 1942/43 the airfield surface was nearly ruined even though the use of octane fuel in the Wellingtons had facilitated their take-off. Yet it appeared unwise to incur large expenditure because Sutton Bridge could never be more than an indifferent site owing also to the limited firing and bombing possibilities in The Wash. ⁽¹⁾ The Director of Flying Training and Headquarters Flying Training Command began the search for a suitable station in November 1942 and persevered in it all through 1943. Sites were inspected in Northern Ireland, the Isle of Man, Scotland, Wales and Yorkshire: but there was always some valid objection from either Flying Training Command or the Directorate of Works. All preferred a location in England because the school gained great value by close liaison with the operational commands. Eventually the C.G.s moved into Catfoss which had been vacated, at the end of February 1944, by the Technical Training Unit of Coastal Command. This station had permanent buildings and concrete runways (one of them 2,000 yards long) and a satellite at Cottam that presented possibilities for doubling the pupil population of the fighter wing and developing the gunnery leader wing according to plans that had been worked on for almost a year. ⁽²⁾ The school inhabited Catfoss for twenty-one months, until November 1945, when Bomber Command was able to surrender for its use much more spacious accommodation and a larger airfield at Leconfield.

Conditions of service - airmen aircrew

During the twelve months from June 1942 to June 1943 the operational commands exerted a steady pressure on the Air Ministry to improve the conditions of service and to raise the pay of non-P.N.B. aircrew with the object of uplifting their morale by bringing their status closer to that of their colleagues in the teams. ⁽³⁾ Early in the year the Air Officer Commanding-in-Chief, Flying Training Command had drawn the attention of the Secretary of

(1) A.M. File S.86371.

The aircraft established for the Central Gunnery School in 1943 were:-

Fighter Wing - Spitfires 33, Masters 7.

Gunnery Leader Wing - Wellingtons 24, Lysanders (T.T.) 24.

The supply to the Gunnery Leader Wing did not reach establishment before 1944. (A.M. File A.953851/47/I.

(2) A.M. File S.86371.

(3) A.M. Files A.54893/40, S.60457 and S.85866.

State to the importance of better training of all aircrew and higher morale.
His letter concluded with the pith of the problem stated simply, thus:-⁽¹⁾

'One point must be emphasised. It is essential to imbue all aircrew volunteers with the conviction that they form the "Pick of the Service". The finest traditions of the Royal Air Force are in their hands now that so many of our pre-war-trained men have gone. Any scheme that can be devised whereby this potentially fine fighting material can be moulded into the shape of their immediate predecessors should be adopted and perfected. I believe that no team can be let down so easily by the failure of one of its members as the crew of an aircraft.'

By means of several conferences and much correspondence between branches and with commands, the Air Ministry slowly gained a piecemeal advance in status and pay for these airmen. The notable decrease in volunteers for air gunner and for flight engineer duties in the winter of 1942, coinciding as it did with a much greater demand for these members, who were wanted to make up crews in heavy bombers, reinforced the ministry's case and eventually brought better conditions for airmen aircrew.

The first advance came to the wireless operators/air gunner when in May and June 1942 the aircrew sergeants who qualified as grade I in the trade after completing at least five operational sorties received nine shillings a day (excluding war pay of sixpence). Pay of the grade II wireless operators/air gunner was raised to eight shillings and of flight sergeants to nine shillings and sixpence. Only those who passed the tests for upgrading were eligible for promotion.⁽²⁾

A dearth of volunteers for flight engineer in the summer of 1942, when there were only 2,000 volunteers for training against a requirement of 6,000⁽³⁾ compelled the Air Ministry to lower the standard for entry. To increase

(1) A.H.B./ID/7/1(A). (Letter reference FTC/AOCC dated 21 January 1942).

(2) For upgrading candidates, besides recommendation after five sorties, had to satisfy the group examining officer that they were fully conversant with the command signals organisation and procedure and had retained a satisfactory standard in air gunnery. They had to pass the tests prescribed in A.P. 1112 for their trade.
A.M. File S.60457 and A.M.O.s A.424/42 and A.551/42.

(3) A.M. File A.54893/40.

the flow of volunteers and to preserve some measure of uniformity in the conditions prevailing for aircrew members a category was created for flight engineers whose posting thereafter became the province of Air Ministry (D.G. of P.).⁽¹⁾ The field of recruitment was widened to reach all the fitter trades and flight mechanics; aircrew selection procedure was applied to all candidates. The courses of training began with the junior N.C.O. course for those below the rank of sergeant; then I.T.W. for five weeks followed by an air gunnery course of three weeks; technical instruction and conversion to fitter II (if not already mustered in the trade) ended their basic training, after which the sergeant with flight engineer brevet moved to operational training and received pay at eleven shillings per day. Promotion to flight sergeant and to commissioned rank (the latter up to six per cent of the total establishment of flight engineer posts) similar to that for remaining other-aircrew categories provided a further inducement to attract serving airmen. After a trial lasting five months it was found that the improved conditions did not draw enough recruits possessing the required mechanical knowledge. Usually twenty-five per cent failed to pass the technical or conversion⁽²⁾ courses. Therefore in June 1943 the system of training was revised so as to admit direct entry volunteers having technical skill, and the conditions of service were modified. The standard for entry was lowered to include aircraftmen serving in all trade groups II to V (except wireless operators, needed in their own air category). All candidates had to reach a certain educational standard and had to be accepted by the aircrew candidates selection board. The courses of training also changed:- (a) Cadets began with initial training wing for six weeks; (b) technical training was phased in two parts of seventeen weeks (elementary) and seven weeks (advanced). Fitter tradesmen already serving entered at a suitable point in part I or took the whole of part II; (c) a ground gunnery course lasting a fortnight. On completing these basic courses the airmen were remustered to flight engineers and promoted to temporary sergeant aircrew. The rate of pay dropped to ten shillings a day for new entrants and reached the level of other non-P.N.B.

(1) Formerly as technical tradesmen posting as far as O.T.U. had been in the hands of the Officer-in-charge of Records.

(2) A.M. File A.54893/40, Encls. 210B and 222D. Also A.M.O. A.978/42.

aircrew on promotion. Compensating for the shilling reduction in pay, the incentive of commissioning on the same scale as wireless operators/air gunner was offered, i.e. ten per cent on qualifying and a further ten per cent after operational experience.⁽¹⁾

The third advance in pay and conditions of service for all types of airmen aircrew occurred in the summer of 1943 in two steps. In May promotion to warrant rank in an aircrew category (not technical tradesmen) was opened on a time basis of twelve months in each preceding rank if recommended as suitable in all respects. Moreover, Air Officers Commanding received authority to reward exceptional merit by accelerated promotion after nine months in the respective ranks, such early promotion being limited to ten per cent of each category in the group. In 'Pathfinder' squadrons the Air Officer Commanding No. 8 Group could promote to acting rank as flight sergeant after fifteen sorties and as warrant officer after twenty sorties. A further incentive to ambition and efficiency among airmen aircrew members authorised a group commander to promote to acting rank an airman appointed captain of a flying boat or of a four-engined aircraft. And, when satisfied that the airman was an efficient captain, the Air Commander could promote a flight sergeant to acting warrant officer, which was confirmed as temporary rank after three months operational experience. After discussing the matter with the Dominion Air Forces a consolidated rate of pay for those non-P.N.B. categories who held warrant rank was decided:-⁽²⁾

	s	d.
Wireless operator mechanics/A.G.	15	6
Wireless operators/A.G.	}	13 6
Flight engineer		
Air gunner (with basic trade in group I or II)		
Air gunner (other trade groups)	12	6

The second step in the process was reached in June when the rates of pay and status of all aircrew cadets during training were founded on a single basis.⁽³⁾ The spurious reclassification to leading aircraftman (which had been used to

(1) A.M. File S.60457 and A.M.O. A.538/43.

(2) A.M.O. A.426/43. The rate compared with that for P.N.B. categories in warrant rank of sixteen shillings and sixpence (exclusive of war pay 1/- and sixpence deferred pay). (A.M. File S.60457).

(3) A.M.O. A.635/43.

support the higher pay) was discontinued. They were classified as aircraftmen, 2nd class throughout the period of training and received increases in pay related to its various stages as follows:-

	Pilot, Navigator (all categories), Air Bomber	Wireless Operator Mechanic (Air Gunner)	Flight Engineer	Wireless Operator (Air Gunner)	Air Gunner *
Grade 'A' (increase of 3s a day)	During initial training wing course	-	During initial training wing course and first part of technical course	During initial training wing course and first part of technical (signals) course	During initial training wing course and elementary air gunner course
Grade 'B' (increase of 5s a day)	-	On posting to a course which included instruction in the air in its syllabus	On completion of first part of technical course	On completion of first part of technical (signals) course	On posting to an air gunner school
Grade 'C' (increase of 7s. 3d. a day)	On completion of initial training wing course and during remainder of training	-	-	-	-

* Including flight mechanic (air gunner)

In addition to pay of the grade non-P.N.B. cadets received flying instructional pay of one shilling during any air training course, such as air gunnery school or advanced signals course in the aircrew wing at radio school. The system under which wireless operators/air gunner had to prove their proficiency in operating and maintaining radar equipment called 'Gee' or 'A.S.V.' in order to qualify for upgrading and promotion above temporary sergeant was retained in the Royal Air Force though it ceased to apply in the Royal Canadian Air Force whose members of similar category were graded I automatically, as a means of fostering recruitment. (1) The measures outlined in the four preceding paragraphs tidied up many loose ends that existed in the status of aircrew personnel, particularly by providing an incentive to greater efficiency through the avenue to promotion. By the end of 1943 they tended to raise

(1) A.M.C.O. A.72/43 and A.M. Files S.60457, Encl. 161A and S.54893/40, Encl. 97B.

morale of aircrew teams within measurable distance of their predecessors of the first year at war.

Introduction of a new aircrew category - Wireless Operator (Air)⁽¹⁾

In the summer of 1943 a sudden demand for double the number of wireless operators as aircrew was created by the vast increase in air transport across the Atlantic, over central Africa to Egypt and (after Rommel's defeat in May) above the length of the Mediterranean Sea. Also the policy of 'round-the-clock bombing of Germany industry' required wireless operator aircrew in large quantity and immediately in Bomber Command. By May the practice had been established of posting these aircrew members after only a short course lasting two weeks in ground gunnery to operational training units preparing crews for medium and heavy bombers, or for transport aircraft. They were graded as wireless operators/air gunner, though it was understood that their employment in such squadrons solely concerned wireless and radar equipment: as far as air gunnery went, they were only expected to fire light machine guns in an 'emergency' in defence of the aircraft on the ground.

It seemed to the Director General of Training unreasonable to award the air gunner brevet to men who had not qualified for it, and, in June, he proposed to the Air Member for Personnel, a new category to include such aircrew with a distinctive badge. The existing practice, he considered, took away all incentive from the real air gunners to attain a high standard when they saw aircrew members who had had no air gunnery course wearing their hard-earned symbol. Divided opinion on this proposal caused lengthy correspondence and much discussion among various branches in the Air Ministry during seven months. In August, the Air Member for Personnel explained to the Air Council how the development of new types of aircraft and the specialising of their functions altered the relative importance of wireless and gunnery in the various types. At one end of the scale was Coastal Command wherein a full gunnery course was essential for all wireless aircrew personnel, and at the other end Transport Command wherein no such training was needed. From time to time gunnery training had been reduced for wireless operators/air gunner allocated to heavy bomber squadrons; but the critical deficiency of air gunner schools compelled the posting of this aircrew member

(1) A.M. File S.95255.

(1)
direct to advanced flying units and O.T.U. without any gunnery training. It was always intended that every member of aircrew should receive full training in air gunnery as soon as sufficient air gunner schools were constructed, but that ideal position lay somewhere in the unforeseeable future. Meanwhile he sought approval of the Air Council to introduce the new category of wireless operator (air).

The decision of the Air Council brought in its wake many awkward administrative problems, created no doubt through an over-sensitive desire among certain officers to enforce an equality in reward for qualifying as aircrew, when by the nature of the duties and of the training for them, no such equality existed. The courses for pilots lasted 44 weeks before they were promoted to sergeant or recommended for commission; for navigators anything between 36 and 64 weeks (in the case of navigator (BW); for air bombers 30 weeks; and for straight air gunners 18 weeks. (2) The disparity between aircrew categories could not be eliminated by administrative action, though Service departments in the Air Ministry and the commands tried to lessen it in favour of this new category, thereby departing from the principle that promotion to sergeant depended on completing 'air' training.

It was decided that the new wireless operator (air) should be remustered and promoted to sergeant (or recommended for commission) at the end of the second part of the technical signals course that converted him from a ground wireless to an aircrew wireless operator. Organised by Technical Training Command in the aircrew wings at Nos. 2 and 4 Radio Schools (Yatesbury and Madley) this conversion course lasted 12 weeks during which the cadet received practice in air operating for an average of 20 hours in Ansons and Proctors. Although the Air Officer Commanding-in-Chief, Flying Training Command, deemed this slender amount of flying experience insufficient to justify grading as aircrew, the Air Ministry introduced the new category as from 9 November 1943

(1) A.C. Paper 51 (43) and Conclusions 12 (43), 3(C), 24 Aug. 1943.

(2) A.M. File S.95255.

and authorised, on conclusion of the conversion course, the award of a new brevet denoting by the letter 'S' within the laurel wreath supporting a single wing that the wearer's basic qualification for aircrew was wireless operating. His basic training lasted 32 weeks followed by either a fortnight's 'emergency' course in handling machine guns at an advanced flying unit, or by the full air gunnery course (then six weeks) at an air gunnery school, according to the type of squadron for which he was posted. (1) The announcement of the new conditions of service in A.M.O. A.1242/43 produced considerable administrative difficulties. All existing aircrew wireless operators/air gunner were remustered to the new category with effect from 9 November, and those being trained, when they reached the end of the basic course. But the departments in Air Ministry and Technical Training Command, which were responsible also for basic and conversion training for wireless operator mechanics/air gunner and for flight engineers,

(1) Wireless Operator (Air) training periods:-

	<u>Weeks</u>
Initial Training Wing	8
Tech. Sigs. Courses Part A (Ground)	12
Tech. Sigs. Courses Part B (Air)	<u>12</u>
<u>Total</u>	<u>32</u>

To ensure correct posting according to training five sub-divisions of category had to be used on all posting records:-

	<u>Fully Trained Air</u>
(a) W.Op./Air	Operator
(b) W.Op./Air (E)	Operator (emergency gunner only)
(c) W.Op./Air (G)	Operator and Gunner
(d) W.Op./Air (A.S.V.)	Operator (A.S.V.) but not gunner
(e) W.Op./Air (A.S.V.G.)	Operator A.S.V.) and gunner

(A.M. File S.95255 and A.M.O. A.1242/43).

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had not noticed that these aircrew types had been omitted from the scheme. Consequently its introduction created a paradoxical situation for those erstwhile wireless operators/air gunner who had taken the trouble on a technical course lasting twenty-five weeks to convert to the higher trade as wireless operator mechanic. Having entered a course as sergeants (aircrew) they would have had to remove the 'S' brevet on completing the trade qualification that demanded higher skill and revert to the simple 'A.G.' brevet as sign of their status. Overseas commands were puzzled by the problem of how to deal with those wireless operators (air) who qualified under the order while in the United Kingdom, then travelled to Middle East or to South Africa, where they took the full six weeks gunnery course but failed to reach pass standard. By an ad hoc decision such cases were classified on posting documents wireless operators/Air (E) and returned to the United Kingdom for employment in Transport Command, since they could not remain in overseas commands except on ground duties. After other anomalies had been discovered the first order was cancelled five months afterwards, being replaced by A.M.O. A.244/44. This order rectified most of the anomalies while retaining the incentives to promotion and efficiency in operating new radar equipment which was coming into
(1)
use.

The Dominion Air Forces did not adopt this new aircrew category with its sub-divisions. Their personnel continued to the end of the war to be trained on former courses, including the full air gunnery qualifications, and they passed into operational training units categorised as wireless
(2)
operator/air gunner.

(1) A.M. File S.95255. New radar devices such as:-
Automatic Gun Laying Turret, Beam Approach Beacon System, 'Monica'
and, later in 1944, 'Fishpond'.

(2) A.M. File S.95255.

Introduction of a Flight Engineer

A far-reaching change which affected the organisation of basic aircrew training occurred early in 1941 when through the swift progress in mechanical achievement the need arose for an additional member to relieve the pilot of some duties in four-engined bombers. Less than any other type of aircrew could the flight engineer have been foreseen before war began. Because the fundamental basis of pilot training had always been to make him competent in handling his engine, creating a systematic scheme of training a flight engineer was protracted throughout nearly three years. But in multi-engined aircraft it became necessary to install a skilled tradesman to observe the engine instruments which had to be situated some distance from the pilot's dashboard.

The idea of 'an engine watcher' germinated when Coastal Command in June 1939 asked for a Fitter (Group I) to be included in the crew of the Sunderland flying boat 'in order to report immediately any engine failure, etc... caused by enemy action.' (1) A meeting of the branches concerned was held on 22 November 1939 by the Director of Operational Requirements to consider the division of duties between the pilot and the fitter I 'engine watcher' in the Stirling and Halifax aircraft, at that time under development. At this meeting the title 'flight engineer' was coined for the new kind of tradesman, and it was thought that he could be trained to most advantage by courses at the works where the engines and aircraft were manufactured. It was considered that his training should cover also a knowledge of turret, electrical, oxygen and other installations so that he could do minor repairs during flight; and

(1) Air Ministry approved the employment of a tradesman from the ground establishment in that role, to cover the issue of flying pay for the days on which flights were undertaken. (A.M. File S.40289/I).

/that

that he must be trained in air gunnery so as to replace a casualty when necessary. A conference attended by Air Ministry staff and representatives from Bomber Command and their Groups on 8 January 1940 confirmed the need to establish flight engineers for these heavy bombers as well as for what later was named the 'Lancaster'.⁽¹⁾ As regards training the new tradesman, Training Command in March 1940 thought that any intelligent flight mechanic could do the job after a brief period with an operational training squadron. The Command therefore recommended only the air gunner course lasting six weeks and dispensed with the proposed courses at manufacturers' works.⁽²⁾ This re-action tended to darken counsel; and the over-simplified solution was not accepted by Air Ministry branches or Bomber Command. The latter throughout summer and autumn of 1940 continued to press Air Ministry for information as to when flight engineers could be expected. Although the Director of Technical Training had promptly arranged for courses in engine operation (from the user angle as distinct from maintenance) to be given by Messrs. Rolls Royce and the Bristol Aeroplane Company, prolonged discussion between the Directorates of Manning and of Establishments brought no decision concerning the requirement for this category nor any indication to Bomber Command of the sequence of training in answer to their query. At that time a training directorate could not take action to create a new aircrew category; the matter reached a standstill for eight months while awaiting Air Staff decision on policy.

The Director of Manning in December stated that there existed in the whole Royal Air Force only a total of two thousand fitters group I (and no more being trained) and about three thousand fitters group II.

(1) The first Stirling squadron formed in May 1941. (A.M. File S.40289/I).

(2) A.M. File A.54893/40.

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This potential allowed no spare skilled tradesman for flight engineer duties beyond the few so employed in Coastal Command. Moreover the conversion course from fitter II(A) or (E) to fitter I could only be accomplished in war-time by a course lasting nine months. He also drew attention to the risk of perpetuating the pristine and extravagant system of the dual-purpose non-commissioned officer, part aircrew part tradesman. In default of any policy direction, units that expected to be equipped some time in 1941 with extra heavy bombers went ahead with selecting suitable tradesmen (fitter II and flight machanic) from existing strength and with training them locally according to their own lights in the hope that ultimately these men would receive air gunner training under arrangements improvised by No. 25 Group.⁽¹⁾

Towards the end of March 1941 the position of these men was regularised through A.M.O. A.190/41 which also called for volunteers from among non-commissioned fitters to be trained on the short courses detailed above. On completing this training they were remustered with the bracket notation as flight engineers, promoted (where necessary) to the rank of temporary sergeant in their trade and posted by 'Records' to units of Bomber and Coastal Commands.⁽²⁾ The first course in response to the order, numbering ten non-commissioned officers and aircraftmen arrived for gunnery training at No.10 B. & G.S. Dumfries on 5 April 1941, and further intakes of about thirty each were expected to follow at weekly intervals to Nos. 7 and 8 B. & G. Schools.⁽³⁾ But owing to the urgent need for straight air-gunners no more vacancies

(1) A.M. File A.54893/40.

(2) The significance meant that they remained tradesmen not air-crew, whose postings were made by Air Ministry (D.P.3). Flight engineers only became a separate aircrew category in September 1942 after publication of A.M.O. A.978/42.

(3) The first course comprised one sergeant, four corporals, three L.A.C.s and one each A.C.1. and 2, all fitters II. (A.M. File S.67509 and Unit O.R.B.)

after the first entry could be spared in any B. & G.S. until October when a thin trickle of flight engineer trainees began to flow into them spasmodically at a rate of between twelve and forty a month. Since Bomber Command needed 480 flight engineers by the end of the year and a further 860 by August 1942 if production plans for heavy bombers were fulfilled, and in addition Coastal Command required 119 flight engineers (fully trained in gunnery) in 1941, the trickle proved totally insufficient. Therefore the system of local training in conversion flights and units persisted until May 1942. (1)

When the single pilot policy started in May 1942 more than 700 flight engineers per month were needed. Bomber Command wanted 220 immediately to replace the second pilots withdrawn from operational crews. The sole stock existing to meet the need consisted of 145 fitter II (E) tradesmen serving in units who had been recommended for flight engineer training under the terms of A.M.O. A.431/42. These men were hurried through a technical course in three weeks at No.4 S. of T.T. to be followed by a ground gunnery course. When it was found impossible to organise the gunnery portion of their training at St. Athan, Bomber Command accepted this batch in a semi-trained state direct into heavy conversion flights, thus omitting I.T.W., aircrew - N.C.O., and gunnery courses. (2)

The sequence of training a flight engineer had been announced in A.M.O. A.262/42 as:-

- (i) For flight mechanics (engine) - conversion course to fitter II(E) before starting the courses for flight engineer.
- (ii) For fitters - (a) Junior N.C.O. course, if below the rank of sergeant.
 - (b) I.T.W. for five weeks.
 - (c) Air gunnery course for three weeks.
 - (d) A short technical course (including that given at manufacturers' works).
 - (e) Operational training stage.

(1) Regular intakes to systematic training courses began in June 1942. See later in this section. (A.M. File S.70262/I).

(2) A.M. Files A.54893/40 and S.70262/I.

By these terms Air Ministry hoped to attract large numbers; but the shortage of volunteers continued throughout 1942 despite a campaign to comb the Service for them. Against the requirement of six thousand, only two thousand had come forward by August.⁽¹⁾ Fully ninety per cent of the applicants had to be returned to their former trade because they could not reach L.A.C. standard in the fitter trade.⁽²⁾ By a signal to the home commands Air Ministry widened the field of recruitment to include fitters II (airframe). As a further means of quick supply the Air Officer i/c Records was instructed to tap the store of volunteers for wireless operator (air) then on deferred list by offering them earlier recall to aircrew training if they agreed to be trained as flight mechanics (the shortest technical course) and subsequent qualifying for flight engineer. When these measures failed to produce anything like the required numbers the standard at entry was lowered to A.C.1 or A.C.2 mustered fitter II (E) or (A) who were recommended as suitable by the commanding officer and who passed the aviation candidates selection board. After an abortive trial-run for two months in the United Kingdom the offer was notified in September to R.A.F. serving in Canada. To help in meeting the still unsatisfied requirement, the Air Ministry in October authorised Headquarters Middle East to qualify flight engineers who were trained locally for Halifax crews.⁽³⁾ All these inducements passed almost unheeded: the technical personnel showed little inclination for flying. For example, up to the first of October only 900 flight mechanics had volunteered for flight engineer training, and very many of these fell by the wayside.⁽⁴⁾ From the beginning of systematic training courses for flight engineers which were organised in June at No.4 School of Technical Training, St. Athan, until the end of December 1942 the actual total output to Bomber and Coastal Commands only reached one thousand seven hundred and eighty.⁽⁵⁾

(1) A.M. File A.54893/40.

(2) A.M. File S.79994.

(3) A.M. File S.70262/I.

(4) A.M. File A.54893/40.

(5) A.M. File S.70262/II. Monthly output totals
were:- June 140, July 151, August 216, September 300,
October 421, November 318, December 234.

Progress of flight engineer training in 1943

In the course of the year 1943 the training of flight engineers really got into stride. As recounted earlier, though some progress towards a co-ordinated system had been made, the plans were interrupted repeatedly or altered by the pressing needs of the moment to meet a surge in expansion of either Bomber or of Coastal Command. Experience proved the truth of a prediction made on 7 December 1941 by the air officer-in-charge of training, Bomber Command. He declared that the essential qualities needed in a flight engineer were 'mental alertness, intelligence and keenness. Outstanding ability as a fitter is not necessary since ordinary maintenance work is not required. It is increasingly evident that the flight engineer's position as a member of an aircrew is just as important as that of any other member.' (1) At that early date he advocated aircrew selection procedure followed by initial wing, air gunnery course, basic and technical training finishing with a normal period in a heavy conversion unit in Bomber Command. The Directors of Flying Training and of Technical Training at once supported these ideas. They wanted to form an initial training wing for flight engineers as a means of improving the physical tone of serving tradesmen who had led a sedentary life for several years, and of introducing them in a proper manner into the category of aircrew as distinct from the outlook of bench workmen. But for more than twelve months no accommodation could be found for what was considered a luxury by the Department of the Air Member for Supply and Organisation, having regard to the training that all fitters group I had received formerly when apprentices at Halton. Such tradesmen were the only source of supply contemplated for the new role in early 1942. It turned out that there were practically no applicants from that source and so poor a response from tradesmen in other trade groups that admitting entrants from civil life became unavoidable. The serious shortage of flight engineer candidates throughout 1942 did not allow time for a course at an initial training wing; but the prospects of having to organise training for direct entrants altered the position materially. By February 1943 the Air Member for Supply and Organisation

(1) A.M. File S.70262/I.

authorised a reorganisation of No.14 Initial Training Wing, Bridlington, by which a half-wing for 600 flight engineers was established in addition to the existing wing containing 1,200 air gunners. The first intake arrived on 26 April 1943.⁽¹⁾

A co-ordinated system of basic training for flight engineers was not delayed so long as the initial course, since facilities for this already existed in No.4 School of Technical Training, St. Athan. An intake numbering one hundred fitters groups I and II on 30 May 1942 was followed a week later by a second hundred. Their course lasting three weeks was limited to instruction on the particular aircraft (Halifax, Stirling or Lancaster) used in the squadrons to which they were posted.⁽²⁾ But the supply of these tradesmen quickly dried up partly owing to the conditions of aircrew service then offered and partly because the kind of man who enlisted to become a fitter was more enthusiastic about engines than about flying. During the last quarter of 1942, when this grave shortage restricted full expansion of the bomber force, straight-through training was organised embracing the essentials for an operational role, not as ground tradesmen, to be undertaken by all flight engineer cadets.⁽³⁾ After having been accepted by the aircrew candidate selection board they passed through the reception centre to the initial training wing for six weeks, thence to No.4 School of Technical Training for a course that varied in length between seven weeks for fitters II(E) and twenty-four weeks for direct entrants. The course comprised two parts. First, a preparatory section graded thus with the trade on

entry:-	<u>Weeks</u>
Fitters II(A)	8
Flight mechanics (engine)	7
Flight mechanics (airframe)	13
Direct entrant	17

Second, type-training built around one special kind of aircraft during seven weeks. Only the second part was taken by serving airmen mustered fitter II (engine). The types of aircraft on which flight engineers were

(1) A.M. File S.79453.

(2) A.M. File S.79994.

(3) A.M. File A.54893/40.

trained during 1943 were:-

Sunderland, Catalina, Liberator, Stirling, Lancaster, Halifax, Fortess, York. (1) On completing successfully these courses the cadet attended an air gunnery school for the course suitable to his posting and then moved to the heavy conversion flight corresponding with his type-training course to prepare for serving in a squadron. The conversion training lasted six or eight weeks depending on the amount of flying practice, a minimum of twenty hours. Towards the end of 1943, a scheme was adopted of forming at heavy conversion units and flights a 'pool' of flight engineers four weeks in advance of the other crew members. By flying as a passenger the trainee overcame any tendency to air sickness and he observed the practical application of his duties free from responsibility. Thus he was ready to pull his weight as a member of a crew when it assembled to receive a month's polish before undertaking operational sorties. (2) The technical courses organised at No. 4 School of Technical Training had an output of 3,396 for the twelve months ending 31 May 1943. (3)

(1) A.M. Files S.70262/I and A.54893/40.
A table recording the actual output of flight engineers^{is} included at Appendix 47.

(2) A.M. File C.36706/48/I.

(3) A.M. File S.70262/II.

The monthly output from the technical courses Nos. 1-52 was:-

<u>1942</u>		<u>1943</u>	
June	140	January	280
July	151	February	230
August	216	March	334
September	300	April	305
October	421	May	467
November	318		
December	234		
		<hr/> Total in 12 months - 3,396 <hr/>	

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The inauguration of this very complicated structure designed to produce flight engineers was not unattended by growing pains. At the beginning of 1943 it was noticed that the rate of failure in the examination that concluded type-training reached twenty-five per cent (in the case of fitters II (airframe)). After being given further intensive training for a fortnight and being allowed to take the examination a second time, the wastage through failure dropped to an average of five per cent of the intake.⁽¹⁾ Wastage on the technical course continued high during the second half of 1943: therefore early in 1944 the type-training part was extended to nine weeks for all cadets, but without the option of re-sitting the examination. The following analysis of the numbers of flight engineer cadets passed out from technical courses between June 1942 and 31 May 1943 indicates the permanent wastage to have been reasonably small:-⁽²⁾

	Sunderland	Catalina	Liberator	Stirling	Lancaster	Halifax
Total taken into work-shops	193	223	45	922	1697	1519
Total passed out	154	185	15	632	1228	1178
Training extra Time	39	38	30	290	469	341
	35	15	6	196	324	263
Permanent loss	4	23	24	94	145	78

In the rush period of expansion during the summer months the smooth sequence of training had to be curtailed, some cadets having to omit altogether the gunnery portion because Bomber Command needed them urgently, others having missed all privilege leave for a year, and many serving fitters having to be taken direct from workshops in a unit to the aircrew course at St. Athan without passing any of the intermediate stages.

(1) A.M. File A.54893/40.

(2) A.M. File S.70262/II.

The acute lack of instructors qualified by operational experience as flight engineers caused many difficulties for Technical Training Command and checked the flow of trainees during 1943. To enlarge the output the Air Ministry gave authority in July and August for the remustering as flight engineers of 95 airmen who had been trained locally in squadrons under Nos. 1, 4 and 5 Groups of Bomber Command. This was a special measure to meet a deficiency in those groups.⁽¹⁾ By the end of the year the flow of flight engineers caught up with the demand and shortly afterwards even exceeded it, and posed an awkward problem concerning the disposal of the surplus.

Flight engineer training during 1944 and 1945

Like other technical courses basic training for flight engineers ran with a smooth rhythm during the last two years of war: the numbers came off the production line in No.4 School of Technical Training according to plan, after the type-training portion had been increased from seven to nine weeks in March 1944. The chief reasons for the extra fortnight were:- (a) additions to the syllabus as a result of liaison with operational commands, and (b) cadets in 1944 were not so experienced in fitter trades as their predecessors. An examination of the passing-out figures during six months ending with February 1944 showed that thirty per cent failed to qualify at the end of seven weeks of the type-training course but that further training for a fortnight had reduced the failures to about five per cent. In comparison, the wastage through all causes during the whole year 1944, calculated on the total intake of 7,380, averaged 7.35 per cent. The new syllabus allotted 54 hours to technical theory, 234 to technical training, and 108 hours to aircrew wing instruction, all of which ran concurrently. A prominent feature was the use of synthetic trainers. Many types of four-engined aircraft, sectioned after crashing, were supplied to the school as well as mock-ups and working models of oiling and fuel systems. Engine handling trainers were made so that each cadet experienced a trip under conditions of day and night with realistic instrument readings at all stages. Classes were kept small: a

(1) A.M. Files S.79994 and C.36706/48/I

proportion of one instructor to six pupils permitted individual attention for every cadet and enabled instructors to record careful assessments of progress.⁽¹⁾

The extended course would have strained the resources of the school beyond its maximum capacity of 3,500 under instruction but for a compensatory reduction that occurred at the same time. This happened in the following way. A preliminary course for Royal Canadian Air Force flight engineers had been started in November 1943 at the Technical Training School, St. Thomas, Ontario. After training for 23 weeks these cadets were to qualify by passing the type-training course in the United Kingdom. But in March 1944 the Canadian authorities decided to organise their own type-training because they disapproved of sending aircrew personnel out of the dominion without brevet and rank for the category. To conduct the advanced course they asked for help from the Royal Air Force in the shape of fourteen tradesmen instructors, four multi-engine aircraft, several power units, and other heavy equipment. At first they suggested an allotment from the factory in Canada of the very latest Lancaster Mark X aircraft; but the Air Member for Supply and Organisation refused to lessen the bomber offensive by diverting the newest types from their lawful purpose. He authorised in May the despatch from Great Britain on the highest priority of four Halifax Marks II or V together with the other equipment. The consignments enabled full training to start in July at St. Thomas. The total output of flight engineers from this school until the British Commonwealth Air Training Plan ended in March 1945 amounted to seventeen hundred and six. In addition to this number, 207 flight engineers of R.C.A.F. received their type-training at No.4 School of Technical Training. The flight engineers who qualified in Canada needed only a short refresher course at No. 4 S. of T.T. to prepare for duty in R.C.A.F. squadrons operating with Bomber Command. The flow of 400 per week lowered the peak population in pupils at St. Athan by 400, which kept within its compass and avoided any increase in domestic or instructional staff. Owing to

(1) E.R.P.312 dated 15 March 1944. Aircrew Training Bulletin No.25 refers.

the manpower shortage, most problems in training at that stage of the war had to be solved in terms of the possible supply of ground personnel.⁽¹⁾

In the summer of 1944 a change in the duties performed by flight engineers added to the curriculum a certain amount of basic flying instruction. At the suggestion of Bomber Command the flight engineer became responsible for flying a heavy bomber home in the event of casualty to the pilot. Formerly this duty in Halifax and Stirling aircraft had devolved upon the air bomber; but no case of its use had been discovered. When crew duties for Lancasters had been distributed the flight engineer had been annotated as pilot's assistant, since his crew station kept him in close touch with the pilot. Some flying practice had been included in the course at the heavy conversion unit. The command wished to increase the amount of air navigation in the syllabus for air bombers and to eliminate from it all instruction as pilot's assistant. The Air Ministry accepted the plan and, in June 1944, amended the crew schedules for Stirling and Halifax bombers. Owing to accommodation shortage at bomber operational training units, they could not intake flight engineers; so the Air Ministry at once arranged to install twenty-four Link trainers in No.4 School of Technical Training and for instruction in airmanship to be given to flight engineers in heavy conversion units. The latter course was extended therefore to eight weeks from July 1944.⁽²⁾

As one means of employment for a portion of the multitude of pilots waiting in No. 7 Personnel Reception Centre, Harrogate, and having regard to flying conditions in the Far East the Air Member for Training (advised thereto by the Director of Bombing Operations) proposed in August that second pilots should be trained in flight-engineer duties in place of direct entrants. The general plan included a new crew composition for 40 squadrons of Lancasters in Bomber Command that, after the German war

(1) A.M. File C.36706/48/I. A.M.T. secret folder Training 3/8.
Final report to the Supervisory Board, B.C.A.T.P.

(2) A.M. Files C.36706/48/I. and S.40289/III.

ended, would be deployed with Liberator squadrons against Japan. The new crew contained two pilots, both capable of undertaking flight engineer duties (including refuelling in the air), plus one straight air gunner instead of a flight engineer/A.G. A reduced course lasting six weeks at No. 4 S. of T.T. was considered sufficient for N.C.O. pilots, followed by six weeks in a heavy conversion unit and two or three weeks at a Lancaster Finishing School. But in actual practice the period at St. Athan varied between eight and seventeen weeks. From the lower levels of multi-engine pilots at No.7 P.R.C. sixty per week were selected for this training, inspired by the hope of more quickly being employed on operations in the role of second pilot/F.E. An unpleasant side to this scheme appeared when an equal number of cadets in the initial stages of training for flight engineer was diverted to other trades from aircrew. Recruiting for flight engineers closed during six months from November 1944: it reopened for only four weeks before hostilities against Japan also ceased.⁽¹⁾ The war-time organisation terminated by the end of December and a new system suitable to peace-time need ushered in the year 1946.

Air Gunnery Training during the first half of 1944

As the year 1944 opened plans to expand the air forces were pursued with tireless vigour that exerted varied pressures on the training of non-P.N.B. categories. The first manifestation brought an urgent demand for large numbers of air gunners who were needed in very heavy bombers and very long range aircraft then being supplied at an increasing rate per month to squadrons in Bomber and Coastal Commands. The Director-General for Air Training stated in February 1944 that 1,000 additional gunners were required by Bomber Command between March and July, and thereafter 140 per month to meet the special role in manning the 0.5 inch Browning gun which was being fitted into the mid-under position in Lancasters. Also, the Liberator squadrons in the Mediterranean Allied Air Force and in Air Command South East Asia required 400 air gunners immediately,

(1) A.M. Files C.36706/48/I and S.104346.

followed by a monthly draft numbering one hundred and fifty.⁽¹⁾ Besides these known requirements, three Liberator squadrons in India (rising to five by September) also needed gunners. To meet these demands Flying Training Command devoted the capacity of nine and a half standard schools (240 pupils each) to training air gunners from mid-February to mid-May 1944. To provide wireless operator mechanics, flight engineers and flight mechanics (E) for these crews only 120 vacancies at each of two air gunnery schools were available. Fortunately, the huge surplus of wireless operators (air) existing at that time could supply enough and to spare in that category for all known demands.⁽²⁾ Although the duration of the gunnery course remained unaltered at eight weeks in three winter months and seven weeks for the rest of the year, the persistent drive produced 6,132 air gunners during the first half of 1944. The peak output was reached in the month of April when 1,415 aircrew sergeants graduated from air gunnery courses.⁽³⁾

Unfortunately this effort was made in vain. The speed at which industry produced and fitted H2S into Lancaster and Halifax aircraft by June 1944, cancelled the special demand for at least 1,253 air gunners who were to have manned the mid-under gun. For the instrument occupied that space in the aircraft and thereby eliminated the need for a third air gunner in the complement.⁽⁴⁾ Thus within three months the demand for straight air gunners fell by more than thirty per cent, a valuable saving in manpower at a crucial period of the war. There is no gainsaying the fact that the accuracy in target-finding through the use of H2S in heavy bombers constituted an overall gain which quite over-weighted the plight of hosts of air gunners who suddenly became redundant, many of whom had to be diverted subsequently to some ground trade.

(1) A.M. File S.40289/III.

(2) The two schools referred to were No.1 A.G.S. Pembrey and No. 9 (O) A.F.U. Penrhos. A.M. File S.40289/III, and T.Arm in folder m2/6a.

(3) See Appendix 48.

(4) A.M. File S.40289/III. H2S is an airborne radar transmitter receiver operating on centimetre wavelengths which gives on a cathode ray tube a map of the area over which the aircraft is flying. It was used for navigational and target location purposes.

Wastage during training

A second manifestation of the pressure of expansion directed attention to the problem of wastage during training. Owing to a long-standing disparity between the numbers volunteering for P.N.B. and non-P.N.B. categories the problem reached an acute stage during the winter of 1943/44. An over-insurance against wastage in training as well as in war casualties had caused severe congestion in the initial stages of training, and in consequence the period on deferment for P.N.B. volunteers had been lengthened in many instances to more than eighteen months. By early March 1944, 21,500 P.N.B. cadets were waiting in aircrew despatch centres and initial training wings: the supply under training was more than enough to meet the entire requirements for overseas draft up to the end of 1944.⁽¹⁾ At the same moment there was a disturbing deficiency in entrants to the non-P.N.B. categories, particularly as air gunners or flight engineers, and consequently men of inferior quality were accepted for training for those categories. The Air Member for Personnel did not wish to break faith with the volunteers to whom an implied promise of employment as P.N.B. aircrew had been given several months previously, yet the needs of the Service must be supplied. The chief obstacle to a solution of the problem was the difference in pay and status between the two main aircrew groups. After the matter had been studied and discussed by the branches concerned the Air Council agreed to an improvement in the status of air gunners and to an increase in the number of commissions to be awarded to non-P.N.B. aircrew.⁽²⁾

An investigation into the methods of selection and classification of aircrew was made with the aim of reducing the wastage due to failure on training courses. For, it had been observed, for example, that in air gunnery schools this wastage had increased from 4.3 per cent in

(1) A.M. File S.100001.

(2) A.C. Conclusions 5(44), 3 May 1944. This move connects with the account given earlier in this chapter.

January 1943 to 13.4 per cent in December of that year.⁽¹⁾ After consulting Flying Training Command the Air Member for Personnel agreed to a revised system of classification being adopted from 1 April 1944 under which the potential ability of all aircrew aspirants was measured and their aptitude for a particular category was revealed by means of a series of tests. Similar aptitude tests had been developed and their efficacy proved by use during the foregoing seven years in the air forces of the United States and of Canada. They indicated the candidate's qualities of general intelligence, skill in mathematics, mechanical and instrument comprehension, observation, brain co-ordination, and auditory morse aptitude.⁽²⁾ When the cadet had been examined at the aircrew reception centre he moved forward to the elementary ground course that fitted his capability and that conformed with Service need - as far as it could be forecasted when the posting occurred. Since only two per cent of the population possessed the right qualities for training as pilots, this new system saved much abortive effort in grading for flying. It also helped to provide a sufficiency of men to enter the remaining categories, although the prerogative called 'shadow selection' exercised by aircrew boards rather hampered its effectiveness until the discretionary power was withdrawn from them towards the end of 1944.

A further cause of wastage among air gunners was from trainees withdrawing at their own request. Flying Training Command had observed the nuisance because 'many men joining the Royal Air Force are doing so to avoid at all costs being drafted into the army or to coal mines. This necessitates volunteering for aircrew, since it is now (March 1944) the only means of entry, though they have little desire to become air gunners.... In practically all cases of withdrawal while training the reasons given are domestic loyalties which override considerations of national duty.')

Such men wasted time and effort in the training organisation and their presence in basic schools had an adverse effect on the morale of others. A digest of voluntary withdrawals from air gunnery training in the United

(1) A.M. File S.99152.

(2) A.M. File S.82828.

Kingdom during the twelve months ending March 1944 is shown below:-(1)

Date	Stage of Withdrawal		Total Withdrawals	Total Intake From All Sources
	A.C.R.C. and I.T.W.	E.A.G.S. and A.G.S.		
<u>1943</u>				
April	107	38	145	851
May	107	73	180	941
June	52	20	72	1,441
July	228	88	316	1,409
August	32	74	106	1,442
September	180	70	250	2,053
October	123	107	230	1,293
November	132	103	235	772
December	127	113	240	1,119
<u>1944</u>				
January	92	114	206	1,038
February	128	107	235	1,226
March	176	113	289	1,400
Totals	1,484	1,020	2,504	14,985

The distribution of withdrawals at own request among three types of entrant was:-

- (a) Serving airmen - 33 per cent.
- (b) Direct entrants - 57 per cent.
- (c) Reselected from training in another category to air gunner - 10 per cent.

(1) A.M. File S.99151. The monthly percentage of wastage through failure to qualify on air gunnery courses is recorded in Appendix 48.

The disposal of these airmen who withdrew was arranged according to their manner of entry into aircrew training. Classes (a) and (c) reverted to their ground trade or were taught a trade, if not qualified. In class (b) above, those who came from a reserved occupation were sent back to that civilian employment, and other direct entrants were transferred to the navy or the army.

Air gunnery instructors

The inflated demand for air gunners that heralded the new year 1944 brought in its train a two-fold increase in air gunnery instructors. Considering the long tradition of No. 1 Air Armament School, Manby, in training instructors it seemed fitting (in 1941) that the reorganised courses for instructors in air gunnery should continue there, although this act usurped from the Central Gunnery School one of its original functions.⁽¹⁾ During the next four years these courses provided a channel for employing non-commissioned air gunners who had completed one tour on operations, or for those who were medically unfit for offensive sorties. At the end of 1941, control of the courses was taken over as a going concern by the Air Ministry (D.T.F. and D.P.5.) from Headquarters No. 25 Group. On a six weeks course, the intake was thirty each three weeks. Early in 1943, when the expansion drive began to gather impetus, the intake rose to forty and included wireless operators/air gunner as well as straight air gunners, both kinds being needed to staff schools and units engaged in basic or operational training and to release for operations instructors who had completed a year or longer. The new syllabus, enlarging the practical instead of the theoretic fields of study, included besides normal subjects ten hours of flying in eight exercises for each pupil, and sixty hours (20.8 per cent of the total) on the theory and practice of technical instruction.⁽²⁾ At No. 1 Air Armament School this last feature formed an integral part of every course for instructors. Places were allotted as follows:-

- | | |
|-----------------------------|------|
| (a) Bomber Command | - 18 |
| (b) Coastal Command | - 4 |
| (c) Flying Training Command | - 18 |

(1) The C.G.S. resumed custody of its natural offspring in November 1945 on moving to Leconfield.

(2) A.M. File S.65438.

The school was authorised to return to his parent unit any pupil who proved unsuitable or appeared unlikely to qualify as an instructor.

The current formula used for reckoning the requirement of air gunnery instructors in basic training was one per ten cadets plus nine to each hundred and twenty pupils in a school. Thus for example No. 7 A.G.S. Stormy Down, having a pupil population numbering 360, needed 63 air gunnery instructors. With the dual purpose of curtailing the flow of instructors and giving employment to airmen aircrew who had become permanently unfit for full flying duties, two new trades were introduced at the end of 1943, viz., air bomber instructor, group I and air gunnery instructor, group III.⁽¹⁾ From the Reselection Centre at Eastchurch the non-commissioned officers took the appropriate course at Manby and remustered in their new trades.

When early in 1944 expansion reached its peak, the annual turnover of instructors in all stages of air gunnery training exceeded 1,300, made up as follows:-⁽²⁾

Flying Training Command

9½ A.G.S.s.	452	
C.G.S., A.A.S., (o) A.F.U., E.A.G.S.	<u>138</u>	590

Bomber Command

22 O.T. Units	484	
15 H.C. Units	150	
3 Lancaster Finishing Schools	18	
Bomber Development Training Flight	<u>10</u>	662

Coastal Command - O.T. Units 132

Air Defence of Gt. Britain - 3 O.T.U. and 1 H.C.U. 14

Total annual requirement 1,398

To meet this demand for air gunnery instructors (then on a seven weeks course) from 1 April 1944 the intake was raised to fifty-five at alternate intervals of four and three weeks, vacancies being allotted in proportion to need:- Flying Training Command - 31; Bomber Command - 18;

(1) A.M.O. A.1011/43.

(2) A.M. File S.65438.

Coastal Command - 4; Air Defence of Gt. Britain and 2nd Tactical Air Force - one each. As the total number of 110 N.C.O.s on this course proved difficult for No. 1 A.A.S. to manage, particularly in regard to flying hours and administration, when taken in conjunction with seven other courses being conducted at Manby at the same time, the sequence of entry to the air gunnery instructor course was altered in May to forty, forty, thirty at intervals of two; two, and three weeks respectively.⁽¹⁾ The total number of pupils and the ratio of vacancies remained the same.

The reduction in training during the winter of 1944, when several air gunnery schools and operational training units were disbanded, affected the numbers attending the air gunnery instructor courses. Moreover, the new permanent trade of air gunnery instructor brought a saving in turnover of personnel to operational employment. Therefore in February 1945 its pupil population was reduced to eighty-seven, having three intakes of twenty-nine on the same ~~rhythm~~ as previously but allotted differently :- to Flying Training Command - twelve; Bomber Command - eleven; Fighter, Coastal Commands and Dominions personnel - two each. This plan proved short-lived. Intakes to the air gunnery instructor course had to be suspended during April, May and June (except for one course of forty) in order to allow room at Manby for special short courses dealing with the latest development in air gunnery training, at first called 'Phase Checks' but later 'Standard Efficiency Tests.' By the time that intakes to air gunnery instructor courses were re-started the war against Germany had ended and the whole training scheme had entered 'Phase II', which made possible a long-desired extension of the course to eight and a half (soon to be ten) weeks, though working to the same syllabus.⁽²⁾

(1) A.M. File S.65438.

The other courses carried on at Manby in May 1944 were Advanced Armament (mostly at Fort Halsted); Specialist Armament Officer; Armament Officer Refresher; Bombing Leader; Air Bombing Instructor; Senior Armament Instructor; and two short courses on special instruments for sighting and bombing.

(2) A.M. File S.65438.

Standard Efficiency Tests are described later in the narrative.

A New Aircrew Category - Wireless Operator Mechanic (Air)

The dearth of wireless operator mechanics willing to be trained in air gunnery created during the first quarter of 1944 a serious situation for Coastal Command whose operations were likely to be hindered unless the supply of such tradesmen kept pace with its expansion. During several months the command had been taking the best of their wireless operators (air) and using them as substitutes for the more skilled tradesmen. After a short course in maintaining signals equipment (lasting fourteen weeks) these airmen acquired enough skill to handle running repairs to the installations in flying boats while being airborne. They could not be remustered to the higher trade because they were unequal to many tasks belonging to full ground employment as wireless operator mechanics.⁽¹⁾ But, for the very long sorties on detached duty undertaken by many flying boats in 1944, and in the complement of Liberators and Catalinas, Coastal Command considered a fully qualified tradesman necessary. By mid-summer it was decided to stimulate recruiting among serving airmen by introducing a new aircrew category - wireless operator mechanic (air) - selected from the trades of wireless operator mechanic, wireless and electrical mechanic, or wireless operator (air) who had finished one tour of operations. After selection procedure like other categories, volunteers passed aircrew reception centre, initial training wing (eleven weeks), then took the aircrew wing course for eight weeks at either No. 2 or No. 4 Radio School. Next they entered No. 1 Radio School, Cranwell, for a special conversion course extending through eighteen weeks. Their basic training finished

(1) If these tradesmen ceased to be employed as aircrew they reverted to their basic trade as wireless operators until such time as they completed a short form of conversion course on maintenance of ground radar equipment at No. 1 Radio School, when they gained group I status. (A.M. File A.138665/40).

/with

with a full air gunnery course (then seven weeks). This training over a period of at least 40 weeks qualified them in the category: they remustered to group I trade and were posted to the Coastal operational training unit for a final course that lasted approximately ten weeks. All existing wireless operator mechanics/air gunner were remustered to the new aircrew category retrospectively as from 13 March 1944, and administrative instructions authorised promotion and award of brevet on commencing the gunnery course.⁽¹⁾

Intakes were planned at the rate of 20 per week for three months, reduced in September to 20 per fortnight. The Central Trade Test Board visited Nos. 2 and 4 Radio Schools and tested volunteers among the wireless operators (air) who were waiting for posting to air gunnery schools. Aptitude and psychological tests discovered a large supply of men suitable for conversion; from No. 2 Radio School 248, while from No. 4 Radio School 482 candidates were chosen, the latter being part of a 'pool' numbering 1,781 sergeants wireless operator (air) who were waiting for vacancies in operational training. From this source the modest needs of Coastal Command were over-subscribed to the extent that within a fortnight of the A.M.O. appearing in print (21 September 1944) intakes to training for the new category had to be stopped because a large surplus would have accumulated steadily from 14 November onwards.

The organisation of training and the new category were not adopted by any of the Dominion Air Forces.

This new aircrew category led a short and uneventful life. Victory over Germany added strength to the recommendation by the Sholto-Douglas committee appointed to consider the composition of air crews who thought that the aircrew trade of wireless operator mechanic (air) was no longer necessary. The trade was declared obsolescent and all posts for them were abolished in June 1945: non-commissioned officers in the trade, together with all airmen flight mechanics (E)/air gunner,

(1) A.M. File A.138665/40.
A.M.O. A.916/44 as amended by A.265 and A.347 of 1945.

not required by Coastal Command for the war in the Far East immediately became redundant. Basic training for this category finally ceased in October 1945.⁽¹⁾

Moves to improve gunnery training

Many times during 1943 Bomber Command had complained about the low standard of skill in air gunnery. And the Air Officer Commanding-in-Chief, Flying Training Command, confirmed the opinion. In April 1944 he wrote:-⁽²⁾

'I have been concerned for a considerable time at the type of man selected to non-P.N.B. aircrew, particularly for the air gunner category. This is reflected in the number of failures at air gunnery schools and the poor material throughout the Service from which to select gunnery leaders and potential air gunnery instructors.'

The Air Officer Commanding, No. 25 Group had initiated an experiment with a straight-through course combining elementary and advanced basic training; but accommodation difficulties interfered with its being adopted generally. He also sponsored 'trials' to find the 'saturation point' in air-to-air firing exercises, i.e. continued practice until the cadets ceased to improve. These small scale tests did not produce evidence sufficiently conclusive to warrant radical changes in methods of training though they pointed to the right line of attack. Further impulse to a swelling movement was added by the Inspector General in June 1944. In Report No. 325 he declared that 'there is no branch of training about which we know less than we do about air gunnery and there is no branch in which scientific investigation might be pursued with greater profit.'⁽³⁾ His critical survey brought prompt action. On 10 July 1944 the Air Member for Training set up a panel comprising

(1) A.M. Files A.138665/40 and S.40289/III.
(2) D. of M. B.J.M.2/6A Part 2.
(3) A.H.B./II/54/41.

officers and civil specialists from the Air Ministry, Headquarters Flying Training Command and No. 25 Group who had had experience in all stages of this kind of work in research. Under the guidance of D.D.T. Arm., the members were instructed to investigate the whole field of air gunner selection and training up to the end of the operational unit stage, with particular reference to (a) the methods and standards of assessment, (b) the length of courses, (c) continuity in syllabuses, and (d) causes of wastage.⁽¹⁾ The team of experts visited many establishments and units up to A.G.S. stage during the next three months and in October presented an interim report recommending action on many points, in particular:-

- (a) The system known as 'shadow selection' should cease. Aircrew Candidates Selection Boards should confine their opinion to suitable or unsuitable for aircrew.
- (b) The A.C.S. boards should reject all candidates who did not reach the minimum standard in tests of intelligence and education. The discretionary power to admit a candidate to train as an air gunner in spite of failure in these tests, formerly permitted should be rescinded in the light of the manpower situation.
- (c) All armament subjects should be dropped from the syllabus of initial training wings as this stage ought to be devoted entirely to producing good N.C.O. material.
- (d) One air gunnery school should be reserved immediately wherein practical tests concerning methods of instruction, quality and scope of qualifying examinations, and cognate matters could be conducted on a representative body of cadets with a view to devising suitable standards of teaching and of testing that could be uniformly applied in all air gunnery schools.

(1) A.M. Files S.99152 and S.101247/I.

- (e) All examinations should be of an objective type.
- (f) Examinations and assessments at air gunnery schools should be controlled by a central board under the direct jurisdiction of Flying Training Command.⁽¹⁾

The main proposals were implemented as matters of urgency. The impressive evidence supporting the statement that 'the air gunner received his present assessment purely on his ability as shown during the final board which covers his knowledge of ground subjects' proved the necessity for new ideas to percolate through this branch of training. No. 1 Air Gunnery School, Pembrey, was staffed and equipped with 27 Wellingtons and 19 Spitfires specially to carry out saturation tests in the matters listed under sub-heading (d). The first 'guinea-pig' entry numbering ninety cadets, chosen in equal parts from the top and bottom of the initial training wing products, arrived on 7 October 1944: the other 'control' entries (courses Nos. 111 and 112) followed on 7 November and 3 December. Their progress through each section of the syllabus was studied by a research team and members of the panel. Under these conditions, and the bad weather (even for winter) having interrupted flying, the duration of 'control' courses extended to twenty-two weeks; but they provided much useful information towards improved methods of training.⁽²⁾

By the end of October 1944 a start was made to re-equip all air gunnery schools with Wellingtons and Spitfires, and the normal course was lengthened to ten weeks in summer and twelve in winter without augmenting the syllabus, in order to allow time for cadets to absorb technicalities and to permit more practice in air-to-air firing. Throughout the winter the panel continued its investigations in

(1) A.M. File S.99152.

(2) Detail of course No. 110:- Intake 90: output 83: duration 148 days: wastage 7.8%: hours flown per pupil 52. T.P. Monthly Stats March 1945. A.M. File S.101247/I.

operational training units and group gunnery flights. The complete report, published in February 1945, created lively interest and some adverse comment on certain recommendations. The most important change in method of teaching and assessment in air gunnery that was introduced as a result of the enquiry came after the German war ended; it concludes this chapter with the section headed 'Standard Efficiency Tests.'⁽¹⁾

The war-time organisation closed

Even while plans were being prepared to improve the methods of instruction other plans were started during the summer of 1944 to reduce considerably the size of the organisation for training non-P.N.B. categories. The paradoxical situation arose partly because a large surplus of all aircrew types (especially of pilots) existed, and partly because the end of war against Germany began to appear in the middle distance. Retrenchment began with the initial training wings for air gunners at Bridgnorth. No. 82 I.T.W., the capacity of which until April 1944 had stood at 1,800 cadets, was disbanded on 31 May. No. 81 I.T.W. reduced from 1,000 to 600 on 14 August, closed altogether on 6 October 1944: and No. 80 I.T.W. was reduced to one-half its former size with an establishment for 600 pupils on 16th of the same month. It alone continued to provide initial training until war ended for the severely depleted flow of entrants to air gunnery training. For, there existed in the various schools and pools of graduates who awaited onward posting a big enough supply to meet any demand likely to arise within twelve months. While arrangements were being made to transfer hundreds of aircrew cadets, mostly in P.N.B. categories, to schools of technical instruction to qualify for ground trades in the Royal Air Force, or to the other fighting Services, several hundreds were sent on loan from the aircrew reception centre to the Commissioner for the Midland Region to do agricultural work. Another method of absorbing part of the large surplus of pilots was instituted in September 1944: those who had been suspended from training at elementary or Service flying

(1) A.M. Files S.99152 and S.101247. D. of M. B.J. M.2/3.
Aircrew Training Bulletin No. 21.

training schools were re-selected into the air gunner category and they entered basic training at the gunnery school stage.⁽¹⁾

New radar appliances such as the automatic gun-laying turret, 'Fishpond', and the Mark IIC gyro gun-sight were issued to front line squadrons in the summer of 1944. To understand and operate correctly these delicate instruments demanded air gunners who possessed very high intelligence together with strong power of concentration over long periods. The Air Member for Personnel used this fact as a lever to obtain an increase in the pay of air gunners and to raise thus their status to a level with the other non-BN.B. members. Also the basic course at air gunnery school had to be extended to twelve weeks so as to admit instruction in handling the new instruments. And the standard for graduation had to be raised after August 1944 in order to eliminate the weaker trainees. The total training of an air gunner in the United Kingdom then occupied 40 weeks. This represented an increase of over 500 per cent in the time spent on basic courses and 300 per cent longer than the total period allowed in 1940 for this category.⁽²⁾ From 1 September 1944 the training of air gunners was organised as follows:-

	<u>Weeks</u>
Initial Training Wing	6
Elementary Air Gunnery School	6
Air Gunnery School	12
Operational Training Unit	10
Heavy Conversion Unit	6
<u>Total</u>	<u>40</u>

After having been built up laboriously through five years of war the air gunnery schools, their population depleted, closed within a few months. By the beginning of September 1944 two schools disbanded, No. 7 A.G.S., Stormy Down and No. 8 A.G.S., Evanton: No. 9 A.G.S.,

(1) S.D.155/1944/885: D. of M. B.J. M.2/6a Part II: A.M.O. A.792/44: A.M. File S.101247/I.

(2) A.M. File S.101247/I.

'Fishpond' was the code name for the attachment added to 'H2S' on which approaching aircraft were reflected on a radar screen. It covered 360 degrees in plan and up to 10 degrees vertically. Used particularly to give warning of attack from below, the instrument superseded the crew members who formerly lay along the centre bottom of the fuselage keeping a sky look-out.

Llandwrog and No. 4 A.G.S., Morpeth were put under 'care and maintenance' before the year ended. The establishment of No. 12 A.G.S., Bishops Court, Northern Ireland, was reduced to 160 pupils in November 1944; but the intakes during the next few months did not reach that total because the school was reserved for pilots/flight engineer and wireless operators (air) diverted to air gunner employment. The last course finished on 31 May 1945 and the school disbanded three weeks later. Intakes of straight air gunners had long ceased; and the Douglas Committee found no reason to include this rather limited specialist in the composition of post-war crews. They contended that all tradesmen aircrew should be capable of undertaking full maintenance and repairs in their appropriate spheres. Thus the new categories were to be styled:- radio operator (air), flight engineer, and air gunner/armourer, all with equal status and pay and trained to a high technical standard. These views combined with the cessation of hostilities, hastened the closing of the remaining schools. By October 1945 only two were in commission, No. 10 A.G.S., Barrow and No. 11 A.G.S., at Andreas, Isle of Man. The former, reduced to a capacity of 130, was earmarked for tradesmen serving in the Royal Air Force or Allied and Dominion Air Forces. As these sources of supply dwindled it continued a wavering and uncertain existence until it finally closed in October 1946. The greater part of the population (limited to 200) of straight air gunners at No. 11 A.G.S. was made up by batches of ex-prisoners of war fit to be rehabilitated by refresher courses, and a few air gunners belonging to foreign or Dominion Air Forces. A year later this school moved to Jurby, Isle of Man, where it stayed, the sole remnant of basic gunnery training in the United Kingdom.⁽¹⁾

Standard efficiency tests

During their investigations the panel set up by the Air Member for Training were impressed by the system used in the United States Army Air Force to create a high standard of manipulative skill among

(1) A.M. Files S.101247/II and S.40289/III.

air gunners. Through all stages of training the main emphasis was placed on what the air gunner had to do rather than on what he ought to know. By repeated practice in feeding the ammunition belt or in managing the turret and so forth, he was taught to eliminate unnecessary movement. This practical instruction by means of a series of time and motion studies had been reduced to a simple form of 'drills': that is, turret drills, gun cleaning drills, prevention of stoppage drills, harmonization drills, and many others. Every pupil was taught to follow a definite sequence of movement in each drill which he practised to the point where he reached accuracy in the quickest time. Before he passed to learning the next 'drill' his competence was tested by an examiner according to the standard checking list that applied uniformly in all schools. This method of assessing a pupil's progress was called 'phase checking'. To ensure that identical conditions of testing prevailed and that a universal pass standard was observed, every examiner was constrained to hold rigidly to the instructions issued by the central authority. For those parts of the syllabus that did not lend themselves readily to a practical 'phase check', such as aircraft recognition or sighting theory, and similar matters, instead of the old type of essay question the examinations were set in the form of 'multiple choice' questions that covered the extent of knowledge required of a normal pupil at that phase of the subject under test. Each question was followed by several alternative answers so framed that the examinee gained nothing by guessing; he had merely to indicate by a single word or a tick which he thought the correct one. The Panel recommended introducing a similar system of teaching and testing into the Royal Air Force for three reasons:-

- (a) It standardized assessment, both in the various units engaged in the same stage of training and as between different levels of training.
- (b) The practical side of instruction received proper emphasis. Although oral tests were gradually superseding written examinations at that time (February 1945) there still existed a strong tendency to 'weight' theoretical knowledge rather than practical knowledge.

- (c) In order to follow a man's progress in absorbing instruction, assessment, were needed at frequent intervals. (1)

In February 1945 the Air Ministry notified commands and delegations at home and overseas that 'phase checks' and 'multiple choice tests' would be adopted in all air gunnery training as soon as the marking system and pass standards had been determined after research into the necessary modification in teaching technique had been completed. Research was organised with thoroughness. Experiments had been conducted on three 'control' courses at No. 1 Air Gunnery School, Pembrey, to estimate the saturation point of instruction on certain parts of basic training. A committee formed of highly qualified air gunners, lent by commands, was added to the staff of the Empire Air Armament School for the purpose of such research by visiting operational as well as training units in order to analyse the work done by air gunners. The committee also sent to gunnery units, ranging from initial training wings to heavy conversion units, cyclostyled copies of experimental standard efficiency tests requesting comments after they had been given a trial run. The reports were studied in the Directorate of Training Research and of Flying Training, which latter (D.D.T.Arm) supervised the compiling of some eighty tests that incorporated ideas of the user units. Weekly courses began in May 1945 at the Empire Air Armament School to train in the principles of conducting standard efficiency tests selected instructors from Flying Training Command and gunnery leaders detailed by the operational commands and 2nd Tactical Air Force, up to a total of forty on each course. An itinerary was planned with Command Headquarters Middle East and Air Command South East Asia for three members of the committee to spread the gospel concerning these tests among their units engaged in training air gunners. The mission was completed in two months by 2 October 1945.

(1) A.M. File S.99152. Aircrew Training Bulletin No.24.

A revolution in teaching methods such as this was bound to take a long time before it penetrated every part of the widespread organisation engaged in training air gunners. Conceived during the peak of the war effort the new prodigy was delivered in an unpropitious hour when gunnery training lay in decline with its administration in a state of flux, when the hope of early release to civil life dominated men's thoughts. In face of such hindrances the printing and distribution of the standard efficiency tests had to be decentralised to commands and groups from drafts approved by Air Ministry. This modification of policy struck at the root principle of uniformity which formed the core of the whole system.⁽¹⁾ The complete scheme with its numerous details of administration and equipment all worked out, eventually ran smoothly in 1946. By then the chief purpose that underlay its creation, viz, to guarantee a uniform standard of instruction and of graduation among thousands of pupils spread over a large number of schools and units, had disappeared in the reorganisation and new developments of the Royal Air Force.

(1) A.M. File A.761076/45.

In March 1946 an O.T.U. was still using copies of the earliest experimental drafts: others had compiled tests to suit their local requirements because they had not received a supply of the 'hall-marked' S.E.T.

CHAPTER 5

RESERVE AND AUXILIARY FORCES

Before the outbreak of the Second World War the Royal Air Force was a small but efficient Service designed and organised so that it could expand rapidly and still retain its efficiency in the event of war. This was the result of a Memorandum by Lord Trenchard on the Organisation of the Permanent Air Force, 1919, which stated:-

'The present need is first and foremost the making of a sound framework on which to build a Service, which while giving us now the few essential Service squadrons will be capable of producing whatever time may show to be necessary in the future.'

The peace-time organisation of the Royal Air Force consisted of two elements; one was the nucleus of the Force, the permanent element composed of the long service officers and airmen; the other was the temporary element, the short-service personnel gathered round the nucleus and destined, after their period of service, to pass to the Reserve. Then there was the non-regular, or Auxiliary Air Force (A.A.F.), corresponding broadly to the Territorial Army, and, like the Territorial Army, intended to merge with the regulars on embodiment. There was also, by 1939, the Royal Air Force Volunteer Reserve (R.A.F.V.R.), which corresponded in some respects, but not wholly, to the Royal Naval Volunteer Reserve, it differed from the regular Reserve in that the members of it had not necessarily passed through the regular air force.

It was a fused compound of these four elements which made up the Royal Air Force that went into battle with the Luftwaffe in the Second World War. So integral and complete was the amalgamation that the distinctions of peace-time between the component parts ceased to be discernible and, the memory of them, to have any significance. In addition, there were three other factors which, although they were not a definite part of the Royal Air Force and were not therefore under any compulsion to serve in or with the Royal Air Force, did, however, play an important part in the eventual homogeneity of the Service as a whole.

One was the Civil Air Guard which formed in 1938 and had as its object the provision of facilities for flying at cheap rates for all persons, both men and women up to the age of 50. The scheme was state subsidised and its

members did give an honourable undertaking to serve with the Royal Air Force in any capacity in the event of war. The two remaining factors were both schemes for attracting the right type of young men to join the Royal Air Force and for encouraging a general spirit of air mindedness in the young men of the country. They were pre-entry training schemes; ⁽¹⁾ one, the University Air Squadrons, was a scheme staffed by the Royal Air Force with members recruited from the universities. They had no liability for service with the Royal Air Force, though of course every encouragement was given to them to do so. Flying facilities were provided by the Royal Air Force and an annual camp was arranged.

The other force, a counterpart of the Army Cadet Force or Officers Training Corps (O.T.C.) was the forerunner of the Air Training Corps. It comprised two parts, the Air Defence Cadet Corps and the air sections of the Officers Training Corps. The Air Defence Cadet Corps was formed in 1938 by the Air League of the British Empire. Its object was to train a large body of cadets aged from 14 - 18 to be of immediate service in defence of the country in the event of war. The squadrons were organised on a local basis, and many were school units. The Air Ministry made a small grant for the maintenance of these units, but the bulk of the cost was borne by the Air League of the British Empire.

The air sections of the Officers' Training Corps existed at a number of public and secondary schools. They were under the general administrative control of the War Office, but some passenger flying facilities were given by the Royal Air Force and the sections were officered by masters who were appointed to commissions in the Royal Air Force Volunteer Reserve. These too, were assisted by a grant from public funds.

From the foregoing narrative it will be seen that reserve and auxiliary forces played an important part of the peace-time composition of the Royal Air Force. It was not until expansion started in 1934 however, that any serious attempts were made to increase the numbers and improve the training of these non-regular forces.

(1) These two schemes are discussed more fully in the section on Pre-entry Training in Chapter 1.

The Auxiliary Air Force

The Auxiliary Air Force was created in 1924, along with the Special Reserve, under the Auxiliary Air Force and Air Force Reserve Act of that year. The two forces were modelled on the Territorial Army and the Special Reserve of the Army, formerly known as the Militia. The Special Reserve Squadrons, the name of which was changed later to Cadre Squadrons, contained a higher proportion - about one third - of regular personnel than did the Auxiliary Units. These squadrons, five of which had formed by 1936, were connected in May of that year to Auxiliary Air Force Squadrons.

These forces were the result of a scheme for Home Defence, approved in 1923, to expand the size of the Home Defence Air Force to 52 squadrons by 1928.⁽¹⁾ Thirteen of these, all bomber squadrons, were to be provided by the non-regular forces: the Special Reserve - seven squadrons and the Auxiliary Air Force - six squadrons.

The first Auxiliary Air Force Squadrons were formed in London in 1925, and by the end of the year four Auxiliary and one Special Reserve Squadrons were in operation.⁽²⁾

The Auxiliary Air Force was, as we have already seen, the Royal Air Force counterpart of the Territorial Army. The squadrons had a small cadre of regular air force personnel, and the remainder - mainly business men from the

(1) This programme was formulated by the Salisbury Committee and it involved forming 34 new squadrons in all. The general principle was laid down that 'British Air Power must include a Home Defence Air Force of sufficient strength adequately to protect it against air attack by the strongest air force within striking distance of this country'. By 1933 the programme was still in suspense. The 13 non-regular squadrons had been formed, however, and comprised almost one-third of the Home Defence Air Force.

(2) The following non-regular squadrons had been formed by 31 December 1925:-

Squadron	Location	Date formed	Aircraft
No. 600 A.A.F.	Northolt	14.10.25	Avro 504 - 2 D.H.9. - 1
No. 601 A.A.F.	Northolt	14.10.25	Avro 504 - 2 D.H.9. - 1
No. 602 A.A.F.	Renfrew	15. 9.25	Avro 504 - 2 D.H.9. - 1
No. 603 A.A.F.	Turnhouse	14.10.25	Avro 504 - 2 D.H.9. - 1
No. 502 S.R.	Antrim	15. 5.25	Vickers Vimy - 2 Avro 504 - 6

Stock Exchange, Lloyds, City Banks and Offices etc. - were recruited locally. Each unit was raised and maintained on a territorial basis by a Territorial Army and Air Force Association. The terms of service were five years for officers and four years for other ranks. ⁽¹⁾ Service could be extended for further periods not exceeding five years, or alternatively, personnel could ⁽²⁾ transfer to the Auxiliary Air Force Reserve.

Pilots were granted an annual retaining fee of £25 per year in addition to allowances and expenses when on duty. The Auxiliary Air Force personnel undertook all this training on their squadron, and served on that particular squadron throughout their engagement. They were required to carry out ground training one evening per week and flying training during week ends together with an annual camp lasting two weeks.

Each squadron was equipped with Service aircraft, and also had a training flight of elementary aircraft to carry out the training of new recruits and to provide annual refresher training for personnel of the A.A.F. Reserve. ⁽³⁾ For training purposes both Auxiliary Air Force and the Special Reserve squadrons came under the Air Defence of Great Britain Headquarters at Uxbridge.

By the end of 1930 there were eight Auxiliary Air Force squadrons in operation together with four Special Reserve squadrons, in No. 1 Air Defence

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- (1) Under the Act of 1924 the members of both forces could be called out 'to serve within the British Islands in defence of the British Islands against actual or apprehended attack', a service within the British Islands was defined 'as including any flight of which the points of departure and intended return are within the British Islands or the territorial waters thereof notwithstanding that the flight may in its course extend beyond these Units' otherwise, as Mr. William Leach, Under Secretary of State for Air, stated in the House of Commons on 24 May 1924, when moving the second reading of the Bill, it gave no power to send any man abroad - H.C. Debates Vol. 173, Col. 2239.
 - (2) The A.A.F. Reserve comprised ex-members of the A.A.F. who had the normal obligations of the Auxiliary Air Force, i.e. to come up for service when the force turned out, but who were not actual members of the auxiliary squadrons and who did not attend regularly for training. Annual refresher training, however, was carried out.
 - (3) A.A.F. Reserve Training consisted of a minimum of 15 hours flying per year and attendance at certain ground training courses.

/ Group

(1) Group. This group was formerly known as the Special Reserve and Auxiliary Air Force Command, and had been renamed in 1927. In May 1930, all the Auxiliary Air Force squadrons were re-equipped with Wapiti aircraft.

As the Act of 1924 indicates, the non-regular Air Units were conceived originally as a Home Defence Air Force which would continue to be such though their members might occasionally venture beyond our tidewater line. Actually, up to 1934, they were all bomber squadrons. The Air Staff, in computing the number of first line aircraft needed to give us parity with France in 1932, reckoned 127 non-regular aircraft as the equivalent of 43 regular aircraft, (2) that is in the proportion of three non-regular machines to one regular. The first fighter squadrons in the Auxiliary Air Force were formed by converting Nos. 600 and 601 on 12 August 1934 and No. 604 on 23 July 1934. (3) They were re-equipped with Demon aircraft.

1936 was an important year in the development of the Auxiliary Air Force, three new squadrons were formed, which with the five squadrons of the Special Reserve which were converted to auxiliary squadrons brought the strength of the

(1) The following non-regular squadrons were in operation by 31 December 1930:-

Auxiliary Air Force Squadrons (Bomber)

Squadron	Location	Date formed
No. 600	Northolt	14 October 1925
No. 601	Northolt	14 October 1925
No. 602	Renfrew	15 September 1925
No. 603	Turnhouse	14 October 1925
No. 604	Hendon	17 March 1930
No. 605	Castle Bromwich	5 October 1926
No. 607	Usworth	17 March 1930
No. 608	Thornaby	17 March 1930

Special Reserve Squadrons (Bomber)

No. 501	Filton	14 June 1929
No. 502	Aldergrove	15 May 1925
No. 503	Waddington	5 October 1926
No. 504	Hucknall	14 October 1928

(2) C.P.10 (32).

(3) A.M.O. N.360/34.

(1)
Auxiliary Air Force up to 16 squadrons. It was at this time also, that it was decided to transfer the responsibility of operation and training of the auxiliary squadrons to regular groups of the Royal Air Force. The Auxiliary Group, which was renamed No. 6 Auxiliary Group on 1 April 1936, was eventually to be responsible only for matters concerning the organisation and administration of the Auxiliary Air Force. In December 1936 the first three squadrons were transferred to No. 11 (Fighter) Group and by the end of 1938 all the remaining auxiliary squadrons were transferred to the regular commands and groups and took their place in the regular air force organisation.

After 1936 more auxiliary bomber squadrons were converted to fighter squadrons, and auxiliary army co-operation and general reconnaissance squadrons were also formed. By the outbreak of war five more squadrons had been formed and one, No. 503, disbanded, making the total strength of the Auxiliary Air Force on the outbreak of war 20 squadrons. Of these, 14 were fighter squadrons, four were general reconnaissance squadrons and two were army co-operation squadrons.

(1) The Auxiliary Air Force comprised the following squadrons by the end of 1936:-

Squadron	Location	Date Formed	Type	Converted to Fighter	Converted to A.A.F.
No. 500	Manston	16. 3.31	Bomber	-	25. 5.36
No. 501	Filton	14. 6.29	Bomber	-	1. 5.36
No. 502	Aldergrove	15. 5.25	Bomber	-	1. 7.36
No. 503	Waddington	5.10.26	Bomber	-	1. 5.36
No. 504	Hucknall	14.10.28	Bomber	-	18. 5.36
No. 600	Northolt	14.10.25	Fighter	12. 8.34	-
No. 601	Northolt	14.10.25	Fighter	12. 8.34	-
No. 602	Renfrew	15. 9.25	Bomber	-	-
No. 603	Turnhouse	14.10.25	Bomber	-	-
No. 604	Hendon	17. 3.30	Fighter	23. 7.34	-
No. 605	Castle Bromwich	5.10.26	Bomber	-	-
No. 607	Usworth	17. 3.30	Fighter	1.11.36	-
No. 608	Thornaby	17. 3.30	Bomber	-	-
No. 609		10. 2.36	Bomber	-	-
No. 610	Heaton Park	10. 2.36	Bomber	-	-
No. 611	Speke	10. 2.36	Bomber	-	-

(2) See Appendix 49.

The Auxiliary Air Force also acquired shortly before 1939 a number of balloon squadrons which added very greatly to the strength of its personnel. In 1934 the strength of the A.A.F. was little over 1,000 men, and by 1 October 1939 it had risen to 23,000 of which some 4,600 belonged to the flying squadrons and the remaining 18,400 belonged to the balloon squadrons.

The auxiliaries were mobilised a few days before the outbreak of war, and aircraft from these squadrons were in the air within a few hours of the declaration of war. To one of those 'weekend flyers' fell the honour of shooting down the first enemy aircraft over British soil.

The Royal Air Force Reserve (Officers) and the Short Service Commission Scheme

In 1919 it was decided to institute short service commissions in the Royal Air Force, in order to provide the large number of officers required in the junior ranks of the Royal Air Force, and also to ensure a reserve of trained pilots in emergency. The terms of service were four years on the active list followed by four years on the reserve, the latter being renewable. The strength of the reserve was limited to 200 pilots but in 1923 this was increased to 700. The new pilot reserve was split into two parts:-

- Class 'A' - Officers with short service commissions who passed into the Reserve on completion of their engagements.
- Class 'AA' - Officers entered direct to the Reserve either from the class of pilots who served in the First World War, or from suitable civil pilots.

Although provision had been made for a large reserve in 1919, it was not until 1922 when the short service idea was maturing that a comprehensive scheme for training was drawn up. The training facilities of the Royal Air Force at this time were fully employed on the training of regular personnel, and so the possibilities of utilising civil companies to operate flying schools on behalf of the Royal Air Force were considered. The primary object was to secure good economic training by utilising the simple and compact organisation of civil firms with repair facilities adjoining their aerodromes.

A scheme was arranged and received Treasury approval on 19 January 1923. It was decided to open five civilian operated schools each with an allotment of 70 pupils. (2) It was deemed necessary for ex-wartime pilots to undergo a

(1) A.M. File 374397/22, Encl. 35A.

(2) See Appendix 50.

requalifying course in their first year, but this was not specifically defined since it would obviously vary according to circumstances and the individual's past flying experience. Instruction was carried out on elementary training aircraft (Avro or similar type) and Service type aircraft (D.H.9 or Bristol Fighter). The training period was roughly six weeks, and as a guide a minimum of 15 hours and a maximum of 25 hours flying was laid down for the elementary flying. Later it was found possible to accept an average of about 14 hours flying and the minimum was then laid down as 12 hours.

The annual training course consisted of 12 hours solo flying on a Service type of aircraft with appropriate dual flying. This was carried out in four periods each of two-six days duration.

In 1924 it was laid down that the aircraft in use at the civil schools should have a common minimum performance. The speed was to be 110 m.p.h. at 6,000 feet, and although the types of aircraft to be used were not specified, the types of engines to be used were.⁽¹⁾ It will be seen that for the next 10 years very little progress was made in the training of these reserve forces and the size of the R.A.F. Reserve remained fairly static.

The financial arrangements with the civil companies, however, required constant revision. After the schools had been in operation for a year it was found that they were operating at a loss and new contracts had to be drawn up.⁽²⁾ These new agreements laid down the quarterly periods of refresher training as two-six days, and a maximum period of 61 days for the requalifying courses.

(1) Lion, Condor, Jaguar and Jupiter engines. The aircraft in general use were D.H.9's and Bristol Fighters. The school at Brough, which was equipped with twin-engined aircraft, was not affected by this order.

(2) The original fees were:-

	<u>Annual Course</u>	<u>Requalifying Course</u>
Single-engined aircraft	£150	£200
Twin-engined aircraft	£180	£240

For broken courses a rate of £10 per hour, up to a maximum of £50 was paid. In 1925 the revised rates were:-

Single-engined aircraft	£300	£200
Twin-engined aircraft	£280	-

Payment for broken time was charged at the rate of £8 per hour for elementary types, and £22 per hour for new Service types. The upper limit of £50 was abolished.

The standard aircraft establishment was three elementary and three Service aircraft per school.

Seaplane Training

When the Reserve was formed it was ~~(was)~~ intended that seaplane training should also be carried out for reservist personnel. It did not actually commence however until April 1925. The firm selected was the North Sea Aerial and General Transport Ltd., (a subsidiary of Blackburn Aircraft Ltd.,) who were already carrying out twin-engined training of reservists at Brough. Prior to this, an investigation had been carried out with a view to carrying out floatplane training at Calshot. The estimate was too expensive, however, and the Calshot scheme was dropped.

Training at Brough commenced on 1 April 1925. ⁽¹⁾ Both annual refresher and requalifying courses were carried out and a total of 20 pupils per year were to be trained at a cost of £425 per pupil. ⁽²⁾ In 1926 the fee was raised to £800 as the first estimate proved far too low. The aircraft used were two Dart-Lion floatplanes. In 1927 the capacity was raised to 30 pupils per year and three aircraft were provided, the contract lasting for two years.

Expansion of Capacity

In order to meet the requirement of the expansion of the Reserve to 700 pilots it had originally been planned to open more schools, each training 70 pupils, as the personnel became available. After the first year of operation, however, it was decided to expand four of the schools to a capacity of 100 pupils per year instead. ⁽³⁾ This gave a total training capacity for 490 pupils (including 20 doing seaplane training). The remaining 210 members of the Reserve were to be made up of instructors at the civil schools, and personnel engaged on Civil Aviation. The strength of the Reserve, however, in 1925 was considerably below 700 pilots.

(1) A.M. File 471393/23.

(2) A.M. File 819324/28.

(3) The contractual arrangements for the schools for the four years 1925 - 1929 were as follows:-

Stag Lane	-	400	pupils	over	four	years
Filton	-	400	"	"	"	"
Coventry	-	400	"	"	"	"
Renfrew	-	400	"	"	"	"
Brough	-	280	"	"	"	"

Introduction of Ab Initio Training

As time went on the number of ex-Service pilots joining the Royal Air Force Reserve dwindled and the supply of reservists from the short service commission scheme was insufficient to make up for the loss.⁽¹⁾ Consequently, a scheme was drawn up in order to increase the number of pilots in the Reserve by accepting direct entry personnel with no previous air force experience and giving them a course of ab initio training. This scheme was submitted to the Treasury and approved as an experiment on 8 May 1925. Two courses totalling 50 pupils commenced training at two of the civil schools, Filton and Stag Lane⁽²⁾ towards the end of the year. The course was continuous and lasted three months, and the syllabus provided 30 hours flying on elementary types of aircraft (this included both dual and solo) followed by five hours solo together with appropriate dual on a Service type. Ground instruction was also included in the course. These pupils then carried out the normal annual refresher training. The next two years saw little development in this direct entry ab initio scheme. The first courses passed out in early 1926, 50 more pilots were trained in 1927, and a further 60 in 1928.⁽³⁾ The Treasury were asked to approve the scheme permanently on 7 December 1926, but instead gave their sanction for a further four years on the basis of 60 pupils a year⁽⁴⁾ (50 in 1927). A further request for permanency led to approval for an annual intake of 60 pupils up to the 31 March 1933.

(1) A.M. File 642023/25.

(2) A.M. File 554051/24.

(3) The number of pupils who passed out from the ab initio courses during the years 1926 to 1928 was as follows:-

Year	Stag Lane	Filton	Refrew	Total pupils
1926	25	25	-	50
1927	20	20	10	50
1928	30	30	-	60

Note:- Coventry and Brough were not used for ab initio training. At the former the aerodrome was unsuitable and at Brough twin-engined aircraft and seaplanes were in use.

(4) A.M. File 723437/26.

School Changes

On 5 November 1928 Beardmores school at Renfrew was closed down. In 1929, when the contracts were about to be renewed (they had been established on a four year basis in 1925) for the annual refresher training, consideration was given to the performance of the aircraft in use at the schools. So far as the single-engined types were concerned it was considered unnecessary to call for a higher standard of performance, so its existing equipment continued to be used. The twin-engined Kangaroo aircraft at Brough, however, were replaced by Darts with the object, inter alia, of providing training on a Fleet Air Arm type. Seaplane training had been carried out for Reserve personnel at this school since 1925 with Dart aircraft and it was thought that a smaller aircraft establishment would serve for the land and seaplane sides of the school than if two types were in use, since land and float undercarriages could readily be interchanged. Twin-engined training was not continued owing to the high operating costs involved using modern twin-engined aircraft.

When in 1929, the new contracts were drawn up for the training at the civil schools they catered for a total of 2,080 training courses to be carried out in a four year period. Of these, 120 were annual refresher seaplane courses, 1,720 were annual refresher landplane courses, and 240 were ab initio landplane courses, for direct entry reservists. (1) The requalifying courses for ex-war-time pilots were by this time unnecessary. In 1930 the old elementary trainers in use at Filton, the Bristol Preliminary Training Machines (P.T.M.), were replaced by Tiger Moths. (2)

On 1 May 1930 De Havilland's moved their school from Stag Lane to Hatfield, owing to the increasing congestion at Stag Lane. On 1 April 1931 Armstrong's school at Coventry was moved to Hamble, owing to the unsuitability of Coventry for ab initio training, and at the same time a separate company known as Air Service Training Limited was formed and took over the contract. The old Service aircraft, the Wolfs were replaced at the firm's expense by Atlas aircraft, the Siskin was also introduced as an additional type.

(1) See Appendix 50.

(2) This was the result of an Air Ministry decision made in January 1930 to fit all elementary trainer aircraft with slots. This could be done in the case of Avro's and Moths but was found impracticable in the case of the Bristol P.T.M's.

Under the new contractual arrangements of 1929, slight modifications were made to the training facilities. The minimum flying hours remained the same, that is 30 hours on the ab initio courses, and 12 hours on the annual refresher courses, but arrangements were made to allow those who wished to carry out extra flying on their annual course. ⁽¹⁾ It had been suggested that the minimum should be raised to 16 hours but it was felt that some personnel would not be able to afford sufficient time for this.

The financial provision was, however, considerably overspent during 1931 and because of this and in view of the urgent need for economy, extra flying was suspended altogether on 11 November 1931 except for officers of Class 'AA' (Section II) in the 2nd, 3rd, 4th or 5th year of their initial service who were allowed five hours a year.

In 1933 the contracts were due for renewal, and consideration was given to the re-equipment of the schools with more modern aircraft. During the past 10 years the aircraft types in use at the schools remained, with one or two exceptions, unchanged. This divergence from the then modern types made re-equipment with aircraft of more modern characteristics essential. ⁽²⁾ Such re-equipment, however, would have occasioned a very heavy capital charge if Service types were used and the cost of reserve training consequently increased. In view of the financial stringency the Air Ministry was unwilling to incur the heavy cost of new Service - type aircraft, and the whole policy was accordingly reviewed from the aspects of finance and training efficiency. As a result it was decided in future to carry out all reserve flying training, both annual and ab initio courses, on light types of aircraft possessing flying characteristics comparable to those of the Service types. The aircraft used were Tiger Moths and Blackburn B.2's the latter being introduced at Brough in 1933.

(1) Extra flying facilities were made available as follows:-

- 15 hours maximum for each of Classes 'A', 'AA' (Section I), 'AA' (Section II after extension of service) and Class 'E'.
- 30 hours maximum for Class 'AA' (Section II in the 2nd, 3rd, 4th and 5th year of initial service).

Note:

- Class 'A' = Direct transfers from the regular air force and short and medium service commissions.
- Class 'AA' (Section I) = Direct entry officers with previous flying experience.
- Class 'AA' (Section II) = Direct entry officers without previous flying experience.
- Class 'E' = Airmen pilots transferred from the regular air force.

The adoption of the policy resulted in a substantial saving in cost and enabled the number of flying hours flown per pupil to be increased and the quality of training consequently improved. The annual training course, hitherto limited by financial consideration was extended from 12 hours to 20 hours solo flying, thus allowing a more comprehensive syllabus to be adopted. The ab initio course was to consist of 50 hours flying (both dual and solo) instead of 30 hours as before. Additional flying was permitted only if a pilot did not reach a satisfactory standard during his course. Arrangements however, were made for special flying instructor's courses of roughly a month's duration to be given to selected pilots in lieu of their annual training. Another specialist course for reservist personnel, an instrument flying course, was also under consideration but did not materialise.

Under the 1933 contracts the number of pilots to be trained remained approximately the same, but the courses were spread more evenly between the four schools. All four schools now carried out ab initio training together with annual training, and some schools carried out amphibian training. ⁽¹⁾

The floatplane training which had been carried out at Brough since 1929 was discontinued when the Service aircraft were withdrawn, and was replaced by training on a small type amphibian flying boat. ⁽²⁾ For some time Brough had been considered unsuitable for floatplane training owing to tidal conditions on the Humber. As from 31 March 1933 seaplane training ceased and on 1 April 1933 amphibian training commenced at Hamble using two small amphibian aircraft operated by Air Service Training Ltd.

The contracts taken out in April 1933 were due to cover the four year period up to 31 March 1937. In 1935, however, the Royal Air Force regular training system was reorganised, and resulted not only in a change in the type of training undertaken by the civil schools, but also increased their importance and numbers.

Introduction of Regular Training

A scheme for the training of regular air force personnel at the civil schools was submitted to the Treasury and approved on 10 May 1935. ⁽³⁾ Under

(1) See Appendix 50.

(2) A.M. File 127561/31.

(3) A.M. File 534816.

this scheme pilot trainees (candidates for short service commissions, university candidates for commissions and airmen pilots) would carry out the first part of their training, formerly carried out at a Service flying training school, at a civil school. The course was based on the ab initio courses given to direct entry reservists and lasted 56 days and included 50 hours flying on elementary types of aircraft. On the successful completion of the course these personnel then proceeded to a F.T.S. to complete the remainder of their training (i.e. the intermediate and advanced stages).

As a result of this reorganisation nine new civil schools, making 13 in all, were opened. All the schools carried out annual training for reservists together with ab initio courses for direct entry reservists and for regular air force personnel. In all cases, however, the ab initio course was the same, and lasted 56 days and gave 50 hours flying all on elementary types of aircraft.

The reserve training facilities were expanded as a result of the formation of the new schools. Ab initio courses for reservists were expanded from 60 to 300 per year, annual refresher courses continued to be given to reservist personnel at the rate of approximately 1,500 per year. In addition, roughly 1,800 regular pilots were given ab initio courses per year at the civil schools. No distinction was made between regular and reserve personnel on the ab initio courses, and intakes were in arranged batches of 18 or 27 pupils every 8 weeks, depending on the capacity of the school. All 13 schools had been formed and were in operation by February 1936. ⁽¹⁾

Expansion 1935

In 1935 the Reserve of pilots consisted for the most part of ex-Service personnel kept in flying practice by annual refresher courses on elementary types of aircraft, ^{supplemented} ~~supplemented~~ by direct entry personnel who had taken an eight weeks ab initio course during the first year's service and who then also carried out the 20 hours annual refresher training. In April 1935 the size of the R.A.F. Reserve was 1,448 pilots, and roughly two-thirds of these had either been off the active list for over five years or were direct entries and

(1) See Appendix 51.

would therefore require at least three months training at a flying training school before joining a squadron. (1)

When expansion began in 1935 it was estimated that by the end of that year there would be 2,300 active pilots, 570 pilots not in training and 270 auxiliary pilots. In addition there were some 1,300 civil pilots who would also be available in an emergency. This was far too small to meet the demands for casualty replacement and first line expansion which would come in war. It is interesting to note that up to this time the size of the Pilot Reserve had been limited, under Treasury authority to 1,500 personnel. (2)

It was evident that drastic alterations both in the size of the Reserve and the standards of training would have to be made. Under the existing organisation direct entries into the Reserve only completed the ab initio course of training; (3) on mobilisation it would therefore be necessary to pass these personnel through a Service flying training school. On the basis of Expansion Scheme 'F' introduced towards the end of 1935, and approved in February 1936, it was estimated that an annual entry of 800 personnel from civil life into the reserve was needed to build up enough pilots by 1939 for replacing first line wastage. Even this figure of 2,400 in all, would not be enough to allow any first line expansion in the first year of the war, or to provide instructors for an enlarged training organisation.

(1) The strength of the R.A.F. Reserve on 1 April 1935 was as follows:-

Class 'A'	- Direct transfers from the regular air force, short service and medium service commissions	-	544
Class 'AA'	- Direct entry reserve officers	-	249
Class 'C'	- As Class 'A' for technical, accountant duties etc. (pilots only)	-	227
Class 'E'	- Airmen pilots transferred from the regular air force on completion of their engagements	-	77
Class 'F'	- Direct entry airmen pilots	-	351
<u>Total</u>			<u>1,448</u>

The availability of these reserve pilots was as follows:-

(a)	Those who could go direct to squadron on mobilisation	-	137
(b)	Pilots off the active list from two to five years and thus requiring six weeks training at a Service F.T.S.	-	132
(c)	Pilots off the active list five years or more, thus requiring 12 weeks F.T.S. training	-	418
(d)	Pilots from the direct entry reserve (i.e. Classes 'AA' and 'F') and thus requiring 16 weeks at a F.T.S.	-	600
(e)	Not available owing to civil employment	-	161
(A.M. File S.36677) <u>Total</u>			<u>1,448</u>

(2) A.M. File S.36677.

(3) There were ab initio courses lasting 56 days which gave 50 hours elementary flying training for direct entry personnel. The numbers trained under this scheme, however, were limited as there were only 13 schools and they were also responsible for the ab initio training of regular personnel and annual refresher courses for reservists.

The One Year Reservist Scheme

In 1936 plans were made to increase the size of the ordinary Reserve, by extending the ab initio direct entry scheme. A scheme was devised where direct entry personnel could undergo a full-time continuous training course lasting roughly a year, and passing through the civil school and a Service flying training school, and thus be trained up to a standard whereby they could be posted direct to Service squadrons.⁽¹⁾ On completion of one year's service, however, these personnel were to be transferred to the Reserve and would carry out the normal R.A.F. Reserve annual training. Their service on the Reserve was to be not less than four years and could be extended after this period. In effect, these 'One Year Reservists' as they became known, joined the Royal Air Force for one year, in which time they carried out the full R.A.F. pilot training syllabus of three months at an E. & R.F.T.S. followed by nine months at a F.T.S.

In the first six months of this scheme (1 September 1936 to 21 February 1937), 80 pupils had been selected for training and 32 of this total had actually commenced training by February 1937.⁽²⁾ The scheme was not an outstanding success, however, and difficulties were experienced in recruiting sufficient numbers of personnel willing to undertake one year's continuous training. The programme for entry for 1937 was originally 168, but in February owing to recruiting difficulties this figure was reduced to 100.⁽³⁾ In April 1937 it was decided to carry two pilots in all heavy aircraft, instead of one pilot and one observer. This change in policy greatly increased the number of pilots required in the regular air force, and consequently it was difficult to find room at the F.T.S. for non-regular personnel and the One Year Reservist Scheme was discontinued after 1937.⁽⁴⁾

(1) A.M. File 638478/37.

(2) A.H.B./IC/2/2.

(3) The programme for pilot training in 1937 was as follows:-

Short service entry at home	-	1,100
Short service entry in the Dominions	-	175
Airmen pilot entry	-	400
One Year Reservist entry	-	<u>100</u>
	<u>Total</u>	<u>1,775</u>

Note:- These were to be trained in the United Kingdom in 13 Elementary and Reserve Flying Training Schools and 10 Service Flying Training Schools - (See Chapter 2).

(4) A.M. File 638478/37.

Progress of the R.A.F. Reserve by the Outbreak of War

When the volunteer reserve scheme commenced training in April 1937, and the direct entry personnel (classes 'AA' and 'F') transferred from the ordinary Reserve to the Volunteer Reserve, part-time ab initio courses for ordinary reservists also ceased. From this time onwards the R.A.F. Reserve comprised solely ex-Service personnel who carried out 20 hours annual refresher training per year.

As the Volunteer Reserve increased many of the ordinary reservists were utilised as part-time flying instructors for V.R. personnel and they carried out their duties in lieu of the annual training.

By the outbreak of war the strength of the R.A.F. Reserve was disappointingly small. The overall pilot strength was less than 1,500 personnel, and the numbers of other aircrew personnel on the Reserve was infinitesimal. There were several reasons for this lack of personnel in the Reserve. They were provided, since 1937, almost entirely by personnel who had served in the R.A.F. on a short service commission. (Airmen pilots were small in number and their length of regular service was long). All appointments to medium service and most appointments to permanent commissions were made from personnel serving under a short service commission, and this consequently reduced the number passing on to the Reserve - medium service ~~commissions~~ extended the officers' length of regular service by a further five years.

Moreover, most of the fully trained pilots who passed out of the Royal Air Force to the Reserve were absorbed into the pre-war expansion, either in the civil schools as flying instructors or staff pilots or in the aircraft industry.⁽¹⁾

(1) A survey carried out in September 1938 showed that of all the Reservist personnel, more than 30% of them would not be available for immediate mobilisation, owing to their civilian employment (e.g. civil flying instructors, other service departments, aircraft industry etc.).

Mr. Scott's Memorandum on Direct Entry Reserves

In February 1936, Mr. W.L. Scott of S.7 wrote a memorandum on direct entry reserves. The calculated requirement from civil life over each of the three years ending 1 April 1939 was the following:-

Pilot Reserve	-	800
Observer Reserve	-	200 (approx.)
Non-flying Reserve	-	200 (approx.)

The non-flying reserve was to include mechanical and electrical engineers for engineer and signals duties, accountants, and business men for stores duties. (1)
At that time, only the pilot reserve existed and this was hopelessly inadequate.

The problem, however, was an urgent one and Mr. Scott's memorandum laid down (2)
the broad lines on which these reserves could be recruited and trained.

The men should be of secondary and public school type and possess the necessary qualifications to be trained satisfactorily. A number of conditions to success of so large a task were laid down including a scheme for aerodrome centres where the reservists would attend as frequently as possible, mainly during the week-ends. The first stage would be to utilize the 13 regular and reserve civil schools already in existence and arrangements would have to be made to provide further training facilities.

Air Commodore Tedder (Director of Training) disliked much of the scheme (3)
put forward by Mr. Scott. The number of aerodrome centres needed to build up an adequate reserve would call for more instructors than could be found. He stressed three essentials in organising a reserve:-

- (a) As high a standard of training as possible so that the reservist could take his place in a Service squadron (if mobilised without delay).
- (b) A close connection between the Reserve and the regular Service.
- (c) A Reserve organised as a second line of defence.

-
- (1) A.M. File S.35435. The direct entry reservist scheme had already been expanded from 60 per annum in 1933 to 300 per annum in 1935 and the existing facilities could not possibly cope with any further expansion.
 - (2) See Appendix 52.
 - (3) A.M. File S.37628.

Provision of Training Facilities

The flying clubs were considered as possible aerodrome centres, but were not looked on with much favour: their social life was not wholly appreciated, they were weak in training facilities, and they had too many non-flying activities. It was thought best to rely on the aircraft industry for aerodrome centres: the R.A.F. had its hands far too full with regular expansion.

The Auxiliary Air Force, which might have appeared a natural nucleus round which to build a reserve training organisation, was reluctant to sacrifice its exclusive character to serve wider interests. Its standard of expenditure and social rigidity were incompatible with a democratic reserve. In fact its opposition to a suggestion from Air Marshal Bowhill that it should form a reserve of accountant and stores officers (who might have been thought socially acceptable) was so violent that the suggestion was hastily dropped.

It was therefore suggested that the aircraft industry should be invited to create approximately 20 schools - to be known as Reserve Schools - provided with training facilities for week-end and annual training of pilots and observers. They would, in effect, be an extension of the existing civil schools organisation.

Town Centres were also to be established in large towns and cities where every instruction could be given and social activities carried out. The need for a strong social flavour was also stressed:-

'While the desire to fly, patriotism, and retaining fees large enough to count in a young man's yearly budget will be the means of attracting our reservists, no permanent success can be attained unless the scheme is a social success. The young men must enjoy their evening meetings and their week-ends. The Air Ministry cannot create a social life; it can only organise so that the reservists can create it for themselves.'

The social and political setting of the time had considerable influence on this proposed Scheme, and there was strong popular feeling against any 'caste' or 'old school tie' attitude. Thus the projected direct entry reserve came to be visualised as a collection of young men drawn from the middle class in its widest sense, and with no suggestion in its organisation of a 'pre-determined social hierarchy'.

Proposed Citizen Air Force

A second influence, that of a feeling against the 'militarism' of any organised preparation for war, was clearly shown in some proposals made by Air Commodore Chamier of the Air League of the British Empire in March 1936. (1) These urged the advantages of a Citizen Air Force without military commitments, dependent on young mens' eagerness to learn to fly cheaply, run by a private company, and paid for at so much a head by the Air Ministry.

There was considerable discussion, in the course of which Air Vice Marshal Freeman (A.M.R.D.) remarked that he could see some advantage in a citizen air force because 'most peace-time pacifists become war-time patriots - it requires less courage'. The discussion made clear that the suggested new direct entry reserve would be a long-term project needing some four years to reach Service efficiency, that full Service efficiency could probable be reached only by attaching reservists to squadrons.

Formation of the R.A.F.V.R.

It was eventually decided that the Service schools and squadrons were too busy with their work of expansion and so civil flying schools would have to be used.

The direct entry scheme very much in the form that Mr. Scott had outlined, was to be put in force, and Lord Swinton (S. of S.) laid down the following conditions:- (2)

- (a) Every man must be under a liability to serve in emergency.
- (b) The Air Ministry must have control over the reserve and responsibility for it.
- (c) The focal points were to be town headquarters and a civil flying school connected with the town headquarters.
- (d) The general spirit of the town headquarters was to be similar to that of the Artists Rifles.
- (e) There was to be common entry in one rank - airmen pilot.
- (f) Officer requirements were to be filled by a combination of selection and competition after the age of 21.

(1) See Appendix 53.

(2) A.M. File S.37628.

The new force was to be known as the 'R.A.F. Volunteer Reserve' a body of volunteers who undertook training as a pilot or observer with a view to employment in the R.A.F. as such in the event of war. Factors affecting the successful launching of this scheme were:-

- (a) Demands on the volunteer's time must be moderate.
- (b) Training centres must be located within convenient range of the men recruited.
- (c) Certain financial re-imbusement in respect of travelling, subsistence and incidental expenses would be necessary.
- (d) An adequate scheme for compensation on injury or death must be formulated.
- (e) The scheme must be a success socially.
- (f) Co-operation of employees must be secured.

The V.R. scheme was instituted on 27 August 1936, and recruiting was due to commence in December of the same year. The volunteers were recruited locally by V.R. commandants and selected by a board of officers. They were medically examined by a travelling medical board and joined on a five year engagement.

The Volunteer Reserve was organised under the Superintendent of Reserve. The town centres were managed by retired or reserve officers on the Superintendent of Reserve's staff, assisted by local advisory committees. The aerodrome centres were to be run by competent firms drawn from the whole range of the aircraft industry, beginning with the thirteen schools already engaged on regular and reserve training. ⁽¹⁾ Service training was to be given ultimately, after about two years' week-end work, by attachment to Service squadrons. Though the scheme included observers, no observer training could be done until the pilots were skilled enough to give them flying practice, and so the Volunteer Reserve was at first confined to pilots.

(1) The original thirteen schools were:-

Hatfield	Sywell	Yatesbury [⌘]
Filton	Desford	Perth
Hamble	Reading	Prestwick
Brough	Ansty	White Waltham
Hanworth		

[⌘] V.R. training was not carried out at No. 10 E. & R.F.T.S. Yatesbury owing to the location of the aerodromes and lack of recruits.

Ground instruction was to be given at the town centres, and it was expected that each volunteer reservist would do some 60 hours flying a year (i.e. 28 at week-ends, 12 on summer evenings, and 20 during the fortnight annual training period). This programme, however, was flexible and fluctuations had to be allowed for in accordance with the zeal, employment, and private circumstances of the individual and the accessibility of the aerodromes. The training scheme contemplated was as follows:-⁽¹⁾

- (a) Initial Training. A large part of the initial flying training would consist of dual instruction. Generally speaking members would be required to attend at aerodrome centres on alternate week-ends (both Saturdays and Sundays) or to give equivalent attendance during the week. They were also required to attend regularly at the town centre on certain evenings during the week for ground instruction in such subjects as theory of flight, airmanship, navigation, and aircraft and engine maintenance. For volunteers who were able to spare the time arrangements were to be made for the initial training to be given at continuous whole time courses of 8 to 10 weeks duration at an aerodrome centre; the course would include 50 hours flying and the appropriate ground instructions. Volunteers who attended this course of training were not required to attend in the same year the 15 days' training referred to below.
- (b) Subsequent Training. After completing the initial training, volunteers were required to continue their attendance at aerodrome and town centres at week-ends and in the evenings for further instruction. When sufficiently advanced they were to continue their training, on Service type aircraft, including night flying.
- (c) Annual Training. In addition to the attendance at week-ends and in the evenings, members were required to attend for 15 days continuous training annually.

(1) E.P.M.16 (37). (A.H.B./Ic/2/2).

The conditions of service were as follows:-

- (a) Retaining Fees. £25 a year was granted after reaching standard of proficiency as pilots subject to the fulfilment of training requirements.
- (b) Pay and Allowances. Volunteers when called up for service or when carrying out authorised continuous training, either initial or annual, received pay at R.A.F. rates, which were as follows:-

Sergeant (u/t Pilot)	10s. 6d. per day
Sergeant (pilot)	12s. 6d. per day
- (c) Volunteer pilots undergoing continuous training at an aerodrome centre remote from their home town received in addition a daily consolidated allowance of 6s. 0d. for accommodation and messing. Marriage allowance at the rates and under the conditions laid down for airmen of the Regular Air Force were paid to married volunteers.
- (d) Training Allowances. For training at week-ends and evenings an allowance at the rate of 1s. 0d. per hour's training was made.
- (e) Travelling. A refund of travelling expenses actually incurred in attending training was made.
- (f) Pensions and Disability Grants. Pilots of N.C.O. rank who, in time of peace, were invalided from the V.R. in consequence of injury or disease directly attributable to the conditions of service were awarded pensions.

When the scheme was first drawn up the intention was to recruit 2,400 pilot recruits in all, by April 1939 - 800 in each of the years 1936, 1937 and 1938. This necessitated the utilisation of the 13 existing schools and the formation of 20 additional aerodrome centres - 10 in 1936, and the remaining 10 in 1937 - making 33 centres in all. ⁽¹⁾ Town centres were planned to match the aerodrome centres. Owing to the extremely late start of the scheme plans had to be modified and the revised programme provided for an entry

(1) E.P.M.74 (37). (A.H.B./Io/2/2).

of 1,200 pilots in 1937 and a further 1,000 in 1938. The revised scheme was due to start on 1 April and by the end of 1937 there were to be the 13 existing schools in operation together with 10 newly-formed centres. The remaining 10 centres were to be opened during 1938 - thus by 1 January 1939, the 33 schools would be in operation.

The first batch of pupils to enter the R.A.F.V.R. - 50 in all - were attested in January 1937 and entered on continuous flying training for eight weeks at the civil schools. These personnel were, virtually, entered under the old direct entry reservist scheme.

The modified programme for the commencement of the R.A.F.V.R. was as follows:-

- January 1937 - Commence recruiting.
- 1 March - Town H.Q.s to open. Courses of instruction to be prepared and syllabus arranged.
- 1 April - Flying training to commence at the 13 existing civil schools.
- 1 July - Flying training to commence at 10 additional schools.

A further 10 schools were planned to open by the end of the year making 33 in all.

The scheme, however, was still slow in starting, Treasury approval for the flying side was not given until 30 April 1937, and unforeseen difficulties were met in formulating prices and contracts with the operating firms. Another difficulty in getting the scheme going was lack of instructors. Although good pay was being offered (£600 - £700 per annum) the existing schools were short of flying instructors and some of those employed were not up to the standard required.

This difficulty, however, was eventually overcome by requiring the companies to maintain a minimum staff of full-time employees, and utilising at week-ends and in the evenings the services of part-time instructors who were not normally employed on flying. This also had the effect of increasing the efficiency of reserve staff personnel who were performing in peace the work they would have to perform in war.

By 12 June 1937, a total of 276 pupils - in addition to the first 50 - had been entered and week-end training had commenced at the 12 existing schools on 1 April 1937.⁽¹⁾ The thirteenth school at Yatesbury proved unsuitable from a recruiting point of view and was therefore not utilised for V.R. training; it continued training Regular R.A.F. pupils.

The provision of town centres proved more difficult and by June 1937 none had opened. In London, Staffordshire House had been offered as a centre and in the meantime lectures were being given at the Air Ministry.

Progress during the summer was steady though not spectacular; during June a further 76 recruits commenced training and three new aerodrome centres were opened at Castle Bromwich, Redhill, and Shoreham. Four more centres were opened on 1 October 1937, bringing the total up to 19. By the end of the year the strength of the R.A.F.V.R. was 845.⁽²⁾ Of these 190 pupils had qualified to fly solo on Hart aircraft. Progress remained slow in the formation of the town centres, this was due largely to the complexities of legal procedure, and only two centres, London and Bristol, were actually in operation by the end of the year.⁽³⁾

These civil schools were, before the formation of the R.A.F.V.R. equipped only with elementary training aircraft such as Tiger Moths, Blackburn B.2's and Magisters. The R.A.F.V.R. training organisation, however, contemplated training pupils up to a standard corresponding to the intermediate stage at a Service flying training school, and consequently Service type aircraft such as Harts, Audax, Hinds and Demons, were established at the civil schools during the summer of 1937.⁽⁴⁾

(1) E.P.M.74 (37). (A.H.B./Ic/2/2).

(2) E.P.M. 5 (38). (A.H.B./Ic/2/2).

(3) See Appendix 54.

(4) Aerodrome centres were of the following types, varying in size according to the potential recruiting capacity of the district:-

Type of School	No. of Pupils	Aircraft Establishment	
		Elementary	Service
'A'	50	4	3
'B'	100	6	6
'C'	150	8	7
'D'	200	10	10

Formation of No. 26 Group

In December 1937 the Superintendent of the Reserve, who was directly responsible for the organisation and administration of all the Reservist Forces (i.e. The R.A.F. Reserve, The R.A.F. Volunteer Reserve, The Auxiliary Air Force, and the University Air Squadrons) became No. 26 (Training) Group. It was also decided to number the civil schools, and they were to be known in future as 'Elementary and Reserve Flying Training Schools'. They were numbered as follows:-

- Nos. 1 to 4 - The original schools carrying out Reservist training.
- Nos. 5 to 13 - The nine schools formed in 1935-36 under the reorganisation of Royal Air Force training.
- Nos. 14 to 33 - The 20 additional schools approved under the V.R. training proposals.

By the end of 1937 quite good progress had been made, 845 pupils had been recruited against the programme of 1,200, and 19 of the 23 schools planned to be in operation were carrying out flying training. Only the town centres were badly behind schedule. By 31 March 1938, by which time this scheme had been in operation for a year, the total intake into the R.A.F.V.R. was 1,122 pupils. The actual strength at that date including transferees from Classes 'AA' and 'F' of the R.A.F. Reserve was 1,355. Of the latter figure 348 pilots were qualified to fly solo on Hart aircraft. 21 aerodrome centres were in operation, and premises for 14 of the 15 projected town centres were selected, although only five of these were actually in full operation. ⁽¹⁾

The original Scheme 'F' plan also provided for the establishment of a non-pilot aircrew section, with the intention of recruiting and training 2,500 observers and 3,200 wireless operators/air gunner by 31 March 1939. Treasury approval, however, for this plan was not obtained until March 1938 by which time a new expansion scheme - Scheme 'L' - was under consideration. ⁽²⁾

(1) See Appendix 55.

(2) E.P.M. 101 (38). (A.H.B./Ic/2/2).

Expansion Scheme 'L'

In June 1938 a much larger R.A.F.V.R. organisation was contemplated under Expansion Scheme 'L'. The comparative figures were as follows:-

	<u>Scheme 'F'</u>	<u>Scheme 'L'</u>	<u>Increase or decrease</u>
Pilots	2,400	7,000	+ 4,600
Observers	2,500	1,500	- 1,000
W.O.s./A.G.	3,200	6,750	+ 3,550
Air Gunners	-	1,000	+ 1,000
	<u>8,100</u>	<u>16,250</u>	<u>+ 8,150</u>

The 33 aerodrome centres provided for under Scheme 'F' could, when expanded to their full capacity, absorb 4,000 pilots and 4,700 aircrew, thus leaving 3,000 pilots and 4,550 aircrew for whose training additional aerodromes would have to be provided. It was estimated that a further 25 centres would be required, thus making a total of 58 aerodrome centres. ⁽¹⁾

The total of 25 Scheme 'F' town centres was to be expanded to a total of 55 under Scheme 'L'. The additional number of aircraft required for the training of pilots was approximately:-

	<u>Elementary</u>	<u>Service</u>
Scheme 'L'	376	860
Less Scheme 'F'	<u>147</u>	<u>400</u>
Net additional requirements	<u>229</u>	<u>460</u>

The types of aircraft required were Moths and Magisters for Elementary and Harts for Service training. An additional 480 aircraft (Oxfords and Ansons) were required for the training of aircrews. Other requirements (approximately) were as follows:-

-
- (1) At this time there were 24 developed civil aerodrome sites, situated in potential recruiting areas, which could be made available within a reasonable time; for the remaining centre it was proposed to use the Royal Air Force Station at Abbotsinch. E.P.M. 101 (38). (A.H.B./Ic/2/2). In arriving at an estimate of the number of pupils to allot to each aerodrome the following points were considered:-
- (a) The size of the aerodrome.
 - (b) Other activities at the aerodrome.
 - (c) The past recruiting record at the centre, and hence the probability of obtaining the numbers of volunteers required.
 - (d) The population of the town or city the aerodrome served.
 - (e) The maximum number of trainees which any one aerodrome could efficiently train at any one time. This figure was fixed at 100 pilots and 100 aircrew per week-end, therefore the total strength of the largest centre would be 200 pilots and 200 aircrew on the assumption that trainees would attend, on the average, one week-end in two.

Flying instructors for pilot training	- 440 (including 200 Scheme 'F')
Qualified pilots for aircrew training	- 480
Armament instructors (full time)	- 165
W/T instructors (part time)	- 175
Navigation instructors (part time)	- 140
Photography instructors (part time)	- 70
A.M.L. Teachers (Sets)	- 70

The overall capital cost of the expansion under Scheme 'L' was estimated as being £10 million, with an annual recurring cost for the three years 1938-41 of £16 million in all.

Expansion Scheme 'L' was approved by the Treasury in August 1938,⁽¹⁾ but although immediate action was taken to implement this programme as quickly as possible, it was not completed by the outbreak of war. The largest bottleneck was the delay in the provision of the town centres; this was due largely to the slow and circuitous procedure involved in the arrangement by which the Office of Works acted as agents on behalf of the Air Ministry in acquiring and conditioning the premises. The average period taken to provide a centre was nine months up to the summer of 1938.

Scheme 'F' called for a total of 33 aerodrome centres and 25 town centres⁽²⁾ acting for a trainee population of approximately 2,500 pilots. By August 1938 the strength of the R.A.F.V.R. had risen to 1,870 pilots of which approximately half were qualified to fly solo on Service aircraft (Harts) and the number of civil schools in operation had risen to 27. Of the 25 projected town centres only 11 were in full operation. By 1 January 1939 the strength was 2,497 pilots and 32 aerodrome centres together with 14 town centres had⁽³⁾ been formed. It was anticipated that the remaining aerodrome centre and⁽⁴⁾ the 11 remaining town centres would be in operation by 30 April 1939.

(1) A.M. File S.44572.

(2) E.P.M. 168 (38). (A.H.B./Io/2/2).

(3) See Appendix 55.

(4) E.P.M. 6 (39). (A.H.B./Io/2/2).

Scheme 'L' called for the establishment of facilities for air crew training at all 33 Scheme 'F' aerodrome centres, and additional facilities for (1) increased numbers of pilots under training at 24 of the 33 centres. In addition 25 new aerodrome centres were to be formed to train both pilots and aircrew (3,000 pilots and 4,550 aircrew approximately). The town centres were also to be expanded under Scheme 'L' and 30 new town centres were to be formed. Until the facilities at town centres could be fully developed - and it was recognised that this would be a somewhat lengthy process - arrangements were made to carry out the ground training of V.R. pilots and aircrews in accommodation rented temporarily for the purpose. In this connection agreement had been reached with the educational authorities throughout the country, for the use of accommodation in primary and secondary schools wherever possible.

Recruiting for the aircrew branches of the R.A.F.V.R. had started at three town centres (Glasgow, Coventry and Leicester) at the end of November (2) 1938. The response up to the end of the year, however, had been poor. An increased publicity campaign was about to be started, but the Air Ministry were unwilling to undertake publicity on a large scale until more centres were ready to enter aircrews. It was anticipated, however, that the supply of navigation and W/T instructors would permit the recruiting and training of air crews to commence in February 1939. The supply of aircraft for the training was rather a bottleneck. The estimated rate and dates of supply of Anson aircraft indicated that 19 of the existing schools should have been supplied with three aircraft each and the remaining schools two each by the end of (3) June 1939.

Effects of the Munich Crisis

The Munich Crisis in the autumn of 1938 gave impetus to the accelerated establishment of the Volunteer Reserve Training Organisation. A Directorate of Volunteer Reserve Expansion was established in the Air Ministry in August

(1) See Appendix 55.

(2) At this time (November 1938) these were the only centres with any navigation and W/T instructors.

(3) The total estimated requirement of twin-engined aircraft for aircrew training was 478 aircraft and it was estimated that this number would be available by 31 December 1939.

(1)
1938 to supervise the formation and expansion of the R.A.F. Volunteer Reserve. A few months later it was decided to establish a separate command - Reserve Command - responsible only for Reservist activities.

Further measures were taken in late 1938 to improve the training of the volunteer reservists. (2) Group pools were to be established, and it was intended that V.R. pilots should be required to carry out at least a fortnight's annual training at a group pool. (3) The qualification was that all pilots should have carried out at least 100 hours flying on Harts before proceeding to the group pools for training. The functions of the group pools in peace were to be:-

- (a) To provide intermediate training and practice to certain regular pilots of operational units, who had just completed their flying training school course, and also to air crews.
- (b) To act as advanced training centres for flying personnel of the R.A.F. Volunteer Reserve, and thus fit them to take their place in operational units as soon after the outbreak of war as they would be required.

While the Group Pool solution was being devised in October 1938, it was realised that urgent measures were needed to deal with the 'dangerous shortage of reserve aircrews' and a scheme for inducing volunteer reservists to take a six month period of continuous training was proposed. (4) The inducement was to be a bonus of £50 (there was some discussion whether it would not be wiser to make it £75) for the six months service. As it will be seen, however, little came of this scheme, owing to the non-availability of aircrew personnel (observers and wireless operators/air gunner), due to the length of time required to train these personnel up to the Group Pool standard.

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- (1) This Directorate (D.V.R.X.) however, did not have any executive powers and was originally formed only as a temporary directorate whilst the V.R. was undergoing rapid expansion.
 - (2) A.M. File S.50933.
 - (3) This was a long term plan, however, and as a short term expedient non-mobilisable bomber squadrons were to take the place of group pools.
 - (4) A.M. File S.50933.

/ During

During this era of rapid expansion plans were also made to provide more advanced training at the V.R. centres. It was proposed to allot Battle aircraft together with camera guns, turrets and other instructional equipment to each of the V.R. centres. The total requirement of Battles was estimated to be 224 making the total advanced and intermediate trainer requirement of 1,084 aircraft.

(1)

Supply of Instructors

The chief limiting factor affecting the speed of development of the V.R. under Expansion Scheme 'L' was the supply of instructional staff, both flying and ground instructors. The flying instructor position was not good; the requirement under Scheme 'L' was 438 and the supply and available sources of supply in November 1938 were as follows:-

Employed on V.R. Training	138	}	176
Reserve pilots who had completed two flying instructor courses and who wished to be employed as such	38		

There were two potential sources of supply:-

Reserve pilots who had completed only one reserve flying instructor course but who, if given another, might be suitable and willing to take up flying instructor jobs.	240	}	501
Civil flying instructors with 'B' licence endorsements not engaged on V.R. work, but who were probably already employed elsewhere. (2)	261		

The ground instructor position was rather uncertain because resort had to be made to part-time civilian instructors. Part-time instructors in navigation, airmanship, theory of flight, engines, rigging, photography, W/T, and armament were required in large numbers for the training of pilots and aircrews. (3) The position in regard to the possible supply of each was as follows:-

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- (1) E.P.M. 168 (38). (A.H.B./Ig/2/2).
 - (2) The Civil Air Guard, for instance, was urgently in need of instructors and would probably absorb some of these personnel.
 - (3) In this connection observers required instruction in navigation, photography, bombing and gunnery; W/T operators required instruction in W/T and gunnery, and air gunners in gunnery only. The total number of instructors required for these subjects was estimated as being 631 under Scheme 'L'.

Armament Instructors. Competent armament instructors were unprocurable in civil life. 174 of them were required, but only 33 could be spared from Service sources, the remaining 141 would have to be drawn from civilian life, and this necessitated giving them a course before they could instruct. Arrangements were made for a course of instruction in armament lasting 14 weeks to be given in batches of 30. The Reserve of Armourers Class 'E' was circulated by O.C. Records and informed that positions at £4 10s. Od. a week awaited anyone suitable, able and willing to undergo these courses. Even so, with these courses running to full capacity it was recognised that the full quota of armament instructors required would not be available until March 1940. The first course started at the Air Armament School, Manby, in December 1938.

Navigational Instructors. It was estimated that 174 part-time instructors in navigation would be required. After reviewing the supply position arrangements were made in December 1938, to give school masters a short course in navigation so that they could act as part-time instructors. Arrangements were also made to give individuals who possessed sea navigational experience a short course in air navigation.

W/T Instructors. It was estimated that 142 W/T instructors would be required, and it was arranged in January 1939, for a month's course of instruction at The Electrical and Wireless School, Cranwell, to be given to reserve personnel who would later act as full time instructors at V.R. Centres.

Photographic Instructors. It was estimated that 135 part-time photographic instructors for the instruction of observers would be required. The syllabus was not very difficult but was sufficiently technical, from an applied point of view, to require instructors who had had experience of air photography. Arrangements were therefore made, in January 1939, to provide a month's course of instruction to be given to reserve personnel at the School of Photography, Farnborough.

Rigging and Engine Instructors. There was no cause for anxiety over this type of instructor. The syllabus was elementary and little difficulty was anticipated in obtaining the necessary number of instructors.

The supply of qualified pilots to fly the aircraft in which the crews were to train was another difficulty; a total of 438 were required and there were four sources of supply:-

- (a) Pilots with 'B' Licences in the United Kingdom. These totalled 932, but it was unknown how many were in employment, but it was believed that there were very few out of employment.
- (b) Pilots in the Class 'A' and 'E' Reserve. It was proposed to circularise these personnel who had been in the Reserve for not more than $2\frac{1}{2}$ years and could therefore be assured not to have entirely lost their skill.
- (c) Volunteer Reserve Pilots. The source was very small in November 1938 but would, of course, grow larger in time.
- (d) Service pilots lent to aviation firms for the training of V.R. aircrews.

The selection of aerodrome centres also led to some difficulties, not only in contractual arrangements, but also in the actual acquisition of the site. Had it been feasible to adopt a completely arbitrary method of commandeering aerodromes and accommodation there is little doubt that much time would have been saved. This, however, was not possible and the volunteer reserve expansion had to be fitted in co-operation with a Civil Air Organisation which itself was in a process of development. The provision of volunteer reserve accommodation on civil aerodromes meant that it had to be conditioned to the state of development of each aerodrome, and regard also had to be paid to the requirements of other competing interests such as Civil Air Traffic, requirements of Regular Air Force Training, Auxiliary Air Force, and the Civil Air Guard.

Formation of Reserve Command

During 1938 the amount of training done at the civil schools increased rapidly. Besides V.R. expansion, Scheme 'L' called for additional facilities for pilot training and navigation training for regular pilots and observers, and much of this was done at the civil schools. (1) At first, all these civil schools were under No. 26 Group which, though nominally under Training Command, was in practice largely controlled direct by the Air Ministry. Training

(1) E.P.M. 166 (38). (A.H.B./Io/2/2).

Command was not staffed to deal with No. 26 Group, which consequently tended to drift out of control, while No. 26 Group itself was not staffed to deal independently with all its administrative work. Again No. 26 Group had far too many units: Air Commodore Pulford was strongly of the opinion that a single group should not have more than 12 V.R. centres or flying schools.

These facts, and the advisability of setting up a separate command to handle the civil reserve training schools, were discussed in a paper by Air Vice-Marshal Portal.⁽¹⁾ In November 1938 it was decided to create a Reserve Command which was formed on 1 February 1939 with its Headquarters at Hendon. No. 26 Group was renumbered 50. In April No. 50 Group moved from Hendon to 11, Tavistock Place, London, and a new Group, No. 51, was formed to relieve No. 50 Group of part of its responsibilities. In August No. 50 Group moved from Tavistock Place to Bristol, and No. 51 Group from Tavistock Place to Leeds. Readiness for war had considerable influence on the decision to form a separate Command, since it seemed that all the war training requirements envisaged under Scheme 'L' would be too much for Training Command to handle alone at the outbreak of war.

R.A.F.V.R. Progress 1939

By 1 May 1939, the strength of the R.A.F. Volunteer Reserve had risen to 4,394 flying personnel of which 3,604 were pilots, 477 observers, and 313 were wireless operators/air gunner.⁽²⁾ All 33 aerodrome centres, and 25 town centres planned under Scheme 'F' were open and operating, and the expansion of these centres to meet the demands of Scheme 'L' was well under way; expansion was completed at four aerodrome centres, and seven town centres⁽³⁾ and it was

(1) E.P.M. 166 (38). (A.H.B./Io/2/2).

(2) See Appendix 56.

(3) Expansion was completed at the following centres:-

Aerodrome Centres

Ansty
Cambridge
Hamble
Perth

Town Centres

Belfast No. 1	Luton No. 1
Birmingham No. 1	Manchester No. 1
Glasgow No. 1	Stoke-on-Trent
London No. 1	

anticipated that work would be finished on the remaining 29 aerodrome centres⁽¹⁾ and 18 town centres due to expand by 1 October 1939.

In addition steady progress was being made in the selection and construction of the additional 25 aerodrome centres required under Expansion Scheme 'L'. Two aerodrome centres opened on 1 May. The formation of the 35 additional town centres was suffering considerable delays however, and these were largely due to the pressure of work in the Office of Works and the failure of that Department to give the Air Ministry the degree of priority which the situation demanded. Other factors making for delay were financial,⁽²⁾ legal, and town planning difficulties. Temporary arrangements had been made in some cases for the use of schools for lectures, and it was agreed to extend this procedure and it was proposed where necessary, to explore the possibility of obtaining temporary accommodation on a monthly rental basis.

The recruitment of personnel was proceeding fairly satisfactorily, the supply of pilot recruits, particularly in the London area much exceeded the demand, and although the recruiting of aircrews started somewhat slowly and was not fully satisfactory, it was supplemented by diverting surplus pilot candidates into this channel. The Military Training Act which had just been introduced was also expected to have the effect of producing the aircrew⁽³⁾ candidates required.

The supply of flying instructors was very low, and although in May 1938 it was fairly satisfactory it was anticipated that within a few months the position would rapidly deteriorate because no more regular flying personnel were being passed into the Reserve; moreover the supply of qualified R.A.F.V.R. personnel would not be forthcoming in time to be of maximum advantage. There were two schemes for providing V.R. instructors:-

- (a) To release regular pilots from the Service to take posts at flying training schools.
- (b) To undertake a centralised scheme for the recruitment of instructors from Canada where it was felt there was a large potential field.

(1) E.P.M. 76 (39). (A.H.B./Ic/2/2).

(2) E.P.M. 83 (39). (A.H.B./Ic/2/2).

(3) E.P.M.s 79 and 83 (39). (A.H.B./Ic/2/2).

The supply of experienced pilots for flying aircrews under training was also very uncertain, and a scheme was under consideration whereby newly trained regular pilots who would normally be attached to Bomber Command to gain experience of flying with a regular crew should be attached to R.A.F.V.R. centres for flying with volunteer reserve crews. Another suggestion was that regular pilots might be employed part time during the week-ends for training the V.R. crews. Neither of these suggestions were very enthusiastically received but nevertheless enquiries were made as to their feasibility.

The position concerning the supply of navigators, W/T and photographic instructors was now regarded as satisfactory, thanks to the provision of courses at R.A.F. schools for potential instructors. Difficulties, however, were being met in regard to the provision of armament instructors, and increased publicity was given to the recruitment of these personnel.

The supply of elementary training type aircraft was adequate, and advanced and intermediate trainers for pilot training would be supplied and met in full by 1 April 1940, providing the allotment remained unaltered. The supply of Ansons for aircrew training, however, was delayed and the first had only just become available.

The Group Pool training scheme had commenced in April for small numbers of V.R. personnel. While there were adequate numbers of qualified V.R. pilots available ⁽¹⁾ there were no trained crews to match them and so only pilots could be given advanced training. The bonus system of inducing V.R. personnel to carry out this six months' continuous service training was rendered unnecessary when the compulsory military training act was passed. By 1 May however the scheme had proved quite successful and some 50 per cent of the employers who had been approached had agreed to release their employees and ⁽²⁾ there were at this time some 120 volunteer reservists undergoing such training.

(1) The Wing Badge was granted to R.A.F. Volunteer Reserve Pilots after about 100 hours flying. Their course, though only carried out part time included the ab initio course of 50 hours elementary flying as given to Regular personnel, followed by a further 50 hours flying on Service aircraft. There were approximately 500 pilots available for advanced training in April 1939.

(2) Those for fighters were trained at the Solitary Group Pool, Andover, and those for bombers in the non-mobilisable Group Training Squadrons. Nos. 7, 44, 52, 63, 75, 97, 104, 108 and 148 Squadrons carried out this training prior to the outbreak of war.

One important change made with regard to the formation of the aerodrome centres under Scheme 'L' was the contractual arrangements. All the 33 schools already formed under Scheme 'F' were operated by commercial firms on behalf of the Air Ministry. Those formed under Scheme 'F' (Nos. 14 and 34 E & R.F.T.S.s) were established on the basis that the buildings, equipment, aeroplanes and spares were provided by the Air Ministry. The operating companies (chosen after competitive tender) had entered into agreement to maintain the aircraft and equipment, and to give flying and other training to the pupils allotted to them. The contracts were framed generally on the current estimates of the number of trainees likely to be forthcoming, the number of instructors required to train them, and the types of aircraft proposed to be allotted. Broadly, remuneration took the form of a quarterly payment in respect of each hour flown, dependent on the type of aircraft used. (1)

It was found, however, that the categories of pupils (having particular regard to the inclusion of aircrew training the V.R. scheme), and the types of aeroplanes available were subject to variation. Also it was not possible to gauge with any degree of accuracy the recruiting response in the different areas. Those circumstances made it necessary frequently to amend the agreements. Such amendments presented considerable difficulty owing to the fact that the original agreements were entered into after competitive tender and without disclosure of the manner in which the prices were made up. Negotiation on each amendment became necessary and the circumstances were such that the company was in a stronger negotiating position than the Air Ministry.

In order to overcome these difficulties and at the same time to enable the department to obtain direct evidence of the cost of operating the schools, it was proposed that resort should be had to a management basis for the operation of the 25 new schools to be formed under Scheme 'L' where such a course was warranted by circumstances. The operating company was selected after competitive tender unless strong grounds existed for giving the contract

(1) The contracts for the schools which were already carrying out R.A.F. regular and reservist training prior to the formation of the R.A.F.V.R., (Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12 and 13 E. & R.F.T.S.s) were redrawn when V.R. training commenced to cover the pilot training of R.A.F. reservists, short service commission officers, airmen pilots and volunteer reserve personnel.

outright on reasonable terms to some particular company, e.g. one having sole flying rights on the aerodrome. In weighing up competitive tenders for a management contract considerable importance was attached to the standing of the companies and the sort of management they were likely to provide. ⁽¹⁾

Remuneration was by way of a management fee varying with the scope of the school, and it was found most convenient for part of the fee to take the form of a payment per hour of flying training given in order that the managing company should be encouraged to make the utmost use of the school. All other costs of the school were repaid to the company by the Air Ministry. The expenditure in relation to their services was settled between the company and the appropriate branches of the Air Ministry. It was found that no great contractual difficulties would be encountered if the schools were run on a management basis even though the numbers and categories of trainees were likely to vary from time to time.

By 1 July 1939 there were 38 aerodrome centres in operation which would give a capacity when fully expanded of 5,500 pilots and 5,450 aircrew. It was anticipated that all the accommodation would be provided by 1 December 1939. ⁽²⁾ The strength at 1 July 1939 at these centres was 4,500 pilots and 2,200 aircrew. A further 16 centres were due to open before 1 October which would give a total of 54 schools with a training potential when fully expanded of 7,250 pilots and 7,950 aircrew. Thirteen of these schools were expected to be fully expanded by 1 December 1939 and the other three by 1 March 1940. In addition another four centres were expected to open before the end of 1939 giving a total potential for the 58 Scheme 'L' schools of 7,550 pilots and 8,450 aircrew.

Thirty-eight town centres were also in use by 1 July 1939 and it was anticipated that a further 12 would be open by 1 November 1939.

⁽³⁾
Expansion Scheme 'M'

With the advent of Scheme 'M' it was necessary to consider further measures to meet a requirement of 13,000 pilots and 13,200 aircrew. To produce the potential required it was proposed to expand to capacity all Scheme 'L' aerodrome centres and to establish approximately 20/25 new centres to begin operation in 1940.

(1) E.P.M. 24 (39). (A.H.B./10/2/2).

(2) See Appendix 57. E.P.M. 109 (39). (A.H.B./10/2/2).

(3) See Appendix 57. E.P.M. 109 (39). (A.H.B./10/2/2).

In order to meet the ground training requirements a further 20 new town centres were planned to form, making approximately 80 in all. These programmes of town and aerodrome centres planned to give only basic training and did not touch the problem of advanced training. The large numbers which they envisaged (26,200 in all) were inevitably only a promise for the future, with week-end and spare-time instruction it needed well over a year to train a volunteer reserve pilot or observer. (1)

Proposals for Continuous V.R. Courses

The scheme for encouraging volunteer reservists to do a six months' voluntary continuous training course was under way and by July 1939 there were about 180 personnel undergoing such training.

A further scheme for volunteer reservists to undertake an initial course of six months' training as observers was proposed, together with similar facilities for the training of wireless operators. The difficulty with this scheme was that they required the same facilities as were used for training regular aircrews, and those facilities could ill be spared, especially since Bomber Command were 54 per cent deficient in trained and experienced crews. Both regulars and reservists trained at civil schools and therefore any numbers of V.R. personnel trained, would be at the expense of regular personnel. (2)

The number of V.R. personnel concerned was set at 300 observers and 500 wireless operators. They would all have to be trained at the civil schools because it was not practicable to give so much elementary training in the non-mobilisable squadrons. This meant that Ansons would have to be provided for the training and these could only come from those used for training by Bomber Command. Similarly facilities for armament training could only be provided at the expense of the operational commands use of tow lines and targets.

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- (1) Recruiting for V.R. observers had not commenced until late 1938 and training did not commence until early 1939 (at three centres Prestwick, Ansty and Desford, each training 24 pupils). Under the most favourable conditions it was obvious that the course would occupy at least 12 months and it was estimated that no trained V.R. observers would be available until 1 April 1940.
 - (2) A further difficulty was met in estimating the response to the recruitment of regular observers. If the response was adequate no facilities would be available for the training of reservists. On the other hand it was imperative that the utmost use should be made of the existing facilities and any lapse in the recruitment of regular personnel would mean that vacancies would occur in the civil schools.

While these proposals were under discussion the Military Training Act was passed; this would provide 'militia' for the R.A.F. and the scheme accordingly became one for the Militia training of aircrew.

Eventually it was decided to train 600 pilots, 420 observers and 300 W/T operators on six months continuous courses at the civil schools. (1) Observers were to carry out a 12 weeks navigation course at the civil schools, followed by eight weeks training at an armament training station and eight weeks in a non-mobilisable bomber squadron - 28 weeks in all. (2) Wireless operators were to start with eight weeks on gunnery training (at No. 7 A.T.S. Acklington) and go on to a 16 weeks wireless course at a civil school (Hamble) followed by two weeks on a non-mobilisable squadron, 26 weeks in all. Pilots were to do the three months ab initio course at civil schools followed by some advance flying. The scheme was due to start in September for observers, October for wireless operators, and November for pilots. The outbreak of war in September nullified this scheme and all the facilities of civil schools were incorporated in the R.A.F. system of full time training.

Meanwhile the part-time training was making steady progress. The flying instructor supply position, which had, by July become critical, was relieved by the premature release of 150 pilots from the Service to the civil schools. Steps were also being taken to recruit qualified flying instructors and crew pilots in America, Australia and Canada.

The expansion and construction of the town and aerodrome centres was not proceeding as rapidly as it should have been and this delay was causing some concern. The delays were due largely to protracted financial arrangements and also to the somewhat cumbersome machinery in the Air Ministry for dealing with the V.R. matters. Arrangements were being made to improve the administrative organisation of the R.A.F.V.R., though the outbreak of war obviated this as the reserve training system then became part of the R.A.F. Training Organisation.

(1) A.M. File 930636/38.

(2) A new A.T.S. at Jurby was due to open in September 1938 for this training. No. 5 A.O.S. opened on 18 September 1939 at Jurby (A.T.S. were renamed A.O.S. on the outbreak of war).

Expanding the Volunteer Reserve was therefore a lengthy business. Time was needed to organise more town and aerodrome centres, instructors were hard to find, and supplying the centres with instructional equipment and advanced trainer types of aircraft could not be done quickly. Although negotiations for V.R. aircrew and advanced pilot training had started in the latter half of 1938 it was not until the summer of 1939 that the Battles for the pilot training and Ansons for the other aircrew training were introduced at the schools. In point of fact, by the outbreak of war only about half of the schools ever received Battle and Anson aircraft, and only a few of these actually commenced any training on such aircraft.

These problems were accentuated by the fact that the aircraft, staff and facilities needed for V.R. training were also needed for regular air force training. Plans for reconciling the two were drawn up shortly before the outbreak of war and consequently were never put into operation.

Progress by the Outbreak of War

By 1 September 1939 there were 45 aerodrome centres and 42 town centres in operation. ⁽¹⁾ On the outbreak of war all the town centres were disbanded and 27 of the aerodrome centres were closed, as the aerodromes were required for other purposes. The aircraft of the aerodrome centres were re-distributed, all their Service aircraft, such as Harts, Battles and Ansons - approximately 540 in all, were withdrawn and used to bring the Service flying training schools up from peace to war establishment. The R.A.F. Volunteer Reserve part-time training stopped and all pupils at the schools were collectively grouped as R.A.F. pupils. ⁽²⁾ The R.A.F.V.R. pupils who, on 3 September 1939 were undergoing pilot training at an E. & R.F.T.S. were on the satisfactory completion of their course, given the option of accepting a commission in the R.A.F. for four years followed by four years on the Reserve, or an emergency commission in the R.A.F. Volunteer Reserve for the duration of hostilities only. The R.A.F.V.R. personnel were mobilised and called up for full-time service during the first few months of the war. Most of the pilot and aircrew members had not progressed sufficiently with their training to enable them to be posted direct to operational squadrons, and they were entered to

(1) See Appendix 58.

(2) It will be remembered that, prior to the outbreak of war the E. & R.F.T.S. dealt not only with the training of volunteer reservists but also carried out ab initio training of regular air force personnel, both short service commission pupils and Anson pilots, besides many refresher courses for personnel of the R.A.F. Reserve.

complete their training at a stage appropriate to their V.R. experience. In the case of pilots, who formed the bulk of volunteer reservists this meant that they were posted to a Service flying training school.

The 19 aerodrome centres or elementary and reserve flying training schools remaining open were renamed elementary flying training schools and continued to function operated by civilian firms on behalf of the Royal Air Force. Their functions however were confined entirely to the ab initio training of pilot pupils. All other functions previously carried out at the schools, such as observer training and wireless operator training, were divorced from the schools and separate establishments were set up to carry out this training. ⁽¹⁾ The war training organisation came into effect and the elementary flying school course was set at eight weeks, pupils then proceeded to a Service flying training school for a 16 weeks course, and on their successful completion of the training were awarded their wings.

At the outbreak of war the strength of the Royal Air Force Volunteer Reserve was roughly 18,000 of which approximately 5,000 were aircrew personnel. The majority of the R.A.F.V.R. pilot personnel had not completed their Service training and this caused a bottleneck at the S.F.T.S.s owing to a shortage of advanced training facilities. This eventually caused a lengthening of the E.F.T.S. courses and during the winter of 1939-40 courses often lasted as long as four to five months. Many E.F.T.S.s trained volunteer reservists as elementary flying instructors on a four weeks course during this time.

The V.R. training organisation disappeared upon the outbreak of war and was absorbed in the regular air force training system. The subsequent list of these activities will be found in the sections dealing with pilot, observer and wireless operator training.

The Civil Air Guard

The Civil Air Guard (C.A.G.), which officially emerged as such in 1938, was considerably older than its title. Before the First World War civil aviation in Great Britain had been kept alive by a mere handful of enthusiasts, and although the war itself had aroused more widespread public interest, the post-war economics had seriously curtailed the progress of the air minded.

(1) Other courses carried out at the E. & R.F.T.S.s were the navigational training of regular pilots and observers.

The Director of Civil Aviation in the Air Ministry (Sir W. Sefton Brancker) realising that the progress of aviation depended on the increase of public interest in active flying persuaded the government to adopt his proposal whereby a subsidy was paid to approved non-commercial organisations for each pupil whom they succeeded in training up to the standard of the Air Ministry's Amateur Pilot Licence. This subsidy though comparatively small (it was limited to an annual total of £10,000) soon caused rapid progress to be made in the light aeroplane world. In a few years light aeroplane clubs were created all over the country and it was not long before flying instruction was available to every one who could afford to pay for it, at the rate of approximately £2 per hour - which was roughly half the cost price.

Shortly before the commencement of the 1934 R.A.F. expansion programme, the subsidy for the flying clubs had been reduced to £25 per pilot, which meant that clubs could only carry on without seriously increasing their prices by having a steady demand for their services. With the advent of the R.A.F.V.R. in 1937, whereby potential pilots found themselves being paid to learn to fly instead of having to pay for it, came the sharp decline in the prosperity of the flying clubs, and for the next two years the flying clubs came very near to extinction.⁽¹⁾

In July 1938, the first approaches were made to form the Civil Air Guard. The Air Ministry and the General Council of Light Aeroplane Clubs came to an agreement and shortly afterwards the scheme was announced.⁽²⁾ The original objects of the scheme were threefold:-

- (a) To create a body of men and women able to perform valuable work in war-time - from piloting down to miscellaneous jobs connected with Service aviation.
- (b) To keep the light aeroplane clubs alive - (which as we have seen were in imminent danger of being unable to carry on) - and thus retain for times of emergency the nucleus pilots and aircraft used by the clubs.

(1) Although both the R.A.F. Reserve and the Auxiliary Air Force had existed for a long period prior to the expansion scheme, neither gave very great opportunities for the enthusiastic amateurs to join.

(2) E.P.M. 170 (38). (A.H.B./Ic/2/2).

- (c) To stimulate the general air interest of the British Public, in fact, to endeavour to make the nation air minded on a scale which had hitherto not been attempted.

The scheme announced that persons of either sex between the ages of 18 and 50 were to be given the opportunity to learn to fly at rates as low as 2s. 6d. per hour provided that they were able to pass the medical examination required for holders of the Air Ministry pilot's 'A' licence.⁽¹⁾ The only other stipulation required for membership of the Civil Air Guard was an honourable undertaking to serve in the Royal Air Force in any capacity required in time of emergency.

The scheme was essentially one for the clubs to run, but in order that there might be a central organisation competent to guide the clubs in their Air Guard activities, and to make contact with the Air Ministry on general questions, a commission was set up under the Chairmanship of Lord Londonderry, with a representative body of members and a secretary with Headquarters at Ariel House, London, all of whom were very closely connected with the light aeroplane world.⁽²⁾

The organisation, therefore, was civil in character and its aim was to enable the maximum number of members to obtain the Air Ministry 'A' licence. This entailed roughly 12 hours dual flying and 4 hours solo. There was no organised ground training carried out. Members were also required to carry out 10 hours practice flying per year.

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- (1) The estimated costs per hour were as follows:-

Normal training	-	10/- at week-ends
type aircraft		5/- during the rest of the week
Lighter type of	-	5/- at week-ends
aircraft		2/6 during the rest of the week

- (2) The five members of the Commission were:-

Lord Londonderry	-	Chairman (Former S. of S. for Air)
Sir Lindsay Everard	-	Chairman of the Royal Aero Club
Major Alan Goodfellow	-	Ex-Wartime Pilot
Mr. Robert Murray	-	President of the Glasgow Corporation Transport Flying Club
Mrs. Maxine Miles	-	Wife of F.G. Miles managing director of Phillips and Powis and herself an aeroplane designer
Air Commodore J.A. Chamier	-	Secretary

The scheme started very well. In the first three months of operation the C.A.G. had 3,500 flying members and 1,380 had obtained 'A' licences. There were some 33,000 applications (approximately half were found suitable for flying instruction) and it was anticipated that by the end of 1939, there would be 10,000 'A' licence Civil Air Guard members.

(1)
There were 60 civilian flying clubs operating with the Civil Air Guard, equipped with various types of light aircraft (typical types were Tiger Moth, Moth Minor, Avro Cadet, Swallow, Taylorcraft, Cygnet, and the Topsy).

At this point it might perhaps be mentioned that there was an essential difference between members of the Civil Air Guard, and members of the Reserve and Auxiliary Forces. The Air Guard member had to pay from his own pocket for his flying - although the cost was reduced by means of a Government Grant; furthermore, he received no remuneration in respect of the time he spent in training as an 'A' licence pilot, or in flying subsequently to the grant of the licence.

The crisis of the autumn of 1938, together with the success achieved in the first few months of the scheme, decided the practical means of achieving the first object of the scheme, namely the creation of a body of volunteers, both men and women, able to carry out valuable work in time of war. When it was suggested by the Civil Air Guard Commissioners that facilities should be provided for further advanced training for Air Guard personnel, the whole scheme was reviewed and a classification scheme drawn up for the Air Guard members.

Classification of C.A.G.

Before considering in what mannerⁿ the services of the Civil Air Guard members could best be utilised in war it was decided to make a brief survey of the response to the scheme during its first few months of operation.

The introduction of the scheme had disclosed the existence of a substantial number of people in the country keen to take up flying and prepared to bear the cost themselves so long as it was kept reasonably low by means of State assistance. The main limiting factors were, of course, training aircraft and instructors, and to a somewhat lesser degree finance. By the

(1) See Appendix 59.

end of October 1938, some 35,000 persons had applied for registration as members of the Air Guard, and a total of approximately 4,000 were either already in possession of 'A' licences, had commenced flying, or had received medical certificates of fitness in accordance with 'A' licence standards.

On 21 November 1938, 4,800 members were registered with the Civil Air Guard Commission, and an examination disclosed the following information in regard to them:-

		<u>Percentage</u>
Men	-	89.36
Women	-	10.64
<u>Age distribution of men only:-</u>		
18 - 30	-	55.67
30 - 40	-	36.31
40 - 50	-	8.02
<u>Flying experience - Men and Women combined:-</u>		
100 hours or more	-	3.85
50 - 100 hours	-	2.87

It was impossible to give figures regarding the remaining 30,000 persons who had applied for registration, and it was recognised that they might well be rather different from those shown for the registered members. It was, however, quite reasonable to assume that of this 30,000, at least 15,000 would be eligible for Civil Air Guard membership.

It was also estimated that over a period of four years from the commencement of the scheme - that is by June 1942 - some 20,000 persons could be trained to 'A' licence standard.

The question of the manner in which Air Guard members might be earmarked for their war roles was discussed in the Air Ministry and the proposals outlined below received an entirely favourable reaction by the Commissioners of the Air Guard. There were to be three classes of Air Guard members in peace-time. These are dealt with hereunder:-⁽¹⁾

(1) A.M. File S.47887.

Class I. Pilots for transfer to the Royal Air Force

This class was open to men only, between the ages of 18-30, who would be eligible for service in the R.A.F. as pilots in War. A member was required to carry out, in addition to his 10 hours flying annually as an Air Guard member, a further 10 hours in accordance with a simple progressive syllabus drawn up by the training authorities in the Air Ministry. This included aerobatics, spinning and cross-country flying. (1)

Members of this class were medically examined by Royal Air Force boards, and arrangements were made that future entrants to the Civil Air Guard would be required to state at the time of their examination for their 'A' licence whether they were candidates for Class I of the Air Guard.

It was also arranged that a flight test was also carried out by the R.A.F. of all members after the completion of their 10 hours syllabus each year. Subject to satisfactory completion a gratuity was then paid by the State - in the form of a special subsidy - to the club in respect of such additional flying. This sum was approximately £20 per member.

It was contemplated that members of this class of the Air Guard would provide a supply of partly trained pilots, probably ready after short tests, for posting to intermediate flying training at the war-time Service flying training schools. This supply of partly trained personnel, it was thought, would provide relief in the early stages of a war for the elementary flying training organisation, and should, on the assumption that the Service flying training arrangements for war were made available immediately, produce an output of pilots in advance of the first war-time entries.

Arrangements were also made for men over 30 years of age who held instructional qualifications or other experience enabling them to act as Service pilots in the event of war, to become members of Class I.

(1) See Appendix 60.

Class II. Civilian Pilots

This class consisted of those members of the Air Guard between the ages of 18-50 of both sexes, with a history of a substantial amount of flying or with 50 hours solo flying to their credit during the preceding three years. The Air Guard Commissioners were left to judge as to the suitability of candidates for this class.

It was anticipated that this class would be filled by civilian private owners and other pilots with very lengthy flying experience but who were not eligible or had not been attracted to any scheme for the utilisation of their services in war. This class would be available for ferry and communication flying in war, and also for elementary instructional work. They had no grant from public funds beyond that already authorised for ordinary Air Guard members.

Class III. Aircraft Crews

This class consisted of men up to the age of 40 who, through reasons of age, medical and other grounds, were not able to acquire any considerable flying experience, but were suitable for other aircrew duties such as observers, wireless operators and air gunners in war.

During peace it was not possible to provide them with any flying experience as such. But special ground training and lectures in connection with navigation, gunning and wireless was arranged. This could not be provided by the clubs, and it was therefore arranged that facilities for these personnel should be provided at nearby R.A.F. Volunteer Reserve Town Centres.

This class also underwent tests by the R.A.F. but no grant from public funds was made, other than that already authorised for ordinary Air Guard members.

All qualified members of the three groups were entitled to wear a distinguishing star in addition to the Civil Air Guard Badge.

By the outbreak of war, although the scheme was by no means in full operation, valuable experience was gained by the Civil Air Guard personnel. The estimated strength on the outbreak of war was 7,500 flying members and

/ when

when the clubs were closed and their aerodromes and equipment were taken over by the Service many Civil Air Guard personnel became valuable members of the Royal Air Force, or the Air Transport Auxiliary.

In actual fact the Civil Air Guard did not survive the outbreak of war. On 29 August 1939, the Commissioners announced that all unit training for applicants over 32 years of age would cease. Those who had volunteered but were not yet enrolled, it was stated 'will doubtless desire to offer themselves for other forms of voluntary service'. Many did, in fact, do so either by transferring to the Volunteer Reserve, which incidentally was called out for permanent service on 1 September 1939, or by joining the Air Transport Auxiliary which was organised for the ferrying of aircraft for the Royal Air Force.

APPENDIX 1

BRITISH, ALLIED AND FOREIGN NATIONALS FROM OVERSEAS ENLISTED (1) IN THE ROYAL AIR FORCE IN THE UNITED KINGDOM, 1939-1945

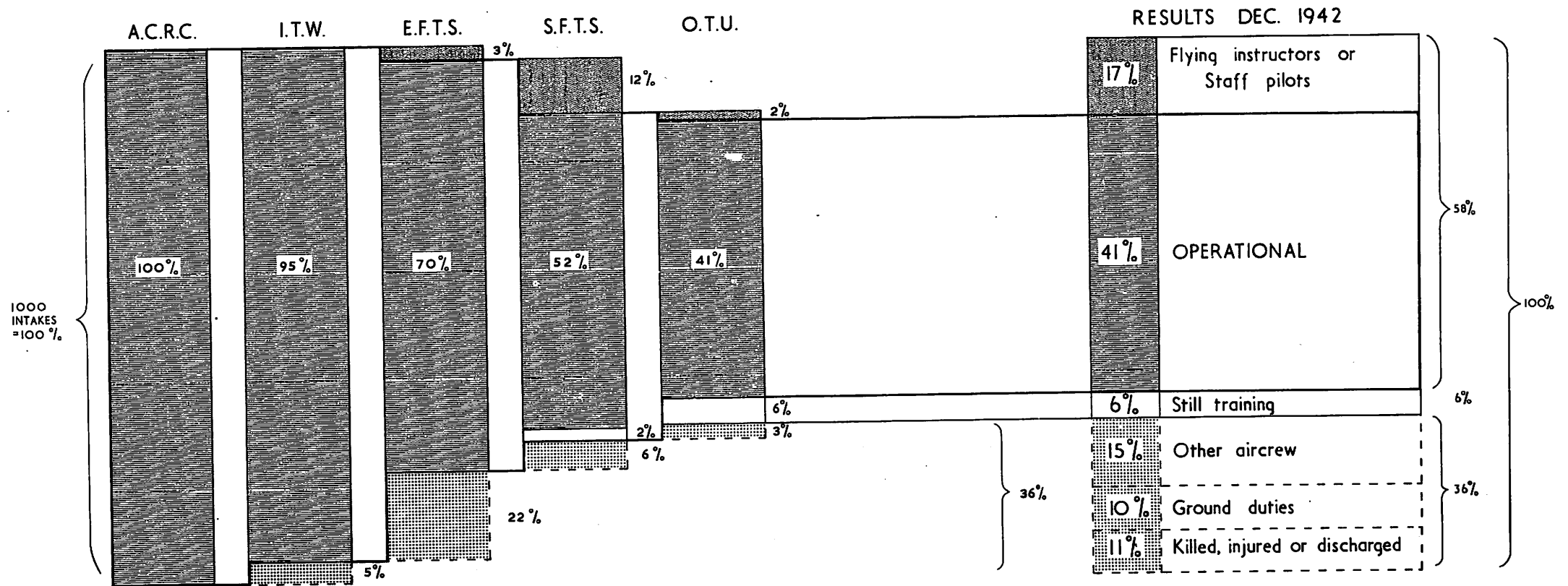
Algeria	3	Madeira	1
Argentina	484	Malaya	12
Australia	30	Malta	1
Bahamas	34	Mauritius	125
Barbados	261	Mexico	20
Belgium	5	Morocco	5
Bermuda	81	Newfoundland	9
Bolivia	3	New Zealand	7
Brazil	128	Nicaragua	3
British Guiana	508	Northern Rhodesia	1
British Honduras	51	Palestine	6
British W. Africa	85	Panama	2
Burma	4	Peru	30
Canada	34	Poland	3
Canary Isles	1	Portugal	30
Ceylon	70	Portuguese E. Africa	3
Cape Verde Isles	1	Porto Rica	1
Chile	131	Roumania	1
China	31	Russia	1
Columbia	10	Seychelles	2
Costa Rica	3	Siam	1
Cuba	9	South Africa	24
Curacao	6	Southern Rhodesia	8
Cyprus	11	Spain	9
Denmark	27	Stateless	1
East Africa	2	Sweden	14
Ecuador	1	Switzerland	1
Egypt	5	Syria	2
Falkland Isles	19	Tasmania	2
Faroos	1	Trinidad and Tobago	420
Fiji	26	Uruguay	52
Finland	5	United States of America	224
France	20	Venezuela	7
Germany	1	Windward Isles:-	
Gibraltar	11	Dominica	11
Greece	3	Grenada	32
Guatemala	1	St. Lucia	14
Honduras	2	St. Vincent	10
Honolulu	1		
Iceland	3		
India	36		
Indo-China	1		
Iran	11		
Jamaica	910 (2)		
Japan	8		
Java	1		
Leeward Isles:-			
Antigua	32		
Montserrat	6		
St. Kitts	17		
		<u>Total</u>	<u>4,229</u>

(1) This does not include:-

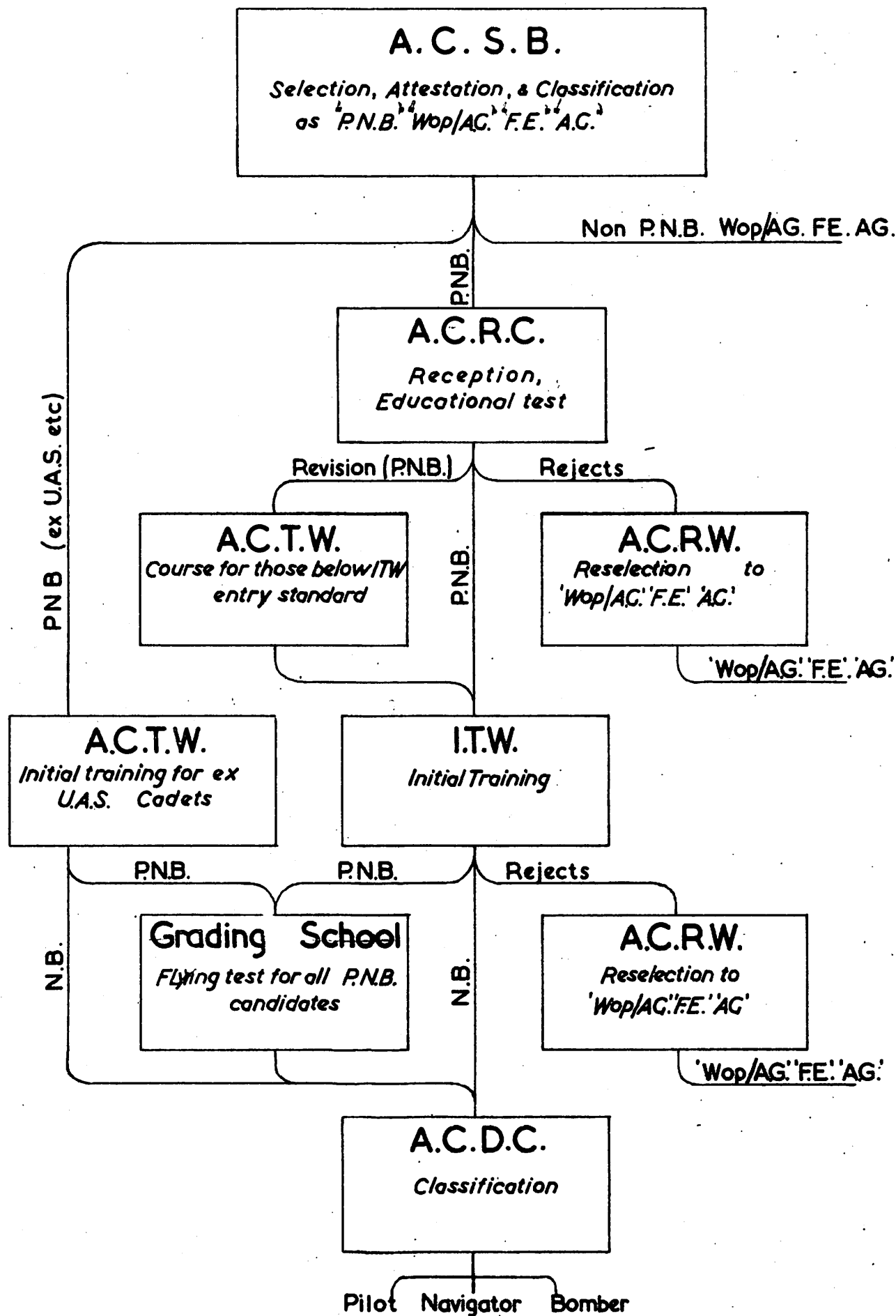
- Personnel of the Allied Air Forces.
- Personnel of the Dominion Air Forces.
- Personnel who came to the United Kingdom under their own arrangements and enlisted in the Royal Air Force.
- Allied personnel from other countries (i.e. Poles from Canada, Czechs from Brazil, etc.).
- Personnel enlisted in their home country (i.e. Jamaicans in the West Indies, Palestinians in the Middle East).

(2) Includes 230 who enlisted in Canada before proceeding to the United Kingdom.

PERCENTAGE OF PILOT TRAINING WASTAGE OVER 2 YEAR PERIOD OF TRAINING ON 1000 SELECTED INTAKES (JUNE - DECEMBER 1940 INTAKE PERIOD)



SEQUENCE OF SELECTION & CLASSIFICATION UNDER P.N.B. SCHEME - MAY 1942



APPENDIX 4.

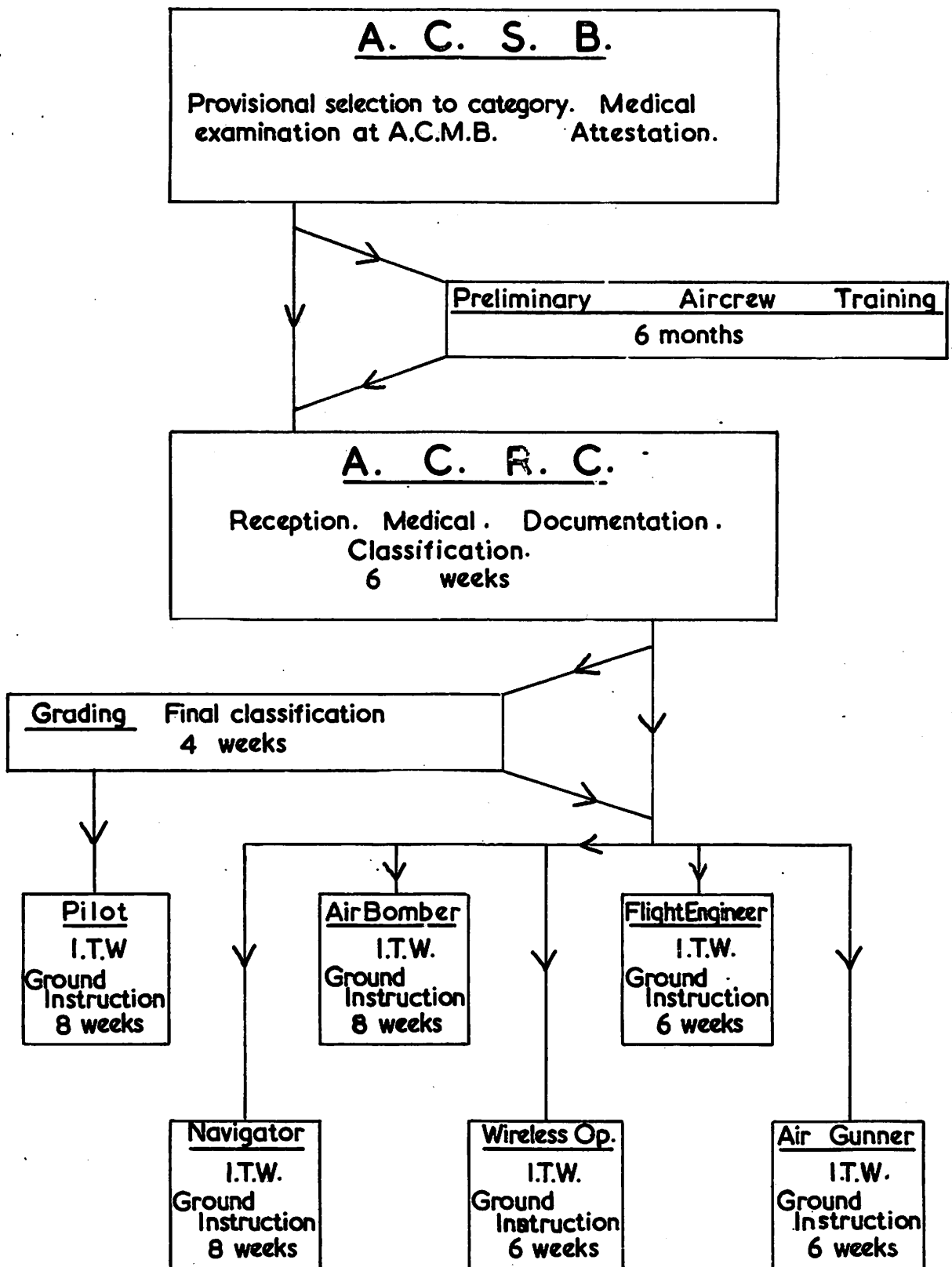
FORMATION OF THE PRELIMINARY AIRCREW TRAINING CENTRES

P.A.C.T. Centre	Formed 1943	School	Capacity
No. 1 - Edinburgh	8 March	Regent Road School	200
No. 2 - London	15 March	Wandsworth Technical Institute	200
	15 March	Battersea Polytechnic	100
No. 3 - London	22 March	Balham and Tooting Institute	200
No. 4 - London	29 March	Borough Polytechnic	100
	12 April	Norwood Technical School	100
No. 5 - London	5 April	Wandsworth Technical Institute	200
No. 6 - Cardiff	12 April	Cardiff Technical College	50
	12 April	Swansea Technical College	50
	12 April	Newport Technical College	50
	12 April	Neath Mining and Technical Institute	50
No. 7 - Aberdeen	19 April	King's College	200
No. 8 - Wolverhampton	10 May	South Staffordshire Technical College, Wolverhampton	50
	10 May	Walsall Technical College	50
	10 May	Hinckley Technical College	50
No. 9 - Bradford	17 May	Technical College	125
No.10 - Manchester	24 May	Manchester High School of Commerce	100
	24 May	Salford Royal Technical College	50
	24 May	St. Helens Municipal Technical College	50
No.11 - London	31 May	Walthamstow Technical College	100
	31 May	S.E. Essex Technical College, Dagenham	100
No.12 - Edinburgh	7 June	Leamouth Technical College	200
No.13 - London	28 June	Ealing Technical College	50
	28 June	Hendon Technical Institute	50
No.14 - Cheltenham	28 June	North Gloucester Technical College, Cheltenham	100
	28 June	Stroud and District Technical College	50
	16 August	Victoria Institute, Worcester	50
No.15 - Hull	5 July	College of Commerce	100
No.16 - Rotherham	5 July	Rotherham College of Technology	100
	11 October	County Technical College, Worksop	50
	11 October	Wakefield Technical College	50
No.17 - Birmingham	19 July	Smethwick Technical College	50
	26 July	Dudley Technical College	50
	2 August	Oldbury Technical School	50
	2 August	Halesowen County Technical School	50
No.18 - Cannock	2 August	County Mining and Technical College	100

P.A.C.T. Centre	Formed 1943	School	Capacity
No. 19 - Liverpool	9 August	College of Commerce	100
No. 20 - Lincoln	2 August	Technical College	50
No. 21 - London	13 September	North Western Polytechnic, Kilburn	100

AIRCREW SELECTION & CLASSIFICATION MACHINERY

APRIL 1944

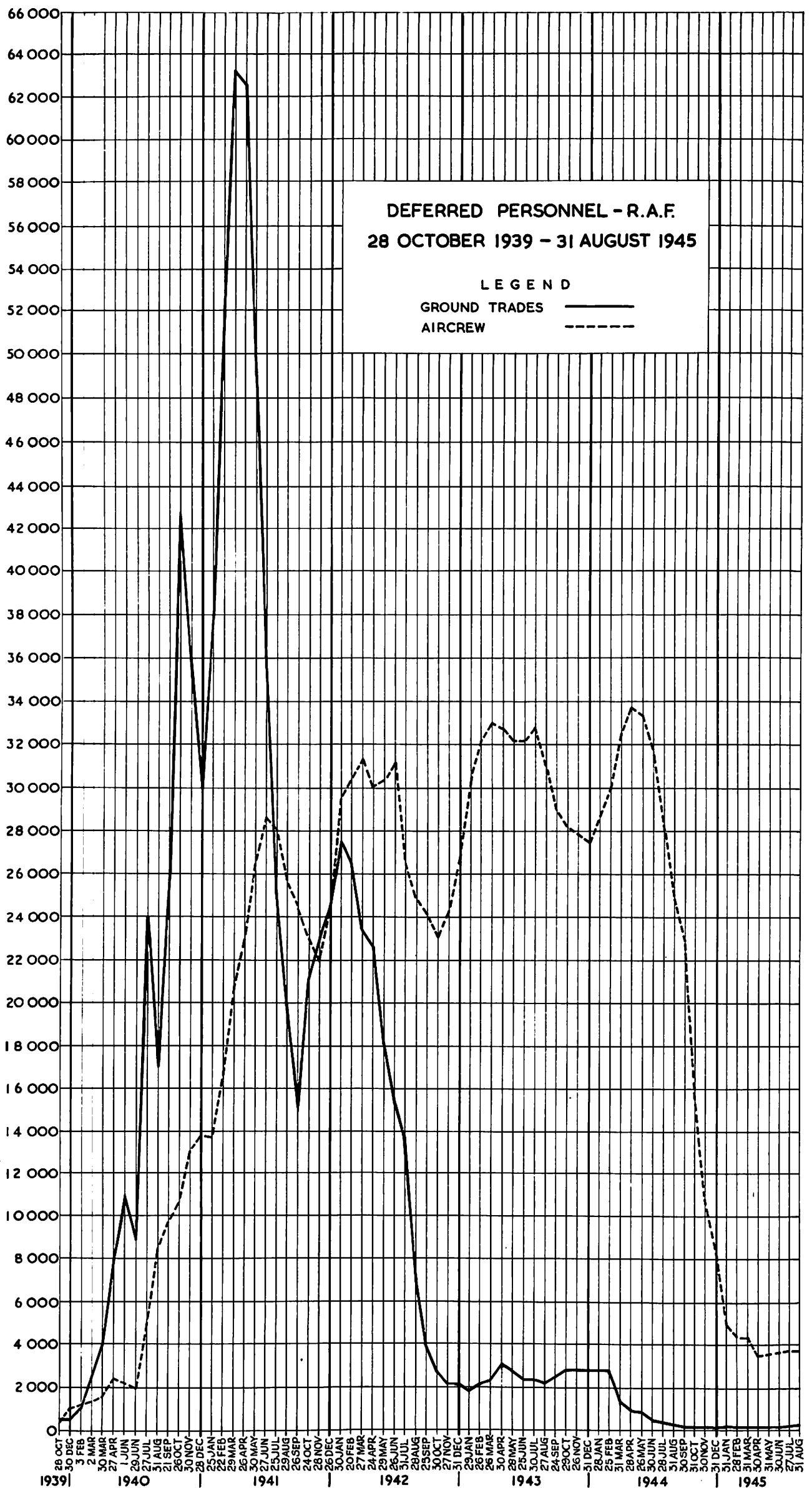


APPENDIX 6

DISBANDMENT OF THE PRELIMINARY AIRCREW TRAINING CENTRES

P.A.C.T. Centre	School	Disbanded
No. 1 - Edinburgh	Regent Road School Leamouth Technical Institute	15 September 1944 1 January 1945
No. 2 - London	Wandsworth Technical Institute Battersea Polytechnic	5 August 1944 5 August 1944
No. 3 - London	Balham and Tooting Technical Institute Borough Polytechnic	5 August 1944 5 August 1944
No. 5 - London	Wandsworth Technical Institute Norwood Technical Institute	5 August 1944 5 August 1944
No. 6 - Cardiff	Cardiff Technical College Swansea Technical College Newport Technical College Neath Mining & Technical Institute	3 November 1944 3 November 1944 3 November 1944 9 September 1944
No. 7 - Aberdeen	Kings College	10 November 1944
No. 8 - Wolverhampton	South Staffordshire Technical College, Wolverhampton Walsall Technical College Hinckley Technical College Cannock County Mining & Technical College	17 November 1944 17 November 1944 17 November 1944 19 January 1945
No. 9 - Bradford	Bradford Technical College Wakefield Technical College	24 November 1944 13 October 1944
No.10 - Manchester	Manchester High School of Commerce Salford Royal Technical College	8 December 1944 19 January 1945
No.11 - Walthamstow	S.W. Essex Technical College	8 December 1944
No.13 - London	Hendon Technical Institute N.W. Polytechnic, Kilburn	21 December 1944 5 August 1944
No.14 - Cheltenham	N. Gloucester Technical College Stroud Technical College	12 January 1945 12 January 1945
No.16 - Rotherham	Rotherham College of Technology Worksop County Technical College	12 January 1945 13 October 1944
No.17 - Birmingham	Dudley Technical College Smethwick Technical College Oldbury Technical College Halesowen Technical College	12 January 1945 5 January 1945 ? 9 February 1945
No.19 - Liverpool	College of Commerce St. Helens Municipal Technical College	26 January 1945 1 December 1944
No.23 - Worcester	Victoria Institute	2 February 1945
P.A.C.T. Wing (A.C.R.C.)	Regents Park	9 February 1945

APPENDIX 7



APPENDIX 8

TABLE OF INTERVIEWS OF DIRECT ENTRANTS FOR AIRCREW SHOWING
PERCENTAGES OF ACCEPTANCES AND REJECTIONS,
16 MARCH 1940 to 31 AUGUST 1945

Period	Percentage Accepted		Percentage Rejected	
	P.N.B.	Other Aircrew	Educational	Medical
3 September 1939 to 15 March 1940		Information not available		
16 March 1940 to 31 December 1940	31.2	22.1	35.0	11.7
1 January 1941 to 31 December 1941	35.5	12.5	45.2	6.8
1 January 1942 to 31 December 1942	40.0	7.1	45.4	7.5
1 January 1943 to 31 December 1943	18.4	33.8	35.4	12.4
1 January 1944 to 31 January 1944	10.0	33.9	44.0	12.1
1 January 1945 to 31 August 1945	9.5	3.2	83.1	4.2

APPENDIX 9

FLYING TRAINING SCHOOLS (UNITED KINGDOM)⁽¹⁾
31 August 1939

F.T.S.	LOCATION	AIRCRAFT	CAPACITY	COURSE LENGTH (WEEKS)
No. 1	Netheravon (2)	Hart 32) 64 Harvard 32)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No. 2	Brize Norton	Harvard 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No. 3	South Cerney	Hart 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No. 5	Sealand	Hart 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No. 6	Little Rissington	Harvard 26) 64 Anson 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No. 7	Peterborough (3)	Hart 32) 64 Audax 32)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No. 8	Montrose	Hart 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No. 9	Hullavington	Harvard 26) 64 Anson 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No.10	Ternhill	Harvard 26) 64 Anson 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No.11	Shawbury	Hart 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No.12	Grantham	Hart 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No.13	Drem	Hart 26) 64 Anson 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No.14	Kinloss	Harvard 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
No.15	Lossiemouth	Harvard 26) 64 Oxford 38)	I.T.S. 48) A.T.S. 48) 96	13) 26 13)
<u>TOTAL</u> 14 F.T.S.s			<u>TOTAL</u> 1,344	

(1) There were two different types of pilots trained:-

- (a) Single-engine Trained - Group I
- (b) Twin-engine Trained - Group II

All schools except Nos. 1 and 7 F.T.S.s were scheduled to train two-thirds of their capacity on T.E. types, i.e. 64 and the remaining one-third (32 pupils) on S.E. aircraft.

(2) Trained Army and Naval personnel.

(3) Trained Naval personnel.

ELEMENTARY AND RESERVE FLYING TRAINING SCHOOL COURSES

31 August 1939

E. & R.F.T.S	LOCATION	DATE FORMED	PILOT TRAINING				OBSERVER TRAINING		OPERATING COMPANY	REMARKS
			R.A.F. RESERVE	R.A.F.V.R. AB INITIO	R.A.F.V.R. ADVANCED	R.A.F. REGULAR	NAVIGATION TRAINING OF R.A.F. PILOTS AND OBSERVERS	R.A.F.V.R.		
No. 1	Hatfield	1. 5.23	1. 5.23	1. 4.37	30. 6.39	1. 8.35	-	28. 4.39	De Havilland Aircraft Co., Ltd.	Moved from Stag Lane to Hatfield in May 1930.
No. 2	Filton	28. 5.23	28. 5.23	1. 4.37	-	1. 8.35	-	20. 6.39	Bristol Aeroplane Co., Ltd.	
No. 3	Hamble	31. 7.23	31. 7.23	1. 4.37	27. 6.39	1. 8.35	23. 5.38	20. 6.39	Air Service Training Ltd.	Originally opened at Coventry was operated by Beardmores. Moved to Hamble April 1931.
No. 4	Brough	21. 5.24	21. 5.24	1. 4.37	21. 6.39	1. 8.35	-	13. 6.39	Blackburn Aircraft Co., Ltd.	Was operated by the North Sea Aerial and General Transport Co., Ltd. until 1938.
No. 5	Hamworth	10. 6.35	10. 6.35	1. 4.37	30. 6.39	10. 6.35	-	20. 6.39	Flying Training Ltd.	
No. 6	Sywell	10. 6.35	10. 6.35	1. 4.37	-	10. 6.35	9. 1.39	20. 6.39	Brooklands Aviation Ltd.	
No. 7	Deaford	25.11.35	25.11.35	1. 4.37	-	25.11.35	15. 8.38	27. 6.39	Reid and Sigrist Ltd.	
No. 8	Reading	25.11.35	25.11.35	1. 4.37	6. 7.39	25.11.35	-	3. 8.39	Phillips & Powis Ltd.	
No. 9	Ansty	6. 1.36	6. 1.36	1. 4.37	13. 7.39	6. 1.36	5. 8.38	27. 6.39	Air Service Training Ltd.	
No. 10	Yatesbury	6. 1.36	6. 1.36	-	-	6. 1.36	26. 9.38	-	Bristol Aeroplane Co., Ltd.	
No. 11	Perth	27. 1.36	27. 1.36	1. 4.37	30. 3.39	27. 1.36	9. 1.39	10. 7.39	Airwork Ltd.	
No. 12	Prestwick	17. 2.36	17. 2.36	1. 4.37	1. 6.39	17. 2.36	15. 8.38 [*]	10. 7.39	Scottish Aviation Ltd.	[*] Three courses of Direct Entry Observers transferred to Grangemouth 26.6.38.
No. 13	White Waltham	18.11.35	18.11.35	1. 4.37	-	18.11.35	-	10. 7.39	De Havilland Aircraft Co., Ltd.	
No. 14	Castle Bromwich	1. 7.37	-	1. 7.37	-	-	-	10. 7.39	Airwork Ltd.	
No. 15	Redhill	1. 7.37	-	1. 7.37	6. 7.39	-	-	1. 8.39	British Air Transport Ltd.	
No. 16	Shoreham	1. 7.37	-	1. 7.37	9. 1.39	-	23. 5.38 [*]	3. 7.39	Brooklands Aviation Ltd.	[*] This training was carried out by Martin Navigation Ltd., using Shoreham aerodrome. Terminated on 13.5.39 and transferred to Gloucester.
No. 17	Barton & Ringway	1.10.37	-	1.10.37	-	-	-	1. 7.39	Airwork Ltd.	
No. 18	Fairoaks	1.10.37	-	1.10.37	21. 7.39	-	-	1.7.39	General Aircraft Ltd.	
No. 19	Gatwick	1.10.37	-	1.10.37	21. 7.39	6.10.38	-	8. 7.39	Airports Ltd.	
No. 20	Gravesend	1.10.37	-	1.10.37	13. 7.39	-	-	1. 7.39	Airports Ltd.	Commenced F.A.A. ab initio Training on 6.3.39.
No. 21	Stapleford Abbots	1. 1.38	-	1. 1.38	6. 7.39	-	-	8. 7.39	Reid & Sigrist Ltd.	
No. 22	Cambridge	1. 2.38	-	1. 2.38	1. 7.39	27. 3.39	-	1. 7.39	Marshalls Flying School Ltd.	
No. 23	Rochester	1. 4.38	-	1. 4.38	-	-	-	-	Short Bros. Ltd.	Commenced F.A.A. ab initio Training on 25.6.38.
No. 24	Sydenham	1. 1.39	-	1. 1.39	-	-	-	3. 8.39	Short Bros. Ltd.	
No. 25	Grimsby	24. 6.38	-	24. 6.38	-	-	-	3. 8.39	Herts & Essex Aero Club	

E. & R.F.T.S.	LOCATION	DATE FORMED	PILOT TRAINING				OBSERVER TRAINING		OPERATING COMPANY	REMARKS
			R.A.F. RESERVE	R.A.F.V.R.		R.A.F. REGULAR	NAVIGATION TRAINING OF R.A.F. PILOTS AND OBSERVERS	R.A.F.V.R.		
				AB INITIO	ADVANCED					
No. 26	Oxford	24. 6.38	-	24. 6.38	-	-	-	11. 8.38	Marshall's Flying School Ltd.	
No. 27	Tollerton	24. 6.38	-	24. 6.38	1. 7.39	-	-	6. 7.39	Nottingham Airport Ltd.	
No. 28	Meir	1. 8.38	-	1. 8.38	-	-	-	-	Reid & Sigrist Lt.	
No. 29	Luton	1. 8.38	-	1. 8.38	-	-	-	1. 8.39	Birkett Air Service Ltd.	
No. 30	Derby	29. 9.38	-	29. 9.38	-	27. 3.39	-	-	Air Schools Ltd.	Commenced extended <u>ab initio</u> courses 1.1.39. This was included in the regular courses on 27.3.39.
No. 31	Gloucester	29. 9.38	-	29. 9.38	-	-	-	-	Surrey Flying Services Ltd.	Airwork Ltd. undertook Direct Entry Observer Training at Gloucester on 15.5.39. (Formerly at No.16 E. & R.F.T.S.)
No. 32	West Hartlepool	15. 4.39	-	15. 4.39	-	-	-	-	Portsmouth, Southsea and Isle of Wight Aviation Ltd.	
No. 33	Whitchurch	3.12.38	-	3.12.38	-	-	-	11. 8.39	Channier, Gilbert Lodge & Co., Ltd.	
No. 34	Southend	1. 1.39	-	1. 1.39	-	-	-	1. 6.39	Air Hire Ltd.	
No. 35	Grangemouth	1. 5.39	-	1. 5.39	-	-	26. 6.39 *	-	Scottish Aviation Ltd.	* Training of three courses of Direct Entry Observers was transferred from Prestwick on 26.8.39.
No. 36	Sherburn	-	-	-	-	-	-	-	Blackburn Aviation Ltd.	In process of opening on the outbreak of war.
No. 37	Exeter	3. 7.39	-	-	-	-	-	3. 7.39	Straight Corporation Ltd.	
No. 38	Carlisle	1. 7.39	-	1. 7.39	-	-	-	-	Border Flying Club Ltd.	
No. 39	Weston-Super-Mare	3. 7.39	-	3. 7.39	-	-	-	-	Straight Corporation Ltd.	
No. 40	Norwich	15. 8.39	-	15. 8.39	-	-	-	-	Air Contractors Ltd.	

E. & R.F.T.S	LOCATION	DATE FORMED	PILOT TRAINING				OBSERVER TRAINING		OPERATING COMPANY	REMARKS
			R.A.F. RESERVE	R.A.F.V.R.		R.A.F. REGULAR	NAVIGATION TRAINING OF R.A.F. PILOTS AND OBSERVERS	R.A.F.V.R.		
				AB INITIO	ADVANCED					
No. 41	Dyce	-	-	-	-	-	-	-	Aberdeen Flying School Ltd.	In process of opening on the outbreak of war.
No. 42	Blackpool	1. 8.39	-	1. 8.39	-	-	-	-	Reid & Sigrist Ltd.	
No. 43	Newcastle	1. 6.39	-	1. 6.39	-	-	-	-	Newcastle-on-Tyne Aero Club	
No. 44	Elmdon	1. 5.39	-	1. 5.39	-	-	-	-	Airwork Ltd.	
No. 45	Ipswich	3. 7.39	-	3. 7.39	-	-	-	-	Straight Corporation Ltd.	
No. 46	Portsmouth	1. 8.39	-	1. 8.39	-	-	-	-	Portsmouth, Southsea & Isle of Wight Aviation Ltd.	
No. 47	Doncaster	15. 7.39	-	15. 7.39	-	-	-	-	Nottingham Airport Ltd.	
No. 48	Bagington	-	-	-	-	-	-	-	Air Service Training Ltd.	In process of opening on the outbreak of war.
No. 49	Preston	-	-	-	-	-	-	-	-	
No. 50	Marlow	-	-	-	-	-	-	-	Whetton Aviation Ltd.	
No. 51	Abbotsinch	-	-	-	-	-	-	-	Scottish Aviation Ltd.	
No. 52	York	-	-	-	-	-	-	-	-	
No. 56	Kenley	22. 8.39	-	22. 8.39	-	-	-	-	British Air Transport Ltd.	

Note (1) Other schools were to be opened at Yeading and Southampton on the outbreak of war.

Note (2)

- (i) R.A.F. reserve courses were annual refresher courses.
- (ii) R.A.F. regular pilots courses comprised of:-
- Short service commission personnel.
 - University candidates for permanent commissions
 - Airmen pilots.
 - R.A.F. reserve personnel undertaking a year's full time training course.
- (iii) R.A.F.V.R. advanced training courses were carried out in Battle aircraft.
- (iv) R.A.F. regular navigational training of pilots and observers was known as 'Direct Entry Observers Training' and was carried out on Anson aircraft.

- (v) R.A.F.V.R. observer training was carried out on Anson aircraft.
- (vi) As regards (iii) and (v) above, this training was due to be carried out at all schools prior to the outbreak of war, but many had not received any aircraft when war broke out.
- (vii) On the outbreak of war all but 19 of these schools closed down. The 19 remaining open retained only their elementary aircraft and undertook the elementary training of R.A.F. personnel.

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)

30 September 1939

S.F.T.S.	LOCATION	AIRCRAFT	CAPACITY	COURSE LENGTH (WEEKS)	
No. 1	Netheravon	Hart 32) 64 Harvard 32)	I.T.S. 48) 96 A.T.S. 48)	8 } 16 8 }	Trained Army & Naval Personnel
No. 2	Brize Norton	Harvard 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No. 3	South Cerney	Hart 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No. 5	Sealand	Hart 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No. 6	Little Rissington	Harvard 31) 75 Anson 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No. 7	Peterborough	Hart 32) 64 Audax 32)	I.T.S. 48) 96 A.T.S. 48)	8 } 16 8 }	Trained F.A.A. personnel
No. 8	Montrose	Hart 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No. 9	Hullavington	Harvard 31) 75 Anson 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No.10	Ternhill	Harvard 31) 75 Anson 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No.11	Shawbury	Hart 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No.12	Grantham	Hart 31) 75 Anson 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No.13	Drem	Hart 31) 75 Anson 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	Closed 27.10.39.
No.14	Kinloss	Harvard 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
No.15	Lossiemouth	Harvard 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	
College S.F.T.S.	Cranwell	Hart 31) 75 Oxford 44)	I.T.S. 60) 120 A.T.S. 60)	8 } 16 8 }	Cranwell connected to an S.F.T.S. on the outbreak of war.

Note: On the outbreak of war the schools were scheduled to increase to their War establishment (108 aircraft and 152 pupils). This however came about gradually - Nos. 1 and 7 S.F.T.S.s were not up to their full war time strength until the summer of 1940.

APPENDIX 12

MEMORANDUM

~~on~~ on ~~12~~

FLYING TRAINING

By

R. Smith Barry and J.N.D. Heenan

~~10~~ 10 October 1939

For summaries of contents see:

Part I - paragraphs 45 to 53.

Part II paragraphs 21 and 22.

~~12~~

R. Smith Barry, F.S.S., late R.A.F.

J. N. D. Heenan, A.M.I.C.E., late R.A.F.
A.M.I.M.E.
A.C.G.I.

Oct. 10 1939.

SUGGESTIONS FOR A FLYING TRAINING SCHOOL TO GIVE
ELEMENTARY, INTERMEDIATE AND ADVANCED
TRAINING

INTRODUCTION

1. It is understood that there is an intention to increase the amount of military flying in this country and that a great effort must be made for the new schools to be as economical as possible. The writers, who collaborated in the last war to form the so-called School of Special Flying at Gosport, have been invited to submit their suggestions.

PART I. 2. This Memorandum is in two parts. Part I deals with the economies that could in our submission be effected in an "all through" school of the size of ^{one} Elementary Flying Training School plus ^{one} Intermediate Training School plus ^{one} Advanced Training School.

3. These economies will be quite independent of the size of the unit. They merely depend (i) on a careful balancing between amount of material and numbers of personnel, and upon some modification of the Elementary course in the light of the results obtained at Gosport of which we possess full records; and (ii) on the results of an investigation that we have just made at several Service Flying Training Stations into the amount of work, and the instructor-hours and pupil-hours needed to carry it out.

4. The "all through" unit described in Part I may be of any size whatever. It will have the economy due to method but not necessarily that due to size. Part I proves that even in a small unit the number of aircraft as at present laid down could be reduced to exactly one-half. (In this connection see Part I, paragraphs 37 and 42). This fraction $\frac{1}{2}$ has been arrived at by a series of calculations which are carefully described and on which criticism would be welcomed. We know that it may be found difficult to believe that this figure was not aimed at from the beginning but made its appearance through pure coincidence. We were, indeed, as much surprised and delighted to see it as we earnestly hope the reader will be who has carefully followed our proofs. The requirements of the "all through" unit compared with those of existing units with the same output will be found in paragraph 50 of Part I.

Part 2
described.

5. If we had more time, we should like to add to Part I an appendix giving a detailed tabular presentation of the answers we received from the expert officers we consulted as to each item of the syllabus of intermediate and advanced training; we should also have liked to consult several more such officers to make our averages more representative. It is hoped, however, that for a preliminary memorandum the summaries we have given in paragraphs 28 and 36 of Part I will be thought to be enough.

6. The economies of Part I may be had in a school of any size whatever; for instance, in paragraph 19 we have said that 18 instructors with 36 aircraft could teach 96 elementary pupils in 8 weeks, but it would have been just as true if we had divided by 6 and said that 3 instructors with 6 aircraft could teach 16 pupils in 8 weeks, and a reference to Part I, paragraph 51, where these economies are summarised, will shew that they are very great.

Part III.
7. Part II discusses the possibility of a school five times the size of the hypothetical school dealt with for comparative purposes in Part I. It was at first hoped to go fully into the question of the economy that would result from this great size, but through pressure of time and for other reasons we have only been able to do so by analogy (paragraphs 26 and 27).

8. Part II also gives a diagrammatic lay-out for the aircraft sheds, workshops and lecture-rooms together with a scheme on the lines of a family tree shewing the suggested organization of the school.

9. The important question of air-congestion is dealt with in paragraph 19. Of course no great economy is possible here, if any, The problem can be readily solved indeed, but only by placing the school in a fat and sparsely populated area.

PART I.

Economy in method

10. As we see it, everything depends upon getting the exact balance between

Number of pupils,

Number of flying instructors,

Number of aircraft, and

Number of weeks in the course,

so that all personnel and all material is employed the optimum number of hours a week, not more and not less. Two simple but important formulae connecting these variables will be found in ^{Annexure}~~Appendix~~/I.

In the course of what follows, we shall obtain data for using these formulae,

for the Elementary Section,

for the Intermediate Section, and

for the Advanced Section (~~in~~sofar as applicable).

Be it observed that with these formulae it is only necessary to know the optimum flying times for all concerned and the number of pupils for the result to be given in terms of number of aircraft required, number of instructors required and length of course. As a matter of fact we have not used the formulae to determine the length of course though we might have done so.

(a) ELEMENTARY TRAINING

11. The Elementary training given at Gosport in the last war covered almost exactly the same ground and used very much the same aircraft as are now used in the E.F.T.S.'s, so that the detailed statistics as to flying times, ratio of dual control to solo flying, etc., which were compiled there are of immediate relevance.

12. The methods introduced there have since been adopted throughout the British Empire and in several foreign countries, and the pupils trained in the Elementary Section reached a higher standard than any others up to that time and were therefore in great demand as instructors. In spite of this, the first 30 "all through" single engine pilots received only 9 weeks' training instead of 15 weeks, which was the average for those trained in the rest of this country.

13. It should not be forgotten that technical and ground instruction were also given there and that the pupils were highly successful in this respect as well. Before leaving they had to be prepared for and to pass examinations in gunnery and other subjects which were not set by the

Gosport staff but by outside organizations.

If little stress is laid on ground instruction in this paper it is not because its importance is lost sight of, but rather because it does not lend itself to economy. We venture to think that for a Service pilot ground instruction is of equal importance with flying.

Although now the training given in the Royal Air Force is of a very high order, these facts encourage us to think that certain all-round economies might be effected without loss of quality.

14. We now proceed to obtain data for using the formulae for the Elementary course.

Total dual control, D, and total flying time, T per pupil.

Average D.C. for the first 54 Elementary pupils at Gosport ...	15.5 hrs.
Average solo	24.9 "
<hr/>	
Total flying on Elementary aircraft	<u>40.4</u> "

Now 15.5 is to 24.9 as 19 to 31.

It is proposed therefore to give in the new Elementary School:

	19 hours dual
	31 hours solo
	<hr/>
Total	50 hours flying
	<hr/>

This gives D as 19, T as 50.

Our elementary pupils will thus have 10 hours more flying than at Gosport, that is they will have the same flying time as is given in an E.F.T.S. These 10 hours can be used for navigation flights. It might also be possible to shorten the course when experience has been gained.

Fifty hours in eight weeks gives the pupil $6\frac{1}{4}$ hours' flying a week, which happens to be exactly the same as was given per week at Gosport. He will thus have $1\frac{1}{4}$ hours flying per working day, inasmuch as we are allowing only 5 working days in the week as will be explained.

15. LENGTH OF COURSE IN WORKING DAYS, c.

The proposed length of course to be eight weeks as at present laid down (S.D.138.1.). At Gosport it took about 7 weeks in Summer and $10\frac{1}{2}$ in winter, but there no attention at all was paid to speed of output.

We would here draw attention to the fact that in this country at least longer training periods in winter are essential. No mention of this is made in S.D. 138, which simply gives 8 weeks each for Elementary, Intermediate and Advanced training. For the Elementary, the 8 weeks would be ample in summer, but perhaps too short in winter in spite of the fact that to make allowance for weather we are allowing for only 5 days flying training a week.

The eight weeks course will thus have 40 working days, that is to say, c will be 40.

16. DUAL CONTROL PER INSTRUCTOR PER WORKING DAY

In actual experiments made in the past to determine the optimum amount of d.c. an elementary instructor can do in a week, the result came to 1.7 hours to 2 hours per diem, i.e., 12 to 14 hours a week. This does not differ greatly from the amount expected of him by S.D. 138 which gives data for calculating that the elementary instructor must do 14.3 hours d.c. a week, and the intermediate instructor 10.4, assuming that our information is correct that half the pupil's flying time takes the form of dual control. In our hypothetical school we are allowing for an instructor to do 2.53 hours d.c. per working day which comes to just about $12\frac{1}{2}$ hours a week.

d, then will be 2.53.

We have chosen 2.53 here and 2.64 for the intermediate (para. 30 inf.), such odd fractions being necessary to get an integral number of instructors. The optimum of 12 to 14 hours d.c. a week allows us to choose anything between 2.4 and 2.8 hours a working day.

17. NUMBER OF PUPILS, p

We are taking the number of pupils at 96 as in the E.F.T.S. (S.D. 138). p is 96.

18. RATIO OF SERVICEABLE AIRCRAFT TO NUMBER HELD, R.

HOURS PER SERVICEABLE AIRCRAFT PER WORKING DAY, t.

We propose that, according to the existing practice, only two thirds of the aircraft on charge should be in use at a time, giving R as two thirds, and that each of these should fly for five hours each working day, i.e., 25 hours a week, so t will be 5. This means that the average

weekly flying time per aircraft on charge will be 16 $\frac{2}{3}$ hours as against 11 $\frac{1}{10}$ hours in an E.F.T.S. We venture to hope to improve greatly on this figure with experience.

19. We now have all the data needful for calculating the ratios for the elementary course by means of the formulae in ~~Appendix I~~ ^{Annexure} I. The arithmetic and a verification are to be found in ~~Appendix II~~ ^{Annexure} II.

Calculated ratios for the elementary
course applied to a school with the monthly output
of an E.F.T.S.

Pupils, 96. Aircraft, 36. Instructors, 18.

Length of course, 8 weeks.

20. 96 pupils require 36 aircraft and 18 instructors, 24 out of the 36 aircraft to be kept continually serviceable. The output to be 48 a month.

(b) INTERMEDIATE TRAINING

21. Of this we have no personal experience and are well aware that conditions have too much changed for our opinion to be of any value. Useful conclusions may however be drawn from (a) the war establishment and length of course clearly laid down in the pamphlet S.D. 138, and (b) the exercises minutely described and numbered in Air Publication 1388.

22. Conclusions from war establishment and length of course.

The Service Flying Training Schools (F.T.S's) are in two parts, Intermediate and Advanced. The Intermediate is an 8-week 50-hours-flying course, and the Advanced is another 8-week 50-hour course. Each holds 54 aircraft, but the former deals with 80 pupils and the latter, owing to weeding out, with only 72.

From the pamphlet it is possible to calculate that their ^{for} machines are only in the air from $8\frac{1}{2}$ to 9 hours a week, that is on an average some 80 minutes a day taking one day with another.

23. Surely some more economical use of them could be made than this, especially when their high capital value is considered and the rapidity with which they become obsolete. It is a well-known fact that it pays, i.e. that it is more economical, to keep machinery continually working, and here we should have the added advantage that the

shorter the life of the aeroplanes the sooner they would have to be replaced and the more up-to-date would our training equipment be. We submit that if we are doing advanced training on obsolete Harts and nearly obsolete Ansons it is through neglect to wear them out fast enough through constant use. At an F.T.S. a Hart is still used as a service machine though it has neither flaps nor retractable undercarriage.

24. Conclusions from the syllabus of exercises in Air Publication

1388.

At the suggestion of Group Captain Robb, the Commandant of the Central Flying School who has been good enough to give us the benefit of his advice upon innumerable points in connection with this paper, we have discussed the Intermediate syllabus item by item with the chief flying instructors of three Flying Training Stations and with an officer at the Central Flying School with a year's experience as an F.T.S. instructor. Our object has been by asking each officer precisely the same series of questions and averaging the results to find out as nearly as possible how much dual control and how much individual flying are necessary to complete the course.

25. Group Captain Robb said beforehand that he suspected that the intermediate course took too long and wasted much time on unnecessary dual control and his opinion has been borne out by the results of these inquiries.

Each individual was asked to imagine that he had a free hand as to times and methods and was to be judged only by results at the Front, due regard being had to speed of output.

26. The results had of course to be tabulated and added up in detail but only summaries are given here. They all agree in the essentials namely, that they postulate less than 25 hours dual control and much less than the total of 50 hours flying which is laid down for them.

27. All the officers gave the figures under reserve saying that they had not time to consult their books, but we did not want them to consult their books which would have prejudiced their opinions, for they all managed to do in fact the amount that is laid down or something very near it. A summary of their suggested totals follows:-

28. Suggested hours for carrying out Intermediate Training.

	<u>Dual.</u>	<u>Solo.</u>	<u>Total</u>	
F. O. Sayers, C.F.S.	16.00	9.85	25.85	
Sqdn. Leader Clarke, S. Cerney	11.75	6.75	18.50	
Flt. Lt. M-Elton, Hullavington	18.50	14.50	33.00	
Sqdn. Ldr. Horner, Brise Norton	20.75	10.75	31.50	
	<u> </u>	<u> </u>	<u> </u>	
Averages	16.75	10.46	27.22	Hours
	<u> </u>	<u> </u>	<u> </u>	

For safety we will then allow for a total of 30 hours flying instead of 27.22. The proportional figures will then be

<u>Dual.</u>	<u>Solo.</u>	<u>Total.</u>
18.45	11.55	30.00 hours

Thus for the Intermediate section of the hypothetical school we have D 18.45, T 30.00.

Length of course in working days, c.

29. LENGTH OF COURSE IN WORKING DAYS, c.

This must be either four weeks or eight weeks to tally with the four-weekly output of the previous school.

A four weeks course of 20 working days would give the pupil 1.5 hours flying per working day. The intermediate flying is less tiring than the elementary, so the increase from 1.25 to 1.5 will be in order. So for length of course we have c = 20 working days.

30. DUAL CONTROL PER INSTRUCTOR PER WORKING DAY, d.

We want to keep this between 12 and 14 hours a week (para. 16), that is to say, between 2.4 and 2.8 hours a working day of which there are five a week. It will be convenient to make this 2.64 hours, so d will be 2.64. (See end of para. 16).

31. NUMBER OF PUPILS, p.

The previous school takes in 48 every four weeks but weeds out 8, so that it delivers 40 each four weeks. This figure of 8 out of 48, or 17%, is assumed by S.D. 138 and tallies fairly well with our own experience. At Gosport some 20% had to be weeded out. According to S.D. 138 a further four in every forty are to be weeded out if necessary during the

intermediate course.

The number of pupils then will necessarily be 40, that is p will be 40. This course being half the length of the one it replaces, the number of pupils must be 40 instead of 80 to keep the flow right.

32. RATIO OF SERVICEABLE AIRCRAFT TO NUMBER HELD

This will be $\frac{2}{3}$ as before, and also as laid down. We have great hopes that this could be improved upon in a larger school, but for the present purpose R will be $\frac{2}{3}$.

33. HOURS PER SERVICEABLE AIRCRAFT PER WORKING DAY, t.

Five as before. Let T be 5.

34. We have now all the data necessary for calculating the ratios for the intermediate course by means of the formulae in ^{Annexure} ~~Appendix~~ I.

Calculated ratios for the intermediate course applied to a school with the monthly output of an I.T.S.

Pupils, 40. Aircraft, 18. Instructors, 14.

Length of course, 4 weeks.

40 pupils require 18 aircraft and 14 instructors, 12 out of the 18 aircraft to be kept continually serviceable. The output to be 40 a month. This may be verified as in ^{Annexure} ~~Appendix~~ II.

(c) ADVANCED TRAINING

35. As regards this we asked questions of only two instead of three Flying Training Stations, and of the same C.F.S. officer, and we came to the conclusion that the advanced training was too various and complicated to submit readily to statistical treatment in just the same way as objects of a certain degree of complexity do not lend themselves to mass production.

We give as before summaries of the answers to our questions, but we make no use of them whatever and allow for the same total hours flying T — 50, and the same number of instructors as is laid down in S.D. 138. Here are the summaries:-

36. SUGGESTED HOURS FOR CARRYING OUT ADVANCED TRAINING

The following figures are rather divergent, but it is interesting to note that even for Twin Engine pilots, who have the most to do, the average comes to only 34.91 hours which is well below the 50 laid down

and allowed for by us in our hypothetical school.

	<u>Twin Engine Pilots</u>		<u>Single Engine Pilots</u>	
	<u>Dual</u>	<u>Solo and Interchange</u>	<u>Dual</u>	<u>S. & L.</u>
F. O. Sayers, C.F.S.	2.25	22.00	4.25	17.50
Sqdn. Ldr. Hamley, S. Cerney	7.00	29.25	9.50	26.25
Fl. Lt. Openshaw, Hullavington	5.25	39.00	9.25	22.00
	-----	-----	-----	-----
Averages	4.83	30.08	7.66	21.93
	-----	-----	-----	-----
	Total T.E. 34.91		Total S.E. 29.59	
	-----		-----	

37. The work of the A.T.S. or Advanced training portion of a Flying Training Station is different from the previous in that it teaches only the military side of things to now fully trained pilots. Without direct experience we of course prefer to leave it as it is now organized. There can however be no doubt that more use could be made of the aircraft. Of these there are 54 to give 50 hours flying to each of 72 pupils in 8 weeks. Each machine is therefore in the air 8.33 hours a week on an average, the corresponding figure for the I.T.S. being 9.26 and for the E.F.T.S. 11.11.

We can see no reason why less and less daily use should be made of the aircraft as they become more valuable and more quickly obsolete. Surely the progression should be the other way and it is the advanced machines that should be used the most if only on account of their higher capital value. Of course there may well be reasons for this of which we know nothing, but it is difficult to believe that much could not be done by careful organization in the flights. We will therefore assume that these machines can perfectly well be made to fly the $16\frac{2}{3}$ hrs hours a week that we have allowed for the other two sections, so that, keeping a pupil's total flying hours still at 50, there will be needed not 54, but $\frac{54 \times 8.33}{16\frac{2}{3}}$ or 27 aircraft to do the work of the A.T.S.

38. We might reduce this yet further in view of the results given in para. 36 above, but should hesitate to do so.

39. As to the number of flying instructors, we suggest taking this as it stands at present. They are not really flying instructors

but instructors in military flying. They are to be 15 in all, including the Squadron Commander over them.

40. Ground Instructors.

In the existing schools these are shared with the intermediate course and are laid down as being 15 in number including the officer in charge of ground instruction. Unaltered.

As to the length of the course we would not venture to change this either.

41. We can now write down the elements of the advanced course in the hypothetical school. It will be merely an A.T.S. as laid down but with half the machines.

42. Ratios for the advanced course applied to a school with the monthly output of an A.T.S.

Pupils, 72 Aircraft, 27, Instructors, 15.

Length of course, 8 weeks.

We put forward this statement that an advanced training school could do as well with half its present number of aircraft with all possible reserve, for it must seem preposterous that individuals with no experience of this kind of training should come forward with so sweeping an assertion. But if the matter is looked at in another light our suggestions seem reasonable enough.

Is it absurd to suppose that these machines could be made to fly for 2 hours and 23 minutes a day taking one day with another and one machine with another? We are told that omnibus companies become uneasy if their engines are ever allowed to get cold except when they are to be overhauled, yet these wretched aeroplanes that fly only 8.33 hours a week are spending less than 5% of their time at their rightful occupation. We have taken upon ourselves to double this and make them work 10% of their time and suggest that they are still being treated uncommonly well and if the war continues may look forward to a much less pampered existence.

43. GROUND WORK

were

From various reliable informants, two of whom indicated to us by Group Captain Robb, we have learnt that roughly the following hours must be and are devoted to ground work and lectures:-

E.F.T.S. (F. O. Maxwell, late of Norwich) 150 hours

	brought forward ...	150	hours
I.T.S. (Flt. Lt. Kelly, C.G.I. H'lavington)	... ..	168	"
A.T.S. (Sqdn. Ldr. Openshaw H'lavington )	... ..	32	"
		<hr/> 350 <hr/>	"

44. The course at the hypothetical school will be of 20 weeks, so the above gives $17\frac{1}{2}$ hours ground work and lectures a week, or roughly three hours on every day of the course except Sunday. As the hypothetical pupils only fly $1\frac{1}{4}$ to $1\frac{1}{2}$ hours a day there should no difficulty here.

45. We can now gather our results together to shew the requirements of a possible school on the above lines that would have the same output as 1.E.F.T.S. plus 1 A.T.S. plus 1 I.T.S.:-

Hypothetical School to replace

46. 1 E.F.T.S., 1 I.T.S.
and 1 A.T.S.

	<u>Elementary</u> <u>para. 19</u>	<u>Intermediate</u> <u>para. 34</u>	<u>Advanced</u> <u>para. 42</u>	<u>Total</u>
Pupils	96	40	72	208
Aircraft on charge	36	18	27	81
Instructors ...	18	14	15	47
Length of course	8 weeks	4 weeks	8 weeks	20 weeks

Intake of the Elementary section, 48 every 4 weeks.

Outflow from the advanced section, 36 every 4 weeks.

47. Division into Flights (merely tentative).

Referring to the last table, and remembering that $\frac{2}{3}$ of the aircraft on charge are serviceable, the Elementary Section could conveniently be divided into three flights each of 6 instructors, 8 serviceable aeroplanes and 32 pupils.

Each instructor giving 2 hrs. 32' d.c. per working day.

Each pupil getting 1 hr. 15' flying per working day.

48. The Intermediate section could be divided into two flights of 7 instructors, 6 serviceable aeroplanes and 20 pupils.

Each instructor giving 2 hrs. 38' d.c. per working day.

Each pupil getting 1 hr. 30' flying per working day.

49. The Advanced section could be divided into flights as may be found convenient. We do not know just how the division is made in the present A.T.S.'s, but would suggest 5 instructors, 6 serviceable aeroplanes, 24 pupils.

Each instructor giving as now a somewhat indeterminate amount of d.c. or other instruction per working day.

Each pupil doing $1\frac{1}{4}$ hrs. flying per working day.

ECONOMIES

50. Comparison of the hypothetical school with

1 E.F.T.S. plus 1 I.T.S.
plus 1 A.T.S.

	<u>Hypothetical School</u>	<u>Existing Schools</u>
Duration of course	20 weeks	24 weeks
Strength under training	208	248
Intake	48 every 4 weeks	48 every 4 weeks
Outflow	36 do. do.	36 do. do.
Establishment	81 aircraft	162 aircraft
Flying Instructors ...	47	59
Ground Instructors ...	19	19
Flying hours	130	150

51. The Economies expressed as percentages.

Duration of course	20 weeks instead of 24	17%
Aircraft	81 instead of 162	50%
Instructors	47 instead of 59	19%
Flying hours	130 instead of 150	13%

52. A table of the figures found in this memorandum enabling us to calculate the proportions of pupils: aircraft: instructors is to be found
Annexure
in Appendix III.

53. Factors of safety.

GENERAL

We are allowing for only 5 working days out of 7 (para. 15)

We are allowing for a working day of only 5 hours out of 12 light hours (para. 18)

On the other hand it must not be forgotten that the lengths of course

that we have allowed are the same for summer and winter (see para. 15 where this is discussed). All three of our suggested courses could be shortened in summer but might have to be lengthened in winter. If an experiment be based on the figures in this memorandum we trust that this may not be lost sight of.

ELEMENTARY

19 hours dual control instead of 15.5 at Gosport.

50 hours total flying instead of 40.4 at Gosport.

INTERMEDIATE

18.4 hours dual control instead of 16.8 postulated (para. 28).

30 hours total flying instead of 27.22 (para. 28).

ADVANCED

50 hours total flying instead of 34.91 postulated (para. 36).

PART I, ANNEXURE APPENDIX I.

Formulae connecting the numbers of

Pupils: Aircraft: Instructors.

Data required.

Total dual control required by one pupil	D
Total flying	T
Length of course in working days	c
Dual control per instructor per working day	d
Number of pupils	p
Ratio of ever serviceable aircraft to total held	R
Hours flying per w.d. per serviceable aircraft	t

Then A == number of aircraft required == $p \frac{T}{R c t}$ (i)

Also I == number of instructors
required == $p \frac{D}{c d}$ (ii)

PART I, ANNEXURE APPENDIX II.

To justify the statement in paragraph 20 that in order to put 96 pupils through a 50 hour elementary course in 8 weeks requires 36 aircraft and 18 instructors, we have:-

Para.	para.
14. D -- 19 hrs.	16. d == 2.53 hrs.
14. T -- 50 hrs.	17. p == 96
15. c == 40 working days	18 R == 2/3
para. 18. t == 5 hrs.	

When from Appendix I formula (i)

A, the total number of aircraft, must be	96 $\frac{50}{2 \times 40 \times 5}$ == 36
and from formula (ii)	
1, the number of instructors, must be	96 $\frac{19}{40 \times 2.53}$ == 18

Verification of the above.

For the course, the 96 pupils require 96 x 50 hours
flying, or 4,800 hours
The 36 aircraft of which 24 are in use do in the
course of 40 working days at 5 hrs. a day
24 x 40 x 5 hrs, or 4,800 hours
So the 36 aircraft exactly suffice for their work.

Again

For the course, the 96 pupils require 96 x 19 hrs.
d.c., or 1,824 hours
The 18 instructors do in the course of 40 working
days at 2.53 hrs. d.c. a day 18 x 40 x 2.53 hrs., or 1,824 hours
So the 18 instructors exactly suffice for their work.
The like statement in para. 34 can of course be verified in the same

way.

PART I, ANNEXURE III.

Summary of the figures found for calculating the proportions of pupils
to aircraft to instructors for all three courses.

	Elem.	Inter.	Adv.	Total.
Total dual per pupil	D 19 hrs.	18.45		
Total flying per pupil	T 50	30	50	130 hrs.
Length of course (working days)	c 40	20	40	100
do do do (weeks)	W 8	4	8	Working days 20 weeks
Dual per instructor per working day	d 2.53	2.64		
Ration serviceable aircraft to total held	R 2/3	2/3	2/3	
Hours per s.aircraft per working day	t 5	5	5	
Number of pupils under training	p 96	40	72	208
Total aircraft held	A 36	18	27	81
Number of flying instructors	1 18	14	15	47

P A R T II.

Suggestions for a large
"ALL-THROUGH" Flying Training School
with a note on
The Economy due to Size.

OBJECT

1. Now that it is proposed to have training units abroad so that they will be beyond the bombing range of hostile aircraft, the question of organisation and size of these units has to be considered so as to arrive at the most efficient unit from all points of view.

GENERAL

2. We submit that a training unit can be considered as a factory where the products are pilots, and consequently unless there is something extraordinary about the manufacture of pilots, which surely there is not, the well known law that the cost of each will be inversely proportional to the output must apply, so that the larger the school the lower the cost. There are however limits to the size of a school such as available ground space and the danger of over-concentration on one spot from the point of view of bombing by hostile machines.

3. We also submit that the greatest item in the cost of making a pilot is the capital cost of the plant and machinery including the aircraft and consequently these must be kept down to a minimum.

These capital items can be divided into two main headings :-

- (a) Buildings,
- (b) Aircraft and engines.

and how we propose to keep their cost to a minimum is dealt with later.

SIZE OF SCHOOL

4. As mentioned above it is in general true that the larger the school the cheaper the product. We have however to consider other aspects such as

the quality of what is produced and the necessity of avoiding over concentration. Dealing first with quality, we appreciate that there is a difference between a living product and a thing that is manufactured such as a motor car. We know the former will be affected to a very large degree by the atmosphere of the place whereas that makes no difference or at any rate very little to the quality of the latter. We believe that the success of the Gosport school was as much due to the environment and the atmosphere created by the staff as to the efficient method of teaching and use of machines.

We feel that we must not make the school too large or the personality of those in control will be too diluted to have the right effect, moreover with too great size the buildings &c. would become so scattered to avoid concentration that it would no longer be a unit. Hence the problem is to have as large a school as possible without its losing atmosphere or becoming too scattered.

5. In our opinion, and we may say that it is also the opinion held in France, the best size of school would be one having about 400 aircraft. This would be large enough to warrant a complete workshop for maintenance, overhaul and repair both of aircraft and engines.

6. We will make our school one of 405 aircraft because this is just five times the size of the hypothetical school described in Part I (see paragraphs 46 to 51 of Part I). The optimum proportions between pupils, aircraft and instructors together with the optimum number of hours flying have been there provisionally determined and so are not repeated here. Thus everything described in this proposed large school bears a ratio of five to one to the corresponding unit of Part I.

BUILDINGS

7. As the school is for the war period only, temporary buildings should be used as far as possible, and their construction should be suitable to the climate.

8. Hitherto it has been necessary to have large hangars for the

aeroplanes, but why these have been made so high it is difficult to see. As it appears that in war-time the machines must be immediately removed and pegged out, it seems to us that in England at any rate sheds are unnecessary, and we do not suggest using them except for repair work.

9. In a hot climate or where there is heavy rainfall or hard frosts, we would propose a type of shed such as is shown in sketch (a) appended.⁽¹⁾ These would be placed round the four sides of an aerodrome, starting at the corners and continuing as far as is necessary to accommodate the machines. The advantages of this arrangement are :

- {1} Rapid exit and entry of aircraft.
- {2} Minimum target for enemy aircraft.
- {3} Low cost.
- {4} Easy heating.

Lean-to buildings can be constructed at the back of these sheds which can be used to accommodate the men and also as various stores, instructional sheds, etc.

10. It is proposed to have one large repair shed to accommodate all the aircraft which are not in the aerodrome sheds, (i.e. 135 machines), and here all repairs to both engines and aeroplanes would be carried out.

AIRCRAFT

11. As the capital cost of 405 machines is a considerable item, it is essential to see that they are used as many of the available hours as possible. We have based our calculations on having 270, that is two thirds,⁽²⁾ always serviceable and keeping them in the air for five hours each day. To do this an instructor cannot keep a machine on the ground while he shews a new pupil the intricacies of its controls, and it is proposed to have cheap dummies in which the new pupil will be taught the elementary principles of an aeroplane and its controls. The next stage would be a Link trainer of which we should like to use a considerable number, and in this manner aeroplanes will be kept in the air the

(1) Sketch not included.

(2) This is the proportion at present worked to in England. (S.D.138).

maximum possible number of hours.

12. Whilst we have mentioned 405 as the number of aircraft required for the school in order to keep 270 serviceable continually, we consider that this reserve will prove too liberal and expect later to be able to cut it down to about 360.

13. We consider that the elementary training should be done on a single engined machine so that there would be 180 of these on charge. The Intermediate and Advanced Training would be carried out on a twin engined aircraft such as the Oxford of which there would be 90 for the Intermediate and 135 for the Advanced, total 225.

	<u>Elemen-</u> <u>tary.</u>	<u>Inter-</u> <u>mediate.</u>	<u>Advanced.</u>	<u>Total.</u>
The aircraft held would therefore be ...	180	90	135	405

These numbers being proportional to those for the hypothetical school.

(Part I, para. 46).

14. Having thus reduced the capital cost as much as possible, the only remaining item of expenditure, namely the labour, has to be dealt with.

LABOUR

15. We propose that the 270 machines always serviceable on the aerodrome should be divided into

A	Flight.	60	Single Engined aircraft	} for Elementary.
B	do.	60	do. do. do.	
C		60	Twin Engined aircraft	for Intermediate.
D		90	do. do. do.	Advanced.

In our plan we have allowed for all machines to be Twin Engine size, so C will not need more accommodation than A and B, but D flight sheds will have to be larger than the other three. No difficulty here as the aerodrome will probably not be truly square in any case. Each flight would be responsible for taking its aircraft in and out of the sheds, if any, or for pegging down where no sheds existed, and also for keeping them clean. All other services and repairs would be done by the

work-shop, including filling and routine repairs. All small repairs, such as checking, ignition, etc., would be done by workshops in the flight sheds.

16. We append an organization chart of the school, paragraph 28 and we consider that this organization and method of operation uses the minimum of skilled men. Another advantage is that it relieves the officer commanding the flight so that he can concentrate all his time on his proper business of teaching flying. Thus his office need only be a small affair consisting of a junior officer and a clerk to keep records and arrange flying times for the pupils.

17. Besides the four flight commanders there would be officers in charge of the various other branches such as armoury, Link trainer, bombing, photography, etc., and these would be directly under the officer in charge of all instruction. The rest of the organization should be clear from the diagram and is largely based on that of some French schools of roughly the same size as the one now under discussion.

18. The chief difference, and in our opinion a very important difference, is that in these schools the aircraft are issued to the flights each morning and collected at night, so that they are never, as it were, the property of the flight. This is thought to be bad from the psychological point of view, as it leads to the flights having no interest in their individual machines, which in our opinion is a very serious matter indeed.

AERODROME QUESTION

19. This is the one thing in which we think it would be foolish to try to economise. Our views on the subject follow :-

We calculate that

An E.F.T.S. of to-day flies	100	hours	per	working	day.
An I.T.S.	83	"	"	"	"
An A.T.S.	75	"	"	"	"

Total	258	"	"
-------	-----	---	---

We, in the hypothetical school, should be doing

Elementary	120 hours per working day		
Intermediate	60	"	"
Advanced	90	"	"

Total	270	"	"
-------	-----	---	---

These figures are calculated in both cases, not guessed.

So if we had the same aerodrome space as at present we should be about as well off.

They, we think, but are not quite certain, have 4 aerodromes, 1 E.F.T.S. aerodrome, 1 central F.T.S. aerodrome, and 2 relief F.T.S. flying grounds.

We do not discuss areas as the congestion would not be on the ground but in the air, especially night-flying. We do not speak in terms of aircraft as they may be used more by us than by them. The above figures avoid both difficulties.

Our school is to be five times the above size. How do we escape having $5 \times 4 = 20$ aerodromes?

Of what nature is the congestion now complained of? Seen from the air, most English aerodromes are generally empty.⁽¹⁾ It is probably at certain moments only that there is overcrowding.

We suggest having an aerodrome one mile square, with buildings at each corner also, roughly at each corner, and at a distance from it and from each other of four or five miles, 3 auxiliary aerodromes, making 12 auxiliary aerodromes, in all, and there is good hope that by careful arrangement of times this would be enough. If it is not, further relief landing grounds must be taken over as required. We do not think the difficulty will be very serious, though it must by no means be lost sight of as the question is one of the very greatest importance. The unit, must of course, be in a flat thinly populated area.

20. A two-track light railway with a simple train going round in each

(1) One of the writers has a private aeroplane at the present time and both have had them at one time or another.

direction, whose trucks would be merely flat cars with hand-rails, could be constructed for carrying men and material from place to place. The tracks would, of course, be outside the sheds. Alternatively a road and omnibus service could be used. The former would probably be the cheaper but the latter has the advantage that a road could be used for other vehicles. The ideal thing would, of course, be to have both.

21. EQUIPMENT, PERSONNEL AND RESULTS.

Aircraft in School	...	...	...	405
Divided into				
Single Engined Trainers	...	...	...	180
Twin Engined Trainers	...	...	...	225
Aircraft always serviceable	...	...	...	270
" " in workshops	...	...	...	135

The S.E.T. are for A and B flights, which do Elementary training.

The T.E.T. are for C and D flights, which do Intermediate and Advanced training respectively.

We append a table giving further particulars.

22. EQUIPMENT, PERSONNEL AND RESULTS.

405 Aircraft School.

A and B flights are elementary.
C flight is intermediate.
D flight is advanced.

				Flights.				Totals.
				A	B	C	D	
Total number of Aircraft	...	...	...	90	90	90	135	405
" " serviceable do.				60	60	60	90	270
Unserviceable Aircraft	...	...	...	30	30	30	45	135
Number of Pupils	...	...	...	240	240	200	360	1,040
Hours of Dual	...	...	...	19	19	18.45	-	37.45
" Solo	...	...	...	31	31	11.55	-	91.55
Total flying hours	...	...	...	50	50	30	50	130
Length of course in weeks	...	...	...	8	8	4	8	20
Intake of Pupils every 4 weeks	...	...	...	120	120	200	180	240
Outgo " " "	...	...	...	100	100	180	180	180

405 Aircraft School (Continued)

A and B flights are elementary.
 C flight is intermediate.
 D flight is advanced.

Flights.

	A	B	C	D	Totals.
<hr/>					
Personnel -					
Officer in charge	1	1	1	1	4
Assistant Officers in charge ...	3	3	3	4	13
Flying Instructors	45	45	70	75	235
Engineering Officers	1	1	1	1	4
Adjutants	1	1	1	1	4
Warrant Officers	1	1	1	1	4
Flight Sergeants	3	3	3	4	13
" Corporals	6	6	6	8	26
Aircraft Hands unskilled	30	30	30	45	135

To these must be added the
 ground instructional staff at
 five times the number for
 1 E.F.T.S. and 1 F.T.S. though
 this might be reduced in so
 large a unit.

15 15 65

FACTORS OF SAFETY

23. These are exactly as in Part I, para. 53. We repeat from there that we are allowing for only 5 working days out of 7 and only 5 flying hours per working day out of 12 light hours.

As to lengths of courses, we have followed the official syllabus (S.D.138) in laying down mean lengths of course, rather too long indeed for the summer, but which may have to be lengthened in winter.

WORKSHOP

24. It has been impossible in the time for us to work out the complete personnel or the equipment required. The workshop will however always have 135 machines in store or being repaired and in addition they will be responsible for all the machines in the flights including filling with petrol and oil and starting up. The personnel and equipment can therefore be taken in proportion to an existing repair depot of similar size.

It should be borne in mind that each machine in a flight will be in the air for 25 hours per week. The workshop would consist mainly of one large building having a floor area of say 214,000 square feet. This is allowing for 60 Single Engined machines covering 1,204 square feet each, this being the ground covered by the Harvard machine, and for 75 Twin Engined machines at 1,890 square feet each, this being the ground covered by the Oxford. (Areas from Chief Technical Officer, C.F.S.). A shop about 1,200 feet long and 180 feet wide would give space for wing storage as well as repairs. Near this building would be the engine repair shop, test shop and stores.

ECONOMIES DUE TO LARGE SIZE

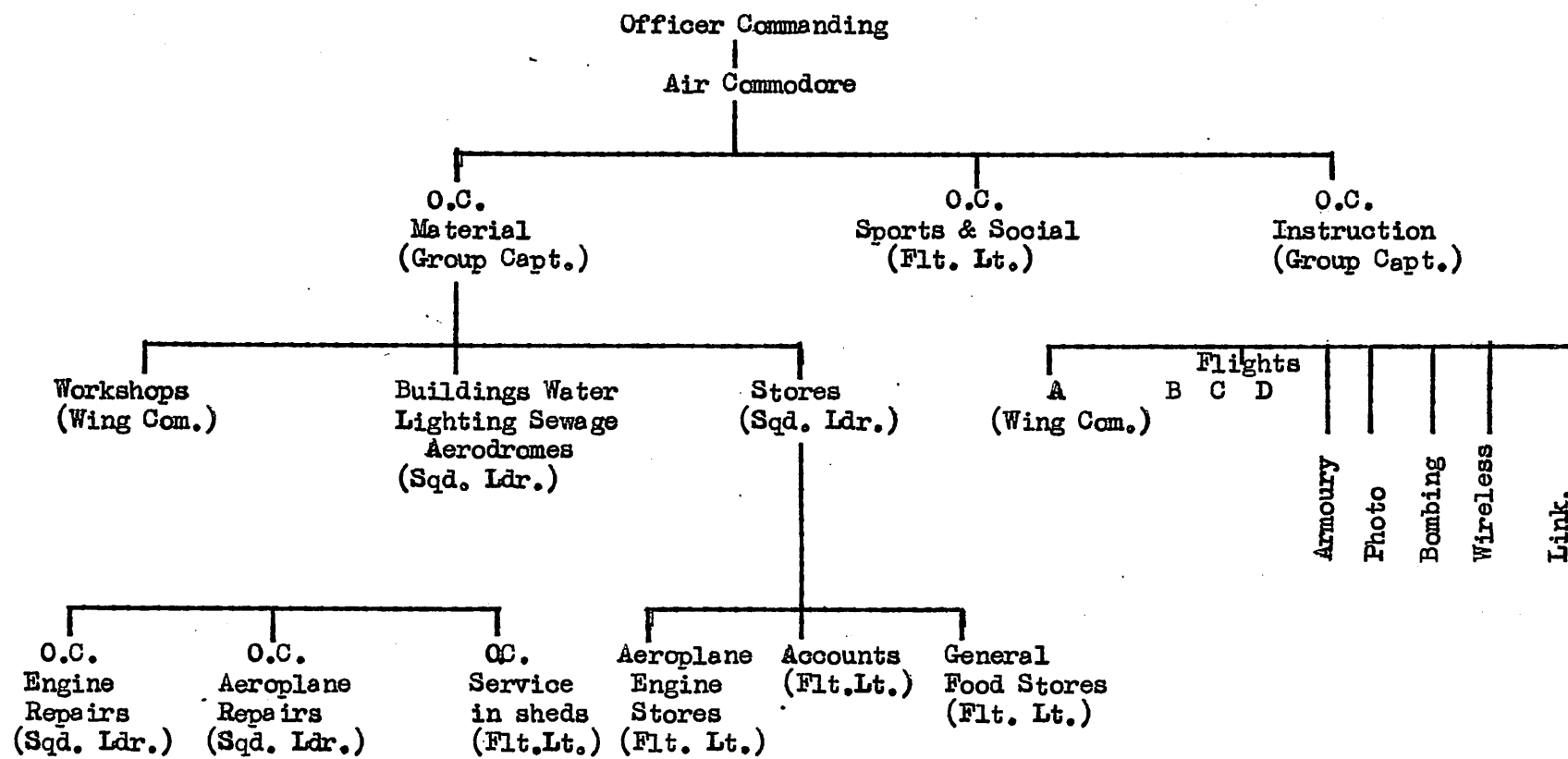
25. We should have liked to go into these more in detail but it would be impossible to do so without working out the full labour requirements in the workshops, stores, etc., and comparing these with those of the smaller units now existing plus their proportion of the Depots which maintain them. This stage has not yet been reached, besides which we should need access to confidential papers shewing the existing establishments in detail before we could institute a comparison.

26. The small units described in Part I of this Report would have the economy due to methodical proportioning of material to personnel, but not that due to size. To do all their own repairs they might need anything up to 25 men per aircraft, and indeed the thing would be altogether impracticable, but to give an example of the economy due to size we may quote from a report made by ourselves when we were sent together on an official visit to the French training centres in 1917.

27. At Pau, 133 aircraft were kept continually serviceable with 10 men per machine including clerical, unskilled and female staff.

But Pau had just four times the proportion of big and little accidents that Gosport had (12.5% per diem instead of 3.11%) and from a careful calculation made at the time after working out in very great detail the complete labour requirements for a proposed large school, the following results were obtained :-

Gosport Elem. Section	24 aircraft	13.22 men per aircraft.
The same on the basis of	400 aircraft	6.00 men per aircraft.



APPENDIX 13

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 May 1940

E.F.T.S.	LOCATION	AIRCRAFT	Pupils
No. 1	Hatfield	48	96
No. 2	Filton	24	48
No. 3	Hamble	36	72
No. 4	Brough	48	96
No. 5	Hamworth	48	96
No. 6	Sywell	48	96
No. 7	Desford	54	108
No. 8	Reading	24	48
No. 9	Ansty	48	96
No.10	Yatesbury	48	96
No.11	Perth	36	72
No.12	Prestwick	36	72
No.13	White Waltham	48	96
No.14	Elmdon	36	72
No.15	Redhill	36	72
No.18	Fairoaks	24	48
No.22	Cambridge	48	96
No.24	Sydenham	36	72
No.30	Derby	54	108

APPENDIX 14

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 May 1940

S.F.T.S.	LOCATION	AIRCRAFT	CAPACITY	COURSE LENGTH (WEEKS)	
No. 1	Netheravon	Hart 54 } Battle 54 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	Trained F.A.A. personnel. Aircraft strength in May was 84. This school became fully established in June 1940.
No. 2	Brize Norton	Harvard 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	
No. 3	South Cerney	Hart 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	
No. 5	Sealand	Master/Hart 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	Masters replacing Harts.
No. 6	Little Rissington	Harvard 45 } Anson 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	
No. 7	Peterborough	Hart 54 } Battle 54 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	Aircraft strength in May was 84. This school became fully established in June 1940.
No. 8	Montrose	Hart/Master 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	Masters replacing Harts.
No. 9	Hullavington	Harvard 45 } Anson 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	
No.10	Ternhill	Harvard 45 } Anson 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	
No.11	Shawbury	Hart 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	
No.12	Grantham	Hart 18 } Anson 63 } Battle 27 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	
No.14	Cranfield	Harvard 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	Moved from Kinloss 20 April 1940.
No.15	Middle Wallop	Harvard 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	Moved from Lossiemouth 20 April 1940.
College	Cranwell	Hart 45 } Oxford 63 } 108	I.T.S. 80 } A.T.S. 80 } 160	16	

Note: The average strength of the A.T.S. course was 72
owing to 'washouts' on the I.T.S. course.

TABLE OF FIGURES INVOLVED PER PUPIL, PER INSTRUCTOR AND PER AIRCRAFT AT R.F.T.S., S.F.T.S., A.T.S. AND O.T.U.s IN THE UNITED KINGDOM (EXCLUSIVE OF POSTING REQUIRED BY NAVAL TRAINING) UNDER THE VARIOUS SCHEMES FOR THE REORGANISATION OF FLYING SQUADRON IN FORCE OR UNDER DISCUSSION, SUMMER 1940

I. HOURS PER PUPIL PER SCHOOL		1			2			3			4			5			6			7		
		Original Programme			First Revise (June 1940)			Second Revise (August 1940)			Third Revise			Column 2 with allowance for 25% overbearing at S.F.T.S.			Column 3 with allowance for 25% overbearing at S.F.T.S.			Column 4 with allowance for 25% overbearing at S.F.T.S.		
		Course Length (Weeks)	Capacity	Hours per pupil per School	Course Length (Weeks)	Capacity	Hours per pupil per School	Course Length (Weeks)	Capacity	Hours per pupil per School	Course Length (Weeks)	Capacity	Hours per pupil per School	Course Length (Weeks)	Capacity	Hours per pupil per School	Course Length (Weeks)	Capacity	Hours per pupil per School	Course Length (Weeks)	Capacity	Hours per pupil per School
R.F.T.S.	8	1,272	25 dual 25 solo	7	1,343	25 dual 25 solo	6	1,272	25 dual 25 solo	6	1,527	25 dual 25 solo	7	1,680	25 dual 25 solo	6	1,590	25 dual 25 solo	6	1,908	25 dual 25 solo	
S.F.T.S.	I.T.S.	8	960	25 dual 25 solo	Gr.I Gr.II 5 7	960 (320)(640)	25 dual 25 solo	6	960 (320)(640)	Gr.I Gr.II 25 dual 22 25 solo 21	5	960 (320)(640)	Gr.I Gr.II 21 dual 18 21 solo 18	Gr.I Gr.II 6 7	1,200 (400)(800)	25 dual 25 solo	6	1,200 (400)(800)	Gr.I Gr.II 25 dual 22 25 solo 21	5	1,200 (400)(800)	Gr.I Gr.II 21 dual 18 21 solo 18
A.T.S.	8	960	16 dual 34 solo	6 7	960 (320)(640)	16 dual 34 solo	6	960 (320)(640)	16 dual 14 34 solo 29	5	960 (320)(640)	14 dual 12 28 solo 24	6 7	1,200 (400)(800)	16 dual 34 solo	6	1,200 (400)(800)	16 dual 14 34 solo 29	5	1,200 (400)(800)	14 dual 12 28 solo 24	
O.T.U.	Heavy Bomber	6	360	55	6	246	55	8	360	70	10	540	85	6	306	55	8	456	70	10	670	85
	Medium Bomber	6	168	60	6	108	60	8	160	75	10	230	90	6	132	60	8	192	75	10	290	90
	Fighter	4	240	40	4	152	40	4	168	40	6	300	60	4	192	40	4	208	40	6	378	60
	Coastal	4	108	12	4	68	12	6	114	57	8	176	72	4	84	42	6	144	57	8	232	72
	A.C. S.E.	6	60	40	6	36	40	6	42	40	8	64	55	6	48	40	6	54	40	8	88	55
	T.E.	8	40	40	8	24	40	8	24	55	10	40	70	8	32	40	8	32	55	10	50	70
II. HOURS PER INSTRUCTOR		Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	Etab. of Instrs.	Hours per Instructor per month	
R.F.T.S.		336	51	378	55	378	61	378	73	378	69	378	76	378	91	378	91	378	91	378	91	
S.F.T.S.	I.T.S.	336	40	Gr.I Gr.II 100 200	Gr.I Gr.II 58 50	Gr.I Gr.II 100 200	Gr.I Gr.II 58 50	Gr.I Gr.II 100 200	Gr.I Gr.II 58 50	Gr.I Gr.II 100 200	Gr.I Gr.II 58 50	Gr.I Gr.II 100 200	Gr.I Gr.II 58 50	Gr.I Gr.II 100 200	Gr.I Gr.II 72 62	Gr.I Gr.II 100 200	Gr.I Gr.II 72 63	Gr.I Gr.II 100 200	Gr.I Gr.II 72 63	Gr.I Gr.II 100 200	Gr.I Gr.II 52 62	
A.T.S.		206	40	60 120	62 53	60 120	62 53	60 120	65 55	60 120	65 55	60 120	65 55	60 120	77 66	60 120	77 66	60 120	77 66	60 120	84 69	
III. HOURS PER I.R. AIRCRAFT PER MONTH		Etab. of I.R. aircraft	Capacity	Hours per I.R. aircraft per month	Etab. of I.R. aircraft	Capacity	Hours per I.R. aircraft per month	Etab. of I.R. aircraft	Capacity	Hours per I.R. aircraft per month	Etab. of I.R. aircraft	Capacity	Hours per I.R. aircraft per month	Etab. of I.R. aircraft	Capacity	Hours per I.R. aircraft per month	Etab. of I.R. aircraft	Capacity	Hours per I.R. aircraft per month	Etab. of I.R. aircraft	Capacity	Hours per I.R. aircraft per month
R.F.T.S.		448	1,272	77	560	1,343	74	560	1,272	82	560	1,527	98	560	1,680	93	560	1,590	103	560	1,908	123
S.F.T.S.	I.T.S.	432	960	60	Gr.I Gr.II 144 288	Gr.I Gr.II 320 640	Gr.I Gr.II 80 69	Gr.I Gr.II 144 288	Gr.I Gr.II 320 640	Gr.I Gr.II 80 69	Gr.I Gr.II 144 288	Gr.I Gr.II 320 640	Gr.I Gr.II 80 69	Gr.I Gr.II 144 288	Gr.I Gr.II 400 800	Gr.I Gr.II 100 86	Gr.I Gr.II 144 288	Gr.I Gr.II 400 800	Gr.I Gr.II 100 86	Gr.I Gr.II 144 288	Gr.I Gr.II 400 800	Gr.I Gr.II 100 86
A.T.S.		432	960	60	144 288	320 640	80 69	144 288	320 640	80 69	144 288	320 640	80 69	144 288	400 800	100 86	144 288	400 800	100 86	144 288	400 800	100 86
O.T.U.	Whitley				72	78	47	72	112	65	72	170	96	72	96	59	72	144	84	72	240	119
	Wellington				96	90	40	96	136	58	96	200	86	96	114	52	96	168	73	96	250	106
	Bombardier				82	78	42	82	112	57	82	170	84	82	96	53	82	144	72	82	240	103
	Battle				45	36	37	45	56	55	45	80	77	45	48	51	45	72	72	45	110	104
	Blenheim				72	72	48	72	104	65	72	150	89	72	84	56	72	120	75	72	180	107
	Fighter S.E.				135	128	46	135	140	50	135	252	89	135	160	57	135	172	62	135	312	111
	" T.E.				21	24	54	21	28	64	21	48	109	21	32	72	21	36	82	21	66	150
	Coastal				63	68	54	63	114	83	63	178	120	63	84	66	63	144	103	63	232	158
	A.C. S.E.				30	36	57	30	42	67	30	64	106	30	48	77	30	54	87	30	88	145
	" T.E.				26	24	22	26	24	30	26	40	52	26	32	29	26	32	40	26	50	65

Note: It is not possible to give any standard syllabus hours for instructors in O.T.U.s. These varied with each O.T.U.

(Air Member for Training, 26 August 1940 Amended 22 October 1940)

APPENDIX 16

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)
SEPTEMBER 1940

S.F.T.S.	Location	Aircraft	Capacity	Course Length (Weeks)	Remarks
No. 1	Netheravon	Hart 54 } Battle 54 } 108	160	16	Trained F.A.A. personnel
No. 2	Brize Norton	Oxford 108	200	10	Group II
No. 3	South Cerney	Oxford 108	200	10	Group II
No. 5	Sealand	Master 108	200	10	Group I
No. 6	Little Rissington	Anson 108	200	10	Group II
No. 7	Peterborough	Hart 54 } Battle 54 } 108	160	16	Trained F.A.A. personnel. Moved to Canada in October 1940 and became No. 31 S.F.T.S.
No. 8	Montrose	Master 108	200	10	Group I
No. 9	Hullavington	Hart/Master 108	200	10	Group I
No. 10	Ternhill	Anson 108	200	10	Group II. Moved to Canada in October 1940 and became No. 32 S.F.T.S.
No. 11	Shawbury	Oxford 108	200	10	Group II
No. 12	Grantham	Battle 64 } Anson 44 } 108	200	10	Group II
No. 14	Cranfield	Oxford 108	200	10	Group II
No. 15	Chipping Norton/ Kidlington	Harvard 108	200	10	Group I Moved from Middle Wallop on 31 August 1940. I.T.S. at Kidlington A.T.S. at Chipping Norton
College	Cranwell	Oxford 108	200	10	Group II

Note: The S.F.T.S.s commenced specialisation in June 1940 as follows:-

Group I - 4 schools

Group II - 8 schools

F.A.A. - 2 schools

This was completed by September 1940.

APPENDIX 17

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)
January 1941

E.F.T.S.	Location	Aircraft	Capacity	Course Length (Weeks)
No. 1	Hatfield	Tiger Moth 72	120	6
No. 2	Staverton	Tiger Moth 36	60	6
No. 3	Watchfield	Tiger Moth 36	60	6
No. 4	Brough	Tiger Moth 72	120	6
No. 5	Meir	Tiger Moth 72	120	6
No. 6	Sywell	Tiger Moth 72	120	6
No. 7	Desford	Tiger Moth 72	120	6
No. 8	Reading	Tiger Moth 36	60	6
No. 9	Ansty	Tiger Moth 72	120	6
No.10	Weston	Tiger Moth 72	120	6
No.11	Perth	Tiger Moth 90	150	6
No.12	Prestwick	Tiger Moth 54	90	6
No.13	White Waltham	Tiger Moth 72	120	6
No.14	Elmdon	Tiger Moth 72	120	6
No.15	Carlisle	Magister 54	90	6
No.16	Derby	Tiger Moth 72	120	6
No.18	Fairoaks	Tiger Moth 24	40	6
No.22	Cambridge	Tiger Moth 90	150	6
No.24	Luton	Tiger Moth 72	120	6

APPENDIX 18

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 January 1941

S.F.T.S.	Location	Aircraft	Capacity	Course Length (weeks)	Remarks
No. 1	Netheravon	Master/Hart 54 Battle 54	160	16	F.A.A. Pupils
No. 2	Brize Norton	Oxford 108	200	10	
No. 3	South Cerney	Oxford 108	200	10	
No. 5	Ternhill	Master 108	200	10	
No. 6	Little Rissington	Oxford 108	200	10	
No. 8	Montrose	Master 108	200	10	
No. 9	Hullavington	Master 108	200	10	
No.11	Shawbury	Oxford 108	200	10	
No.12	Grantham	Oxford 108	200	10	
No.14	Cranfield	Oxford 108	200	10	
No.15	Kidlington	Harvard 108	200	10	
College S.F.T.S.	Cranwell	Oxford 108	200	10	
Polish S.F.T.S.	Hucknall	Magister 32 Master 40 Oxford 20	160	24	Covered E.F.T.S. and S.F.T.S. stages.

APPENDIX 19

REPORT ON THE MAXIMUM TRAINING CAPACITY AT SERVICE FLYING TRAINING SCHOOLS IN THE UNITED KINGDOM BY GROUP CAPTAIN GORDON DEAN. 16 MAY 1941

INTRODUCTION

The following report is based upon investigations carried out by the writer into the organisation of Service Flying Training Units since his attachment for this purpose to Headquarters, No. 23 Group, on 29th April 1941.

2. During the period the writer has discussed the organisation in detail with the Staff of No. 23 Group, and spent one week at No. 6 Service Flying Training School in order to acquire first hand information regarding the problem. The aim of the investigations was to see whether any suggestions can be introduced which will add to the general efficiency, and in particular secure an increased output of pupils from this type of school.

PRELIMINARY CONSIDERATIONS AFFECTING MAXIMUM CAPACITY

3. For maximum efficiency in any machine it is desirable that the loading shall be spread as uniformly as possible in order to avoid any excess of overload or underload periods. In flying training this applies equally to personnel, to aircraft, and also to aerodrome congestion and wear and tear. If the daytime flying required is spread evenly throughout the available flying hours, the load on the machines will ensure better results than if there is uneven distribution.

4. As regards maximum output, there are four main limiting factors for any one unit:-

- (a) The safe 'saturation point' for day flying.
- (b) The safe 'saturation point' for night flying.
- (c) The limits of accommodation available for personnel.
- (d) The limits of accommodation available for aircraft.

5. Ancillary, but important, factors are the availability of spare parts and the loading on the aerodrome surfaces. For all year round establishment it would appear that the present strength in aircraft (108) is about the maximum that can be usefully employed and maintained. It would also appear not practicable to increase substantially the accommodation for personnel. As regards aircraft congestion, the limiting factor is the number of aircraft that can be operated during the mid-winter period when loading on each available flying hour by day will be at its peak. The consensus of opinion seems to be that any addition in aircraft strength would cause undue flying congestion and result in loss of efficiency and a rise in the accident rate. With this opinion, I agree. As regards night flying, the limiting factor is the number of aircraft that can be operated at any one time over any aerodrome. The present practice of operating three aircraft (with three in reserve) throughout the hours of darkness seems to be the most efficient in all circumstances. The mid-summer period has the shortest number of night flying hours. Therefore, this limits the number of pupils who can complete their night flying training at this time of the year.

FACTORS LEADING TO LOSS OF EFFICIENCY IN FLYING OUTPUT

The following factors have been brought to my notice which cause inefficiency in the training machine at present:-

6. Uneven Loading on Instructors. The present practice by which flying instructors receive all their pupils on entry causes unnecessary peak loads on each instructor. A more uniform loading would be achieved if instructors' pupils were not all at the same stage of their course.

APPENDIX 19

7. Time Lost Unnecessarily During Flying Periods. The time lost under this heading is mostly due to refuelling and lack of forward planning. As far as possible the refuelling of aircraft should be distributed in time as evenly as possible. Also no unavoidable minute should be lost during the changeover of crews in any aircraft. To achieve the above, a vigilant control needs to be exercised at all times by the officer-in-charge of each aircraft operating point.
8. Unnecessary Aircraft Congestion During Available Flying Hours. Only the minimum number of aircraft necessary to complete the flying programme should be called for at any one period. This will ensure that the maintenance personnel have as many aircraft as possible available for inspection and maintenance purposes. As far as possible, therefore, there should be no peak periods of flying at any period through the day. The uniform loading throughout the day will reduce the number of aircraft required to a minimum, and also create less congestion and risks of taxiing accidents, etc.
9. Unserviceability of Aerodrome Surfaces During Winter Months. During the winter months daylight hours are short. Therefore, the aircraft congestion is then at its highest. Also during the winter months the aerodrome surfaces are most liable to deterioration due to conditions of wet, frost and snow. Grass surfaces in the United Kingdom are never in a position to stand up consistently to the overload which occurs at training units during this period of the year. The only solution to this difficulty would appear to be the provision of adequate runways in time before the next winter season.
10. Delay in Obtaining Spare Parts. It seems essential that all Units should hold a sufficient stock of spare parts as experience proves necessary for day to day maintenance purposes. Everything possible should also be done to ensure that any spare parts not so held should be obtainable with the least possible routine delay.

PROPOSED TRAINING PROGRAMME

11. At Annexure 'A' is a suggested training programme for the spring and summer periods. This programme has been agreed by O.C., No. 6 Service Flying Training School. It extends the daylight flying period to fifteen hours, divided into three 5 hour periods, and enables the total of pupils under training to be increased from 200 to 288. As long as daylight hours permit, the programme requires 32 aircraft for 48 pupils throughout each of these periods. When the hours shorten, recourse should be made to a similar two period programme calling for two flying periods each day, which would require 48 aircraft to serve 72 pupils during each of these periods. This two period programme could be continued throughout the winter, but in order to clear up arrears due to weather, etc. it will be necessary to increase the number of aircraft to the maximum possible on occasions for a double class of flying pupils. Under the three period programme each instructor will have one 5 hour flying period each day with half of his pupils. The pupils in each of these halves will be divided between junior and senior entries, as explained in more detail later (see paragraphs 19 and 20).

COMMENTS ON THE ABOVE PROGRAMME

12. Length of Course. Experience has shown that it is impossible to complete the present programme in ten weeks except during the summer months. It is recommended that the course should be extended to 13 weeks during the early spring and autumn, and to 16 weeks during the winter in order to set an aim which is more nearly obtainable. It may also be considered desirable to reduce the pupil population during the winter period to the present total of 200.

13. Analysis of Day flying. The total day flying hours required under the syllabus for each pupil is approximately 68. Each pupil will have a flying period on 30 alternate days over a 10 weeks' course if one day a week is allowed for leave. The average flying required per pupil per flying period is approximately 2.3 hours. During the early period of the course, he will not receive this but should be able to make up the balance during the latter half of his time. If this is insufficient, extra flying can be taken from lecture periods during the ninth and tenth weeks of each course when ground instruction has ceased. The maintenance organization must be prepared to provide additional aircraft for this purpose if necessary. Apart from this the reserve of maximum possible flying hours provided in the programme to meet contingencies due to bad weather and time wastage is about 47 per cent.

14. Night Flying. The reduction in the hours available for night flying during the spring and summer periods and the proposed increase in the strength of pupils make it essential for two aerodromes or landing grounds per Service Flying Training School to be available for night flying every night if the night flying programme is to be completed. On the shortest nights there are about five hours only available and the continuous use of three aircraft each at two landing grounds provide a total capacity of 30 hours per night. If each pupil requires $4\frac{1}{2}$ hours night flying and half the pupils (144) are night flying over the last five weeks of their course, it will be necessary to fly on the average 144×4.5 divided by $5 \times 7 = 18.5$ hours per night. The above margin between what is available and what is required is a very close one and it will clearly be impossible to complete the night flying programme if one night landing ground only is available.

15. Maintenance. Investigation has brought to light the fact that two fitters and one rigger class of personnel are allowed per aircraft for servicing purposes. The amount of work is practically in the reverse proportion to this, and an establishment of two riggers and one fitter would more nearly meet the load to be carried by this personnel. The total flying hours called for under the new programme total 8,294 per month, exclusive of incidental flying. In order to meet the additional maintenance work involved the Station Engineer Officer at No. 6 Service Flying Training School considers that he would require the following additions:-

Servicing Squadron	-	Flight Mechanic 'A'	...	...	48
		Aircrafthands	...	...	32
Maintenance Squadron	-	Fitter II A	...	...	12
		Aircrafthands	...	...	8
Total					100

16. The provision of aircrafthands will enable a dilution of flight servicing parties and allow the routine inspections, etc. necessitated by the increased number of flying hours.

17. Daily Inspections. A minimum of one hour is required in daylight each day to enable the maintenance personnel to complete the daily inspections before flying commences in the morning, since these inspections must be carried out in the daylight when the aircraft are picketed out. The programme at Annexure 'A' allows sufficient time for this work to be completed.

18. Aircraft Requirements. The programme calls for the maintenance organization to provide 32 aircraft for continuous operation 15 hours daily out of an establishment of 108 aircraft. This gives four aircraft to each flight. It is considered that an additional aircraft per flight should be provided under the control of each flight as an immediate reserve, making a total of 32 in use plus eight in reserve.

19. Establishment of Instructors. A note regarding the establishment and loading on the Flying Instructional Staff is attached on Annexure 'B'. The new programme calls for 36 pupils per flight and a minimum of 48 instructors apart from the four group commanders and the two squadron commanders in each school. The present establishment allows a total of 60 flying instructors and this includes four group commanders, two squadron commanders and eight flight commanders.

20. Allocation of Pupils to Instructors and Flights. Under the new programme the pupils of each of the eight flights have been divided into six sections. Six pupils are allotted to each section and six pupils to each instructor split between the two sections, so that an instructor will not have more than three pupils flying at any one period. Each new entry will be absorbed in each of the two squadrons alternately, the new pupils being divided between all the instructors in the squadron concerned. Each instructor will, therefore, receive three new pupils every alternate entry, i.e., every five weeks. This will result in the loading on the instructors for dual being reduced from the present high peak which occurs when the instructor receives six new pupils all at once under the present system. Each instructor's pupils are divided so that half are in a section on flying whilst the other half are on ground lectures on alternate days. Each instructor, therefore, has one flying period of five hours every day with three 'graded' pupils.

21. Under the new programme each pupil will receive one period of individual training on the same day that he has a flying period. On the next day he has no flying period but is employed on ground lectures.

FLYING TRAINING PROGRAMMESpring and Summer PeriodFLYING

Periods	Sections	Shift	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Mon.	Tues.	Wed.
0700 - 1200	A B C D E F G H 1 1 1 1 1 1 1 1	L	L	O	N	Q	M	P	L	O	N	Q	M
1200 - 1700	A B C D E F G H 2 2 2 2 2 2 2 2	M	M	P	L	O	N	Q	M	P	L	O	N
1700 - 2200	A B C D E F G H 3 3 3 3 3 3 3 3	N	N	Q	M	P	L	O	N	Q	M	P	L
Night Flying		Pupils selected preferably from lecture period pupils											

INDIVIDUAL GROUND TRAINING

0730 - 1030	A B C D E F G H 4 4 4 4 4 4 4 4	O	M	P	L	Q	N	Q	M	P	L	O	N
1030 - 1330	A B C D E F G H 5 5 5 5 5 5 5 5	P	N	Q	M	P	L	O	N	Q	M	P	L
1500 - 1800	A B C D E F G H 6 6 6 6 6 6 6 6	Q	L	O	N	Q	M	P	L	O	N	Q	M

GROUND LECTURES

0800 - 1730 as detailed		OPQ	OPQ	LMN	OPQ	LMN	OPQ	LMN	OPQ	LMN	OPQ	LMN	OPQ
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Note:

(a) Instructor's pupils are divided between two shifts as that half are on flying whilst the other half are on Ground Lectures.

(b) 4 Aircraft per Section
32 Aircraft per Flying Period (plus 8 Reserve)
2 Instructors per 2 Sections of Pupils
6 Pupils per Section (3 old, 3 new)
Totals
Pupils 288, Instructors 48, Aircraft 32 (plus 8 Reserve)

6 Sections per Flight
4 Flights per Squadron
2 Squadrons per Unit

NOTE RE FLYING INSTRUCTORSPresent establishment and loading on Flying Instructional Staff

1. The present establishment allows 60 flying instructors for each Service Flying Training School, but included in this total are two squadron leaders, four flight group commanders and eight flight commanders, i.e. 14 'Supervisory Instructors' with special responsibilities. This leaves a minimum of 46 instructors available for a full load of flying instruction. Of these, it is stated that on the average six are always non-effective on account of leave, sickness and other reasons, so that a minimum of 40 only can be considered effective.

2. The position is complicated still further because a proportion of the actual instructors are deemed to be 'inexperienced' and it has been laid down that these cannot train as many pupils as the 'experienced' instructors. The ratio of experienced to inexperienced is stated to be about 3 to 1.

3. As regards the 14 instructors mentioned in paragraph 1 above, it has been agreed by Flying Training Command, that under 'maximum effort' conditions the group and flying commanders themselves can take a certain proportion of pupils in addition to their supervisory duties. This distribution of pupils is as follows:-

4 Group Commanders @ 2 pupils each	-	8
8 Flight Commanders @ 4 pupils each	-	<u>32</u>
Total		40 pupils

4. Experienced instructors are allowed under the present organization to take six pupils each and inexperienced instructors to take five pupils each. Therefore, pupils can be allotted to the 40 remaining instructors as follows:-

30 experienced instructors @ 6 pupils each	-	180
10 inexperienced instructors @ 5 pupils each	-	<u>50</u>
		230

5. The School establishment of 60 instructors, therefore, enables a total strength of pupils to be accepted as follows:-

	<u>Pupils</u>
6 Non-effective	
14 Supervisory instructors	40
30 Experienced instructors	180
10 Inexperienced instructors	50

6. For a total of 288 pupils, therefore, a further increase of three instructors, in the authorised establishment of 60 would be required, unless it is considered that the relief in peak overloading on instructors by the more even distribution of their work will enable them to take a higher average load.

APPENDIX 20

MEMORANDUM BY FLYING TRAINING COMMAND ON INCREASE OF OUTPUT AT S.F.T.S.s (H.Q., F.T.C. Notes of 4 June 1941) (1)

Flying Day

08.30 - 19.45 All flying instructors available for duty.

Routine

08.30 - 11.30 Flying 'A' and Ground Instruction 'B'

11.30 - 13.00 Dinner and lunch break. Cross countries can break into this for individuals.

13.00 - 16.00 Flying 'B' and Ground Instruction 'A'.

16.45 - 19.45 Flying 'A'. Either Synthetic Training, Ground Instruction, or Night Flying 'B'.

The whole of the pupils are divided equally into two sets of squads, 'A' set or 'B' set. The members of squad 'B' (as above) who have been on night flying late miss the morning flying period the next day. For most months of the year, the same periods hold good, the routine being varied as regards time of commencement and ending, if necessary, according to the effect of 'Summer time' in relation of day-light. When the hours of day-light become too short to allow of the normal working day of $11\frac{1}{4}$ hours, including meals, the third flying period is gradually reduced as required.

Load on Instructors and Pupils

Each instructor, other than a supervisory one (Squadron Commander, Flight Group Commander or Flight Commander) takes six pupils. Supervisory instructors take no pupils of their own, but conduct tests, and help out with instructions in their flights or flight groups if instructors are absent. During each period of three hours an instructor has three pupils. Allowing for 20 per cent of days unfit for flying and one day a week off flying, there are then in the ten weeks' courses 80 per cent of 70 - 10 days fit for flying i.e. 48 days. A pupil must, therefore, average $68/48$ hours per day available for flying.

Calculating on a three period day but allowing the third period to count only half the value of the earlier two periods, because allowance has to be made for breaking into it by shifting the afternoon period owing to bad weather and shortening of day-light etc., the pupils obtain one period every fit flying day and one-and-a-half periods every other fit flying day, i.e. two-and-a-half periods in two days on an average of one-and-a-quarter periods per day. The pupil has to do a total of 68 hours flying on the course in which there are available to him $1\frac{1}{4} \times 48$ available flying periods = 60 flying periods. Therefore, his average time per flying period is $68/60$ hours = 1.134 hours = 1 hour 8 minutes. Now, three pupils have to do an average total of 1 hour 8 minutes $\times 3$ in the three hour period = 3.4 hours or 3 hours 24 minutes. An aeroplane may be expected to fly for $2\frac{1}{2}$ hours out of 3 hours. Therefore, arithmetically, the aircraft requirement is, 1 instructor; 3 pupils; 1.37 aircraft. Allowing a small margin, the aircraft requirement may be put at 1.5 for 3 pupils per period. As on a 200 pupils' course there will be 100 under instruction in any period, the aircraft requirement is 50 serviceable continuously for a day of nine working hours. As 50 is not a convenient figure for division amongst the eight flights into which a S.F.T.S. is

(1) A.M. File S.71940.

organized for flying instruction and because of dispersed working a flight cannot share an aircraft with another flight, it is proposed that the pupil population should be 224, an increase of 12 per cent over the present 200. For flying by 112 pupils per period 56 aircraft will be required and in order to ensure that those aircraft will be continuously available one additional aircraft per flight must be held as serviceable float = 64.

Instructors

The existing establishment is 2 squadron commanders, 4 flight group commanders, 8 flight commanders and 40 flying instructors, i.e. 14 supervisory and 40 ordinary instructors. Allowing for leave at the rate of one week per quarter, the instructors available will be 13 supervisory and 37 ordinary instructors, which almost exactly cover the 224 pupils at 6 per ordinary instructor. The supervisory instructors will have to carry the pupils of ordinary instructors who may be sick or not available for some other reason. If the flight group and flight commanders were to average 2 pupils each they would take 24 pupils between them, which allows for 4 out of net 37 ordinary instructors to be unavailable owing to sickness, extraneous duties, delay in replacement and other causes.

Flying Load on the Individual Instructor

Assuming that courses are not split between flights - consider the working in the peak dual-1st sole stage.

3 Periods

Each period the instructor gives each of 3 pupils $\frac{3}{4}$ hour dual. 3 pupils get $\frac{3}{4}$ dual each and 3 get $1\frac{1}{2}$ hours each per day. The instructor gives $3 \times \frac{3}{4}$ hours dual each period $\times 2\frac{1}{4}$ hours. This is possible in 3 hours with one aircraft. Over the day the instructor does $6\frac{3}{4}$ hours flying. The figure can, however, be reduced if necessary by the flight commander and flight group commanders' tests and by their giving other help.

The pupils during this period average $1\frac{1}{8}$ hours per period which is very nearly their average per day over the whole course, so that there is no appreciable increase in the average daily flying that they have to do over the remainder of their course. Over the whole course the instructor has to give dual approximately 28×6 hours over 10 weeks = 168 hours or 67.2 hours per 4 weeks. Adding incidental flying, say 75 hours in 4 weeks. Average dual per flying day $3\frac{1}{2}$ hours.

Ground Instruction - Three Period Day

	8.30-11.30	11.30-13.00	13.00-16.00	16.00-16.45	16.45-19.00
Section A	Flying	Lunch	Ground	Tea	Flying
Section B	Ground	Lunch	Flying	Tea	Ground

In the case shown above where Section 'A' starts flying at 8.30 they will do 3 hours ground instruction that day. The following day when this Section starts flying at 13.00 hours they will do $5\frac{1}{4}$ hours ground instruction.

Therefore, every 2 days they will have $8\frac{1}{4}$ hours ground instruction, and the average per day will be $4\frac{1}{8}$ hours.

2. The S.E. Syllabus requires 121 hours ground instruction for its completion and the T.E. Syllabus 145 hours. We may, therefore, ignore the S.E. Syllabus in these calculations.

3. Ground instruction finishes at the end of the 8th week, i.e. 56 days: deducting 8 'days off' from this figure we get 48 days available for ground instruction. During these 48 days each pupil must do 145 hours ground instruction or $3\frac{1}{48}$ hours per day, leaving a margin of $1\frac{1}{8}$ hours per day approx.

4. No account has been taken of the possibility of doubling up with the Section due for ground instruction when the weather makes the other Section's flying programme impossible, as this is not always feasible owing to accommodation difficulties, but Airmanship lectures might well be under flight arrangements, mainly in bad weather periods.

Comparison of basic points in Group Captain Gordon-Dean's
Scheme (A) (1) and Headquarters, Flying Training Command's
Scheme (B) for maximum output from S.F.T.S.s

(A)

(B)

Allotment of pupils to
Instructors

Pupils of two courses to each instructor.

Pupils of one course each instructor.

Air Congestion

During the 4 months of 15 hours daily flying period, the minimum, to train 288 pupils in a ten weeks' course.

Greater air congestion proportion. At the peak of 56; 32 during routine working in fine weather. As a result of subsequent discussion with Group Captain Gordon-Dean it appears that the figures should be 56; 40.

Need for adequate supplies of
spare parts

Essential to the working of the scheme.

Very important; but less so than in Scheme 'A', because of greater margin allowed in planning.

Flying day total and periods

15 hours. 3 of 5 hours. No break for meals.

11½ hours. 3 of 3 hours. Long breaks for meals and to cover movements between R.L.Gs and parent aerodrome.

Number of pupils

288

224

Number of aircraft

114

112

Adjustments to meet seasonal
reductions in daily hours of
daylight

A complete change of the organization as soon as daylight hours become less than 16.

No change until daylight hours become less than 12½; after that, no change of organization, but adjustment of the daily timetable.

Instructor's daily flying
periods

One of 5 hours

3 of 3 hours each.

Spread of the pupil's flying

Alternate days one 5 hour period.

Every day one 3 hour period and every other day a second 3 hour period.

Average Flying time required
per pupil per period

2.3 hours

1.134 hours.

(1) See Appendix 19.

A

B

Pupils making up their average during the latter part of the course

Necessary and involving the production of more than the planned total of 32 aircraft available for flying, during nearly the whole course.

The margins allowed by the scheme over and above the 20% bad weather allowance are so great that the problem does not arise, except during the worst winter periods.

Allowance for bad weather

No allowance is included in the calculations. The scheme allows very small margins.

Allowance of 20% for bad weather is included in the calculations. In addition the scheme allows very large margins.

Additional maintenance personnel

72

29

Period over which the scheme would be fully operative (summer season)

4 months (April 20th - August 15th)

6½ months (17th March - 5th October)

Proportion of pupils to instructors

Approximately 6 per ordinary instructor.

6 per ordinary instructor. Supervisory instructors have no pupils. (The schemes are, or can be, the same on this point).

Peak dual load on instructors

Avoided, by splitting courses between flights and instructors.

Extreme during one week's dual-to-first-solo period for each course.

Proportion of pupils to supervisory flying instructors and ground instructors

Raised in proportion 288; 200 as compared with existing basis.

Raised in proportion 224: 200. The proportion is important in view of flying tests by supervisory instructors and of the importance of the supervision of the work of inexperienced instructors.

The possibility of supervision by flight commanders etc of the periods when day flying is in progress in their flights etc.

Impossible over 15 hours.

Possible and normal over 9 hours.

Synthetic training by flying instructors

Systematically arranged

Dependent on non-flying weather and detailed arrangements in the unit.

Classroom accommodation

Required for 144 cadets at a time.

Required for 112 cadets at a time.

Ground Instruction squad sizes

36

28

Station Administration and
domestic services

Extremely complicated by the routine and with added establishment of 88 cadets, 72 airmen.

Routine unchanged. Additional 24 cadets and 29 airmen.

Output

Theoretical output in every $2\frac{1}{2}$ weeks 72: but owing to lack of margin in planning probability of course extensions.

Theoretical output in every $2\frac{1}{2}$ weeks 56: but probability of course extensions reduced by an allowance of 20% bad weather and big margins in the planning.

APPENDIX 21

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)

30 September 1941

E.F.T.S.	Location	Aircraft (Tiger Moth)	Capacity	Capacity Increased by 25% on - Date
No. 1	Hatfield	90	180	5 July 1941
No. 2	Staverton	36	60	
No. 3	Watchfield	54	108	5 July 1941
No. 4	Brough	72	120	
No. 5	Meir	48 *	96	
No. 6	Sywell	108	216	21 June 1941
No. 7	Desford	90	180	2 July 1941
No. 8	Reading	54	108	18 June 1941
No. 9	Ansty	90	180	21 June 1941
No.10	Weston	72	120	
No.11	Perth	90	180	28 June 1941
No.14	Elmdon	72	120	
No.15	Carlisle	108	216	21 June 1941
No.16	Derby	90	150	
No.17	Peterborough	90	180	21 June 1941
No.18	Fairoaks	72	144	18 June 1941
No.19	Sealand	72	144	18 June 1941
No.20	Yeadon	54	108	5 July 1941
No.21	Booker	72	144	28 June 1941
No. 22	Cambridge	108	180	
No.24	Luton	72	144	12 July 1941
No.25	Hucknall	-	-	
No.26	Theale	36	60	
No.28	Wolverhampton	54	90	
No.29	Clyffe Pypard	72	120	

* Upgraded to 72 aircraft with effect 7 September 1941.

APPENDIX 22

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)
30. September 1941

S.F.T.S.	Location	Aircraft	Capacity	Course Length (Weeks)	Remarks
No. 1	Netheravon	Master/Hart 54 Battle 54	160	16	F.A.A. pupils
No. 2	Brize Norton	Oxford 108	240	12	
No. 3	South Cerney	Oxford 108	240	12	
No. 5	Ternhill	Master 84 Hurricane 24	200	12	Moved from Sealand December 1940
No. 6	Little Rissington	Oxford 108	288	12	Re-equipped from Ansons, February 1941. A course of 288 pupils commenced 18 June 1941 as an experi- ment.
No. 8	Montrose	Master 84 Hurricane 24	200	12	
No. 9	Hullavington	Master 84 Hurricane 24	200	12	
No. 11	Shawbury	Oxford 108	240	12	
No. 12	Grantham	Oxford 108	240	12	
No. 14	Lyneham	Oxford 108	240	12	Moved from Cranfield, August 1941
No. 15	Kidlington	Harvard 108	200	12	
No. 16	Newton	Master			Formed on 9 June 1941 from the Polish F.T.S., Hucknall - Train- ing Polish Pilots.
College S.F.T.S.	Cranwell	Oxford 108	240	12	

APPENDIX 23

COURSE LENGTH POLICY UNDER A.M.T.'s TRAINING PROPOSALS, JANUARY 1942

LENGTH OF COURSES IN WEEKS										
Stage of Training	U.K.	R.A.F. Canada	South Africa	S.Rho- desia	E.A.T.S.			R.A.F. IN U.S.A.		
					Canada	Aust- ralia	New Zealand	Arnold	B.F.T.S.	Towers
I.T.W.	12	12	12	12	12	12	12	12	12	12
Air Test- ing in U.K.	-	3	3	-	-	-	-	3	3	-
E.F.T.S.	10	10	8	8	8	8	8	27	28	24
S.F.T.S.	16	16	16	16	16	16	16			
Total to end of S.F.T.S. Stage	38	41	39	36	36	36	36	42	43	36

STANDARD A.F.U. & O.T.U. COURSE LENGTHS IN WEEKS (SUMMER)				
	A.F.U.	O.T.U.	TOTAL	REMARKS
Heavy Bomber	8	12	20	These totals should be added to ex-SFTS totals shown above.
Medium & Light Bomber	4	8	12	
S.E. Fighter (Day)	4	6	10	
T.E. Fighter (Night)	8	9	17	
Torpedo Bomber	4	12	16	
Other Coastal Types	4	8	12	
Army Co-operation	4	8	12	

Notes:

- U.K. Training: Pupils ex-S.F.T.S. situated in U.K. would not be required to do an A.F.U. course.
- U.S.A. Training: Pupils from Arnold and B.F.T.S. As the total hours under these two schemes would be less than the new policy demanded, it was proposed to give an additional 60 hours flying at advanced schools in Canada. This would add approximately 7 weeks to the totals shown.
- Pupils from Towers: After training would convert to flying boats on a 6 weeks course, which would count as part of their O.T.U. training.

APPENDIX 24

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)

31 MARCH 1942

S.F.T.S.	LOCATION	AIRCRAFT	CAPACITY	COURSE LENGTH (Weeks)
College	Cranwell	Master 54 Oxford 54	240	16
No.16 (Polish)	Newton	Master 51 Oxford 33	160	16

The S.F.T.S.s in U.K. with the exception of the two schools
shown above, ceased S.F. Training as follows:-

S.F.T.S.	LOCATION	DATE	REMARKS
No. 1	Netheravon	7. 3.42	School disbanded. Station used for Glider and Parachute Training.
No. 2	Brize Norton	1.11.41	Commenced A.F.U. Courses. Renamed No. 2 (P) A.F.U. 14.3.42.
No. 3	South Cerney	1.11.41	Commenced A.F.U. Courses. Renamed No. 3 (P) A.F.U. 14.3.42.
No. 5	Ternhill	11. 4.42	Renamed No. 5 (P) A.F.U.
No. 6	Little Rissington	22. 4.42	Renamed No. 6 (P) A.F.U.
No. 8	Montrose	15. 4.42	School disbanded and became No. 2 F.I.S. - (No. 2 F.I.S. formed at Montrose 5.1.42).
No. 9	Hullavington	1.11.41	A.F.U. Course commenced. Renamed No. 9 (P) A.F.U. 14.3.42.
No.11	Shawbury	20.12.41	A.F.U. Course commenced. Renamed No. 11 (P) A.F.U. 14.3.42.
No.12	Grantham	14. 1.42	A.F.U. Course commenced. Renamed No. 12 (P) A.F.U. 1.4.42.
No.14	Lyneham	7. 1.42	Disbanded. Aircraft transferred to No. 14 (P) A.F.U. Ossington.
No.15	Kidlington	1. 2.42	Disbanded. No. 101 O.T.U. formed. Aircraft transferred to 15 A.F.U.

APPENDIX 25

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 June 1942

E.F.T.S.	Location	Aircraft	Capacity			Remarks
			Grading	Misc.	Total	
No. 1	Hatfield	Tiger Moth 36	36	36 (A.O.P.)	72	
No. 3	Shellingford	Tiger Moth 72	144	-	144	Two flights restarted E.F. training for glider pilots in August 1942 (i.e. 72 Grading and 72 E.F.T.)
No. 4	Brough	Tiger Moth 90	180	-	180	
No. 6	Sywell	Tiger Moth 108	216	-	216	
No. 7	Desford	Tiger Moth 108	216	-	216	Reduced by one flight in July 1942 (i.e. 18 aircraft and 36 pupils).
No. 8	Reading	Magister 54	108	-	108	Closed 22.7.42 and became No. 10 F.I.S.(E) Woodley.
No. 9	Ansty	Tiger Moth 108	216	-	216	
No.10	Stoke Orchard	Tiger Moth 72	120	-	-	To close and be converted into No.3 G.T.S. on 13.7.42.
No.11	Perth	Tiger Moth 108	216	-	216	
No.14	Elmdon	Tiger Moth 72	-	144 (F.A.A.)	144	
No.15	Carlisle	Tiger Moth 108	216	-	216	
No.16	Derby	Tiger Moth 72 Magister 36	-	216 (Glider Pilots)	216	
No.18	Fairoaks	Tiger Moth 72	144	-	144	
No.21	Booker	Tiger Moth 72 Magister 36	-	216 (G.P.s)	216	
No.22	Cambridge	Tiger Moth 126	252	-	252	
No.24	Sealand	Tiger Moth 72	-	144 (F.A.A.)	144	
No.25	Hucknall	Tiger Moth 60	-	100 (Poles)	100	
No.26	Theale	Tiger Moth 36	72	-	72	
No.28	Wolverhampton	Tiger Moth 108	-	216 (E.F.T.)	216	One flight started grading August 1942 (i.e. 36 Grading and 180 E.F.T.).
No.29	Clyffe Pypard	Tiger Moth 72 Magister 36	-	216 (G.P.s)		

APPENDIX 26

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 JANUARY 1943

S.F.T.S.	LOCATION	AIRCRAFT	CAPACITY							COURSE LENGTH (WEEKS)	REMARKS
			GRADING	F.A.A.	A.O.P.	GLIDER	E.F.T.	ALLIED	TOTAL		
No. 1	Holwell Hyde	Tiger Moth 36	-	-	72	-	-	-	72	12	Moved from Hatfield on 16.8.42
No. 2	Worcester	Tiger Moth 36	72	-	-	-	-	-	72	3	No. 6 F.I.S. reverted to No. 2 E.F.T.S. 22.7.42.
No. 3	Shellingford	Tiger Moth 72	72	-	-	72	-	-	144	3 (Grading) 12 (Gliders)	
No. 4	Brough	Tiger Moth 90	180	-	-	-	-	-	180	3	
No. 6	Sywell	Tiger Moth 108	216	-	-	-	-	-	216	3	
No. 7	Desford	Tiger Moth 90	180	-	-	-	-	-	180	3	
No. 9	Ansty	Tiger Moth 108	216	-	-	-	-	-	216	3	
No.11	Perth	Tiger Moth 108	216	-	-	-	-	-	216	3	
No.14	Elmdon	Tiger Moth 72	-	128	-	-	-	-	128	8	
No.15	Carlisle	Tiger Moth 108	216	-	-	-	-	-	216	3	
No.16	Derby	Tiger Moth 72 Magister 36	36	-	-	180	-	-	216	3 (Grading) 12 (Glider)	
No.18	Fairoaks	Tiger Moth 72	144	-	-	-	-	-	144	3	
No.21	Booker	Magister 36 Tiger Moth 72	36	-	-	180	-	-	216	12 (Glider) 3 (Grading)	
No.22	Cambridge	Tiger Moth 126	252	-	-	-	-	-	252	3	
No.24	Sealand	Tiger Moth 72	-	128	-	-	-	-	128	8	
No.25	Hucknall	Tiger Moth 60	-	-	-	-	-	100 Poles	100	8	
No.26	Theale	Tiger Moth 36	72	-	-	-	-	-	72	3	
No.28	Wolverhampton	Tiger Moth 108	36	-	-	-	180	-	216	3 (Grading) 8 E.F.T.	
No.29	Clyffe Pypard	Tiger Moth 72 Magister 36	36	-	-	180	-	-	216	3 (Grading) 12 (Glider)	

APPENDIX 27

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 JANUARY 1943

S.F.T.S.	Location	Capacity	Aircraft	Course Length (Weeks)
College	Cranwell	240	Oxford 70 } Master 96 } Anson 4 }	16
No.16 (Polish)	Newton	(a) S.F.T.S. 160	Master 74 } Oxford 36 } Anson 4 }	16
		(b) Instructors' Training 8	Master 2 } Oxford 2 } Magister 2 }	8
		<u>Total</u> 168		

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 JANUARY 1944

E.F.T.S.	Location	Aircraft	Capacity							Course Length (Weeks)	Remarks
			Grading	E.F.T.	Pre-A.F.U.	A.O.P.	Glider	Allied	Total		
No. 1	Panshanger	Tiger Moth 36	-	72	-	-	-	-	72	8	Included some Turkish Personnel
No. 2	Worcester	Tiger Moth 36	36	-	36	-	-	-	72	3	
No. 3	Shellingford	Tiger Moth 72	108	-	36	-	-	-	144	3	
No. 4	Brough	Tiger Moth 90	144	-	36	-	-	-	180	3	
No. 6	Sywell	Tiger Moth 108	180	-	36	-	-	-	216	3	
No. 7	Desford	Tiger Moth 90	144	-	36	-	-	-	180	3	
No. 9	Ansty	Tiger Moth 108	180	-	36	-	-	-	216	3	
No.11	Perth	Tiger Moth 108	180	-	36	-	-	-	216	3	
No.14	Elmdon	Tiger Moth 72	108	-	36	-	-	-	144	3	
No.15	Carlisle	Tiger Moth 108	180	-	36	-	-	-	216	3	
No.16	Derby	Tiger Moth 108	180	-	36	-	-	-	216	3	
No.18	Fairoaks	Tiger Moth 72	108	-	36	-	-	-	144	3	
No.21	Booker.	Tiger Moth 100 Magister 8	-	-	-	-	216	-	216	12	
No.22	Cambridge	Tiger Moth 108 Auster 6 Magister 12 Master 4	144	-	-	36	-	-	252 [¶]	10 (A.O.P.)	This commitment transferred from No. 1 E.F.T.S. on 27.10.43 [¶] Included 72 pupils carrying out F.I.S. training.
No.24	Sealand	Tiger Moth 72	108	-	36	-	-	-	144	3	
No.25	Hucknall	Tiger Moth 60	-	-	-	-	-	100 Poles	100	8	
No.26	Theale	Tiger Moth 36	36	-	36	-	-	-	72	3	
No.28	Wolverhampton	Tiger Moth 108	144	-	72	-	-	-	216	3	
No.29	Clyffe Pypard	Tiger Moth 108	180	-	36	-	-	-	216	3	
	Total Flights		60	2	16	1	6	4	91 [¶]		[¶] Included two F.I.S. Flights

APPENDIX 29

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM) 1 JANUARY 1944

S.F.T.S.	Location	Capacity	Aircraft	Course Length (Weeks)
College	Cranwell	(a) S.F.T.S. 120	Oxford 35) Master 48) Anson 4)	16
		(b) Refresher Flights 60	Oxford 28) Master 22) Magister 6)	4
		(c) Turkish Flights 60	Blenheim 15) Spitfire 18) Master 3)	6
		<u>Total</u> 240	<u>Total</u> 179	
No. 16 (Polish)	Newton	(a) S.F.T.S. 200	Master 102) Oxford 49) Anson 4)	16
		(b) Instructors' Training 8	Master 2) Oxford 2) Magister 2)	8
		<u>Total</u> 208	<u>Total</u> 161	

APPENDIX 30

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)

1 JANUARY 1945

E.F.T.S.	Location	Aircraft	Capacity	Course Length (Weeks)	Remarks
No. 1	Hatfield	Tiger Moth 36	72 Pre-A.F.U.	3	To convert to 60 Pre-Glider personnel w.e.f. 21.2.45.
No. 2	Worcester	Tiger Moth 36	80 Pre-A.F.U.	3	
No. 3	Shellingford	Tiger Moth 72	60 Pre-Glider 80 Pre-A.F.U.	4 3	To convert to E.F. Training w.e.f. 7.2.45. 128 pupils on a 12 weeks' course.
No. 4	Brough	Tiger Moth 90	160 Grading 40 Pre-A.F.U.	3 3	Commenced Grading on 12.1.45. Formerly 200 Pre-A.F.U.
No. 6	Sywell	Tiger Moth 108	120 Grading 90 E.F.T.	3 12)	Trained French personnel.
No. 7	Desford	Tiger Moth 90	150 E.F.T.	12	
No.11	Perth	Tiger Moth 108	220 Pre-A.F.U.	3	
No.14	Elmdon	Tiger Moth 72	160 Pre-A.F.U.	3	
No.15	Carlisle	Tiger Moth 108	240 Grading	3	To commence Grading on 12.1.45 - Formerly 240 Pre-A.F.U.
No.16	Derby	Tiger Moth 108	240 Grading	3	To commence Grading on 12.1.45 - Formerly 240 Pre-A.F.U.
No.18	Fairoaks	Tiger Moth 72	160 Pre-A.F.U.	3	
No.21	Booker	Tiger Moth 108 Magister 2	180 Pre-Glider	4	Included 120 Army personnel and 60 R.A.F. personnel.
No.22	Cambridge	Tiger Moth 108 Auster 18 Oxford 1	81 A.O.P. 160 Pre-A.F.U.	12 3	
No.24	Sealand	Tiger Moth 72	160 Pre-A.F.U.	3	
No.25	Hucknall	Tiger Moth 60 Anson 2	134 Polish E.F.T.	12	
No.26	Theale	Tiger Moth 40	72 Pre F.I.S.	3	
No.28	Wolverhampton	Tiger Moth 108	56 E.F.T. 170 Pre-A.F.U.	12 3	w.e.f. 12.1.45 the E.F.T. capacity was to expanded to 120 and Pre-A.F.U. capacity reduced to 60.
No.29	Clyffe Pypard	Tiger Moth 108	160 Naval Grading 60 Pre-A.F.U.	3 3	

APPENDIX 31

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM)
1 JANUARY 1945

S.F.T.S.	Location	Capacity	Aircraft
No. 7 (Formed 21.12.44)	Peterborough	160 French	Oxford 47 Harvard 29 Anson 4 Magister 1
No.16	Newton	200 Polish (plus 8 Instructors)	Harvard 73 Oxford 51 Anson 4 Magister 2 Tiger Moth 1
No.17	Cranwell	120 (plus 60 Refresher) (plus 60 Turks)	Harvard 45 Oxford 57 Anson 4 Magister 7 Blenheim 15 Spitfire 18

APPENDIX 32

ELEMENTARY FLYING TRAINING SCHOOLS (UNITED KINGDOM)

15 AUGUST 1945

E.F.T.S.	LOCATION	CAPACITY	AIRCRAFT	COURSE LENGTH (WEEKS)
No. 1	Panshangar	56 Pre-Glider	Tiger Moth 30	12
No. 2	Yatesbury	72 Grading ⁽¹⁾	Tiger Moth 30	4
No. 3	Shellingford	108 Grading	Tiger Moth 45	4
No. 4	Brough	108 Grading	Tiger Moth 45	4
No. 6	Sywell	120 E.F.T.	Tiger Moth 60	12
No. 7	Desford	144 Grading	Tiger Moth 60	4
No.11	Perth	144 Grading	Tiger Moth 60	4
No.14	Elmdon	108 Grading	Tiger Moth 45	4
No.15	Carlisle	108 Grading	Tiger Moth 45	4
No.16	Derby	108 Grading	Tiger Moth 45	4
No.18	Fairoaks	72 Grading	Tiger Moth 30	4
No.21	Booker	112 Pre-Glider ⁽²⁾	Tiger Moth 60 Magister 2 Proctor 2	12
No.22	Cambridge	30 A.O.P. ⁽³⁾ 74 Pre-Glider	Tiger Moth 52 Auster 10	12
No.24	Sealand	108 Grading	Tiger Moth 45	4
No.25	Hucknall	120 E.F.T. (Polish)	Tiger Moth 60 Anson 2	12
No.28	Wolverhampton	90 E.F.T.	Tiger Moth 45	12
No.29	Clyffe Pypard	144 Naval Grading	Tiger Moth 60	4

- (1) Changed to Pre-Glider training and capacity reduced to 56 w.e.f. 31 July 1945.
- (2) Capacity changed to 56 Pre-Glider and 36 Grading and aircraft reduced to 45 Tiger Moths w.e.f. 31 July 1945.
- (3) Capacity changed to 60 A.O.P. and 56 Pre-Glider w.e.f. 31 July 1945.

APPENDIX 33

SERVICE FLYING TRAINING SCHOOLS (UNITED KINGDOM) 15 AUGUST 1945

S.F.T.S.	LOCATION	AIRCRAFT	CAPACITY	COURSE LENGTH (WEEKS)
No. 7	Peterborough	Oxford 47 Harvard 29 Anson 4 Magister 1	160 (French)	22
No.16	Newton	Harvard 73 Oxford 51 Anson 4 Magister 2 Tiger Moth 1	200 (Polish)	22
No.17	Spitalgate (Moved from Cranwell on 1.5.45)	Oxford 55 Harvard 43 Anson 4 Blenheim 15 Spitfire 18 Magister 1	120 plus 60 Turks plus 60 Refresher	22
No.19 (Type I)	Cranwell	Harvard 90 Tiger Moth 43 Anson 3	84 Elementary 168 Advanced Total - 252	Elementary - 12 Advanced - 24 Total - 36
No.20 (Type II)	Church Lawford	Harvard 42 Anson 2	100	33
No.21 (Type II)	Snitterfield	Harvard 42 Anson 2	100	33

APPENDIX 34

MEMORANDUM ON NAVIGATION TRAINING WITH
SPECIAL REFERENCE TO THE TRAINING
OF SPECIALISTS (1)

In considering present or future policy for training in navigation, it is important to understand the background of the present situation:

- (i) Before the war, facilities for training were restricted and at different times since 1939, various ad hoc arrangements have had to be made. It follows that there are a number of pilots and navigators whose training shows an undesirable variety in the stages which it has reached. It will be necessary to bring them all up to a common standard.
 - (ii) Meanwhile, within the past 18 months, the general body of navigation training has been completely recast. This has achieved a considerable advance in the scope and quality of training at the basic stage and also at a second stage which was originally intended to provide S.N. Instructors competent to instruct those undergoing basic training. Now that these two stages have been established they provide a suitable standard by which all other training can be measured and adjusted.
 - (iii) While this has been happening, Specialist 'N' training has been left very much where it was.
 - (iv) These inter-acting factors have produced two important results. The advance in the two earlier stages of training means that many navigators, who have completed both these stages and had adequate practical experience, are competent to fill many posts now established for Specialist 'N'. Because of this, and the fact that the present Specialist training carries a navigator's knowledge only a little way beyond that of the new S.N. Instructor, the function of the true Specialist differs from what it was conceived to be in 1939.
2. The position must be clarified by
- (i) Stating the three recognised standards.
 - (ii) Bringing those referred to in paragraph 1 (i) up to an appropriate common standard.
 - (iii) Raising the training of the Specialist to a standard which will make him competent to fulfil the function for which he has become destined by these inevitable developments.
3. There will now be three recognised standards of training:
- (i) Basic Training Standard of Navigation: this for navigators and pilots will be the standard laid down in the relevant A.P.1388 current for the time being. Any further training, such as the odd courses now given at The Central Navigation School, Cranage, which will continue, other than that defined below, will render the individual merely 'basic training plus'.
 - (ii) S.N.I. This standard will aim to furnish instructors competent to handle any stage of the highest basic training in navigation - i.e. that of the air navigator - for the time being, and individuals to fill certain staff posts. This standard will be required of navigation instructors as defined in A.M.O. A.94/1942.
 - (iii) Specialist N. (See below).

4. The courses for S.N.I.s are intended to bring navigators to the standard defined. Because as explained above, some pupils will continue to show variation in the stages reached in their basic training, the course will have to be varied to fit the pupils. For those who have completed full basic training at the standard now required, four weeks will be sufficient but a maximum of 12 weeks will probably be necessary for pilots who had as much training in navigation as was considered sufficient for them in 1940. It is a proper reflection of progress that, as already indicated, the level of the S.N.I. Course is now not materially different from that of the old Specialist 'N' courses. Details of the new S.N.I. syllabus are being forwarded to all Dominions and it is hoped they will arrange similar courses.

5. The foregoing is an essential preamble to an explanation of the new policy for Specialist training. It is clear that apart from selecting suitable men for basic and S.N.I. training, policy must now have two main aims:-

- (i) Vigorously to advance our knowledge of navigation.
- (ii) To devise means of simplifying the application of present or future knowledge so that perfect application is within the competence of all navigators whose basic training is adequate.

6. Experience has shown that these aims are most likely to be achieved by those navigators who, in addition to being men of practical experience, have technical aptitude and training of a high order.

7. It is proposed therefore to establish new Specialist courses and eventually (probably in 6 or 8 months' time) to close down, in so far as they affect R.A.F. personnel, the present Specialist courses now running in Canada and South Africa. The new courses will commence at the Central Navigation School, Cranage, early in September. There will only be one course at a time of 12 pupils and it will run for 6 to 8 months. The pupils, in addition to adequate basic training and practical experience, must be men who can reach at least the minimum acceptable standard in mathematics and, if possible, in appropriate sciences such as physics. An Air Ministry Order to be published immediately sets out in detail the conditions governing admissions to the course. Briefly they are as follows:-

- (i) It is anticipated that some candidates will be Honours graduated in mathematics or physics.
- (ii) The Higher School Certificate or an equivalent qualification will be kept in mind as the minimum acceptable standard for these subjects.
- (iii) In order not to rule out the able navigator who may not possess these paper qualifications, he will be offered an opportunity of taking a qualifying examination. This will require physics and allied sciences at the standard of the Higher School Certificate plus mathematics at a standard somewhat above that of the School Certificate, or, mathematics only at the standard of the Higher School Certificate. The candidate who does the mathematics only at the higher stage will be able to support his application by attempting some questions in science. The purpose of this examination is not to test detailed knowledge at these standards but to find out whether a candidate can profit from technical training of a high order. He will be allowed therefore to take to the examination, which will be written at his own station, any text books or notes for reference which he may require, or apparatus such as a slide rule.

/ (iv)

- (iv) The candidate must be recommended by his Commanding Officer who will issue a certificate that the candidate satisfies the conditions respecting practical experience. These are that the candidate
 - (a) Must have completed, or be about to complete, an operational tour or
 - (b) Have held a navigation post for not less than 6 months and have had at least 200 hours flying as pilot or navigator or
 - (c) Have experience which may fairly be deemed comparable with (a) or (b).
- (v) Those who now hold the Specialist Symbol 'N' are encouraged to apply for admission to these courses but will be subject to the conditions which apply to other candidates.
- (vi) Places will be offered to the Dominion Air Forces but officers of those Air Forces who are serving with R.A.F. units may make application through the usual R.A.F. channels.

8. The Higher School Certificate has been used as a reference for the standard required because that standard is considered to be the minimum which will enable a candidate to derive full benefit from the Specialist course. Moreover, it represents a standard well-known and understood in the United Kingdom on which, for example, Education Officers can easily advise. It is normally taken at school after 2 years specialist study between the ages of 16 and 18 and carries a candidate well towards his first public examination for an honours degree - an examination taken at the end of his first year at the university. The School Certificate examination, to which reference has been made in paragraph 7 (iii) is normally taken at 16.

9. The object of the course is to produce graduates who will be competent to develop air navigation and to act as consultants on all matters pertaining to the science in which they are experts. The course will be planned therefore:-

- (i) To give a wide learning in existing navigational knowledge and allied subjects,
- (ii) To stimulate and guide pupils towards research and development,
- (iii) To fit graduates to fulfil the staff and instructional aspects of their duties.

10. Since one of the main functions of these Specialists is to contribute to the development of navigation and to devise means of simplifying its practice, an important part of their training must consist of exercises and opportunities which will be a preliminary and stimulus to this aspect of their work. Hence exercises will be set, say at the beginning of each week, postulating some circumstances and requiring a thesis on the navigational instancy of these circumstances.

11. Because the training of pupils must envisage not only their technical excellence as consultants but their capacity to fulfil this function in staff and Instructor posts, an integral element of their technical training must be insistence that all papers are meticulously and logically reasoned and that pupils adhere rigidly to the standard practice for staff duties in the Royal Air Force, in, for example, such details as those laid down in A.P.837. In addition, they must have knowledge of the administration and organisation of training, and operational, navigation in the Royal Air Force.

12. The small number of Specialists produced by this more advanced training will be employed in close association with flying in posts (irrespective of whether they are established 'N'), where, for the time being, their knowledge will most effectively contribute to the aims stated in paragraph 5.

13. In addition to this provision for producing a Specialist 'N' of high quality, we must bring the knowledge of present Specialists up to date and so far as is possible in the time available, bridge the gap between it and the standard of the new specialists. 3-week courses of 12 pupils will be run at Cranage for this purpose - one course at a time. As many present Specialists as possible will eventually take these courses if they are not elected to the longer course. The main purpose will be to enable present Specialists to know what development has made possible and where more detailed information is available.

14. Reference has been made to the Central Navigation School. This is the new name for the School of Air Navigation, Cranage. It is hoped that the Central Navigation School will be, in a sense, the 'university' of navigation; that in addition to being a school for training of high quality, it will be a dynamic factor in the world of navigation, at the one time, stimulating research and recording and studying its results.

Directorate of Flying Training,
Air Ministry,
27th July, 1942.

APPENDIX 35

ASSESSMENT OF OUTPUTS OF NAVIGATORS AND AIR BOMBERS

(1)

AUGUST 1942

Date 1942	A.O.S.									
	United Kingdom		Canada J.A.T.P.		Canada R.A.F.		South Africa		Grand Totals	
	No. of Schools	Total Capacity	No. of Schools	Total Capacity	No. of Schools	Total Capacity	No. of Schools	Total Capacity	Schools	Capacity
July	2	600	10	2,106	2	480	6	1,300	20	4,486
August	2	600	10	2,106	2	633	6	1,300	20	4,639
September	2	600	10	2,727	2	633	7	1,540	21	5,500
October	2	600	10	4,339	2	753	7	1,540	21	7,232
November	2	600	10	5,639	2	753	7	1,540	21	8,532
December	2	600	10	6,122	2	753	7	1,540	21	9,015

Notes:

- In United Kingdom: Capacity divided as between one school of 360 training navigators (BW) and one school of 240 training navigators (radio) and miscellaneous personnel.
- In Canada J.A.T.P.: ten single schools expanding by stages to the equivalent of 19 schools and at the same time introducing preliminary ground (E.A.N.S.) course. Each school will train navigators and air-bombers.
- In Canada R.A.F.: one single and one double school both training navigators(w) and air bombers. Increased capacity due to introduction of air bomber training and subsequently of four weeks ground (E.A.N.S.) course.
- In South Africa: two schools training navigators (B), 4 schools training navigators and air bombers and 7th school training navigators and W.O.s/A.G. (S.A.A.F. school included).

(1) Extract from Summary used as a basis for assessing aircrew outputs. T.P.42/3 Table XIII. (A.H.B./IIIC1/11).

APPENDIX 36

ESTIMATED DRAFTS FROM THE AIRCREW DESPATCH CENTRE

(1)

November 1942 to March 1943

Aircrew Category	Month	Canada	S. Africa	U.K.	Total	Monthly average after March
Navigators	Nov.	Nil	100	300	400	550
	Dec.	94	200	300	594	
	Jan.	94	100	300	494	
	Feb.	250	200	150	600	
	Mar.	406	100	Nil	506	
Navigators (B)	Nov.	Nil	160	Nil	160	230
	Dec.	108	80	Nil	188	
	Jan.	108	160	Nil	268	
	Feb.	108	80	Nil	188	
	Mar.	108	160	Nil	268	
Navigators (W)	Nov/ Mar.	156	Nil	Nil	156	Constant
Navigators (BW)	Nov.	Nil	Nil	40	40	60
	Dec.	Nil	Nil	80	80	
	Jan.	Nil	Nil	40	40	
	Feb.	Nil	Nil	80	80	
	Mar.	Nil	Nil	40	40	
Navigator (R)	Nov./ Feb.	Nil	Nil	40	40	60
	Mar.	Nil	Nil	60	60	
Air Bombers	Nov.	Nil	60	300	360	480
	Dec.	38	120	300	458	
	Jan.	38	60	300	398	
	Feb.	210	120	300	630	
	Mar.	382	60	Nil	442	

Note: Table excludes those already assembled on 1 November 1942.

(1) T.P. Table II dated 5 November 1942 in A.M. File S.83798.

APPENDIX 37

Allocation of unit capacity November 1942 - May 1943

(Adapted from Aircrew Production Programme No. 5 -
Reference FTC/S.80279/42/TO A.M. File S.86084/Enc. 1A)

NOTE: Figures are given for each month, but intakes and outputs were arranged every two weeks in all schools. There were three intakes in May 1943 on 3rd, 17th and 31st.

No. 1(O) A.F.U. WIGTOWN (capacity 300)

Month	Basic Navs.		Ex U.S.A. Nav.	W.O./A.G.	A.B.	Total Basic	Avail for A.F.U.	Total
	Existing	Future						
Nov.	160	-	40	160	160	520	80	600
Dec.	120	-	-	140	160	420	180	600
Jan.	120	120	-	120	160	520	80	600
Feb.	40	220	-	120	200	580	20	600
Mar.	40	240	-	120	200	600	-	600
Apr.	-	200	-	120	200	520	80	600
May	-	60	-	180	180	420	480	900

No. 2(O) A.F.U. MILLOM (Capacity 300)

Month	Basic Navs.		W.O./A.G.	A.B.	Total Basic	Avail A.F.U.	Exist- ing A.F.U.	Total
	Existing	Future						
Nov.	140	-	160	160	460	60	80	600
Dec.	120	-	160	200	480	120	-	600
Jan.	120	100	160	200	580	20	-	600
Feb.	80	160	160	200	600	-	-	600
Mar.	40	240	160	180	620	-	-	620
Apr.	-	200	160	160	520	80	-	600
May	-	140	240	160	540	360	-	900

No. 3 (O) A.F.U. BOBBINGTON (capacity 280)

Month	Basic Navs.		Ex U.S.A. Nav.	W.O./ A.G.	A.B.	Total Basic	Avail A.F.U.	Total [*]
	Existing	Future						
Nov.	-	-	280	80	-	360	40	400
Dec.	40	-	280	80		400	40	440
Jan.	80		280	80		440	-	440
Feb.	80	20	280	80	40	500	-	500
Mar.	80	280	-	80	80	520	-	520
Apr.	-	400	-	80	80	560	-	560
May	-	580	-	120	80	780	60	840

* The population kept as low as possible in view of accommodation difficulties.

No. 4 A.O.S. WEST FREUGH (capacity 280)

Month	Basic Navs.		Nav. B. & W.	W.O./ A.G.	A.B.	Total Basic	Avail A.F.U.	Total
	Existing	Future						
Nov.	120	-	280	40	80	520	40	560
Dec.	120	-	120	40	160	440	120	560
Jan.	120	-	40	40	160	360	200	560
Feb.	60	220	-	40	160	480	80	560
Mar.	-	340	-	40	160	540	20	560
Apr.	-	360	-	40	160	560	-	560
May	-	320	-	60	240	620	220	840

No. 5 A.O.S. JURBY (capacity 360)

Month	Nav.	Nav. B.W.	A.B.	W.O./ A.G.	Allied Trg.	Total Basic
Nov.	80	120	80	40	160	480
Dec.	-	280	120	40	120	560
Jan.	-	400	120	40	100	660
Feb.	-	480	120	40	80	720
Mar.	-	560	-	20	80	660
Apr.	-	640	-	-	80	720
May	-	960	-	-	120	1,080

No. 6 A.O.S. STAVERTON (capacity 300)

Month	Basic Nav.		Nav. (B.W.)	Nav. Radio	A.B.	W.O./ A.G.	Total Basic	Avail A.F.U.	Total
	Existing	Future							
Nov.	120	-	200	120	40	80	560	40	600
Dec.	160	-	120	140	80	80	580	20	600
Jan.	160	40	-	160	80	80	520	80	600
Feb.	120	140	-	160	80	80	580	20	600
Mar.	-	220	-	160	80	80	540	60	600
Apr.	-	240	-	160	80	80	560	40	600
May	-	180	-	240	120	120	660	240	900

No. 9 (O) A.F.U. PENRHOS (capacity 320)

Month	Basic Navs.		W.O./ A.G.	A.B.	Total Basic	Avail A.F.U.	Total
	Existing	Future					
Nov.	140	-	160	160	460	180	640
Dec.	140	-	160	160	460	180	640
Jan.	120	100	160	160	540	100	640
Feb.	120	160	160	200	640	-	640
Mar.	-	260	160	200	620	20	640
Apr.	-	240	160	200	600	40	640
May	-	200	240	180	620	340	960

No. 10 (O) A.F.U. DUMFRIES (capacity 300)

Month	Basic Navs.		W.O./ A.G.	A.B.	Total Basic	Avail A.F.U.	Total
	Existing	Future					
Nov.	120	-	160	160	440	160	600
Dec.	100	-	120	160	380	220	600
Jan.	80	100	120	160	460	140	600
Feb.	80	180	120	160	540	60	600
Mar.	-	280	120	200	600	-	600
Apr.	-	240	120	200	560	40	600
May	-	180	180	220	580	320	900

(1)

EMPLOYMENT OF NAVIGATOR CATEGORIES, 1943

Aircrew Category	G.R. Trained or Non-G.R.	Class of Squadron	Type of Aircraft
Navigator		Heavy Bomber, Transport, Special duties	Halifax, Lancaster, Stirling, Dakota, York, Halifax.
Navigator (B)	non	Heavy Bomber.	Liberator.
	non	Medium Bomber.	Buckingham.
	non	Light Bomber	Baltimore, Blenheim, Boston, Mitchell, Mosquito, Ventura.
	G.R.	Flying Boat.	Catalina, Sunderland.
	G.R.	Long Range and Medium Range General Recce.	Halifax, Liberator (L.R.) Fortress, Warwick, Wellington (M.R.).
	G.R.	Short range General Recce.	Baltimore, Blenheim, Hudson, Ventura.
	G.R.	Torpedo Bomber.	Beaufort, Hampden.
	non	Fighter Recce. Flights.	Ventura.
	non	Bomber Recce. Squadrons.	Bisley, Ventura.
	non	Airborne Forces.	Albemarle, Halifax, Whitley.
	non	Special duties squadrons.	Hudson, Halifax, Wellington.
	G.R.	Air/Sea Rescue.	Warwick I.
Navigator (W)	non	Light Bomber.	One in three Vengeance crews in India.
	non	Intruder Squadrons.	Mosquito.
	G.R.	Torpedo Fighter and Coastal Fighter.	Beaufighter.
	non	Long Range Fighter and Fighter Bomber.	Mosquito.
	G.R.	Photo Recce.	Mosquito.
	G.R.	Air/Sea Rescue.	Mosquito.
Navigator (BW)			Met. Flights and overseas in Mosquito Light Bomber.
Navigator (Radio)		A - I Night Fighters.	Beaufighter, Mosquito.

(1) Tabulated from Summary of Training Requirements to match expansion programme C.W.E./E/47. (T.P.43/2, Appendix 1).

SCHOOLS FOR TRAINING NAVIGATORS AND AIR BOMBERS

Key Figures show 1 the location: 2 the title and date: 3 pupil population and date: 4 the courses, their duration and the numbers of pupils.

The following authorities are represented by capital letters - A. FTC/S.80279/42/T.O. dated 17 September 1942: B. - ibid - dated 12 July 1943:
C. FTC/S.60977/Org.I (68) dated 8 January 1944: D. FTC/80587/Org.I dated 11 June 1945.

<p>1. <u>WIGTOWN</u></p> <p>2. No. 1 A.O.S. (19.8.41) (O) A.F.U. (1.2.42)</p> <p>3. 120 240 300 (Sep. 42)</p> <p>4. <u>A</u> Basic Nav. 14 wks. 80 Adv. Nav. 6 wks. 60 100 W.O./A.G. 6 wks. 80 100 Air Bombers 6 wks. 80 100</p> <p><u>D</u> Nav. 'B' 5 wks. 120 Pool 40 Allied Nav. 'B' 5 wks. 25 Met. Air Obs. 3 wks. 12</p>	<p>1. <u>MILLOM</u></p> <p>2. No. 2 A.O.S. June 41 (O) A.F.U. 22.12.41</p> <p>3. 300 (Sep.42) 320 (July 43) 300 (Jan.44)</p> <p>4. <u>A</u> Basic Nav. 14 wks. 80 Adv. Nav. 6 wks. 60 Adv. W.O./A.G. 6 wks. 80 100 A-B 6 wks. 80 80 Nav. 'B' 14 wks. - 60</p> <p><u>C</u> Adv. Nav. 4 wks. 100 Adv. A-B 4 wks. 100 Adv. W.O. (Air) 4 wks. 100</p> <p>Closed 9 Jan. 45. (FTC/55575/27/P(TN) 28.12.44)</p>	<p>1. <u>BOBBINGTON</u> <u>HALEPENNY GREEN</u> (Jan. 44)</p> <p>2. No. 3 A.O.S. (1.11.41) (O) A.F.U. (11.4.42)</p> <p>3. 280 (Sep.42) 300 (July 43) 250 (June 45)</p> <p>4. <u>A</u> Nav. ex-U.S.A. 8 wks. 140 Adv. Nav. 'B' 6 wks. 60 W.O./A.G. 6 wks. 60 100 A-B 6 wks. 20 80 Adv. Nav. 6 wks. - 120</p> <p><u>C</u> Adv. Nav. 6 wks. 60 Nav. 'B' 6 wks. 40 A-B 6 wks. 60 W.O. (Air) 6 wks. 100 Flt. Eng. 6 wks. 40</p> <p><u>D</u> Basic Nav. 32 wks. 90 Allied 5 wks. 15 W.O. (Air) 5 wks. 110 Allied 5 wks. 15 Pilot Nav. 6 wks. 20 Instr.</p>	<p>1. <u>WEST FREUGH</u></p> <p>2. No. 4 A.O.S. (14.6.41) (O) A.F.U. (June 42)</p> <p>3. 280 (Sep.42) 300 (July 43)</p> <p>4. <u>A</u> Basic Nav. 14 wks. 80 Adv. Nav. 6 wks. 40 100 A-B 6 wks. 80 100 W.O./A.G. 6 wks. 80 100</p> <p>Closed 1 June 45 (FTC/S.90528/Org.I(41) 26.5.45)</p>	<p>1. <u>JURBY</u></p> <p>2. No. 5 A.O.S. (19.7.41) A.N. & B.S. (Jan. 44) A.N.S. (18 July 45)</p> <p>3. 380 (Sep.42) 300 (Jan.44) 240 (June 45)</p> <p>4. <u>A</u> Basic Nav. B.W. 22 wks. 300 Nav. (Polish) 14 wks. 20 A-B (Pole) 14 wks. 20 A-B (Special) 20 wks. 20 A-B 14 wks. 20</p> <p><u>B</u> Basic Nav. 17 wks. 160 Basic Nav. 'B' 20 wks. 100 Basic Nav. 'W' 17 wks. 100</p> <p><u>C</u> Basic Nav. 14 wks. 80 Basic Nav. 'B' 20 wks. 40 Basic A-B 14 wks. 40 Elem. Nav or Nav. 'B' 8 wks. 75 Compass Adj. basic 16 wks. 43 Compass Adj. refresh. 2 wks. 20</p> <p><u>D</u> Nav. B conversion 14 wks. 100 Allied Nav. 28 wks. 90 Air Bomber 14 wks. 40</p> <p>* Eventually capacity would be Basic Navs. 'B' 34 wks. 240.</p>
<p>1. <u>STAVERTON</u></p> <p>2. No. 6 A.O.S. (20.2.42) (O) A.F.U. (July 43)</p> <p>3. 300 (Sep. 42)</p> <p>4. <u>A</u> Basic Nav. 14 wks. 80 Adv. Nav. 'B' 6 wks. 140 Adv. A-B 6 wks. 40 Adv. W.O. (Air) 6 wks. 40</p> <p><u>B</u> A.F.U. Nav. 6 wks. 100 A.F.U. A-B 6 wks. 100 A.F.U. W.O. 6 wks. 100 Special for T.A.F. (June 44) Adv. Nav. 4 wks. 128 Adv. A-B 4 wks. 128</p> <p>Closed 12 Dec. 44 (FTC/S.60400/16/Org.I(40) 24.11.44)</p>	<p>1. <u>BISHOPS COURT</u></p> <p>2. No. 7 A.O.S. (17 May 43) (O) A.F.U. (15 Feb. 44) A.N.S. (June 45)</p> <p>3. 300 (July 43) 200 (June 45) Basic Nav. 300 A.F.U. W.O. (Air) 60</p> <p><u>C</u> Adv. Nav. 6 wks. 100 Adv. A-B 6 wks. 100 Adv. W.O. 6 wks. 100</p> <p><u>D</u> Nav. 'B' Conversion 14 wks. 200</p> <p>* Eventually Basic Nav. 'B' 34 wks. 280</p>	<p>1. <u>PENRHOS</u></p> <p>2. No. 9 A.O.S. (14 June 41) (O) A.F.U. (28 Feb. 42)</p> <p>3. 320 (Sep.42) 300 (Jan.44)</p> <p>4. <u>A</u> Basic Nav. 14 wks. 60 A-B special 20 wks. 20 Adv. Nav. 6 wks. 80 120 Adv. A-B 6 wks. 80 100 Adv. W.O. (Air) 6 wks. 80 100</p> <p><u>C</u> Adv. Nav. 6 wks. 100 Adv. A-B 6 wks. 100 Adv. W.O. (Air) 6 wks. each</p> <p>Closed 14 June 45 FTC/S.80587/Org.I(32) 17.5.45</p>	<p>1. <u>DUMFRIES</u></p> <p>2. No. 10 A.O.S. (13 Sep. 41) (O) A.F.U. (25 April 42) A.N.S. (10 June 45)</p> <p>3. 300 (Sep. 42) 240 (June 45)</p> <p>4. <u>A</u> Basic Nav. 14 wks. 60 Adv. Nav. 6 wks. 80 100 Adv. A-B 6 wks. 80 40 Adv. W.O. (Air) 6 wks. 80 120 Adv. Nav. 'B' 40</p> <p><u>C</u> Adv. Nav. 6 wks. 100 Adv. A-B 6 wks. 100 Adv. W.O. (Air) 6 wks. each</p> <p><u>D</u> Basic Nav. 'W' 32 wks. 240</p>	<p>1. <u>MONA</u></p> <p>2. No. 8 (O) A.F.U. (4.11.43)</p> <p>3. 180 (Nov. 43) 200 (Jan. 44)</p> <p>4. <u>A</u> Adv. Nav. 6 wks. 60 80 Adv. A-B 6 wks. 60 60 Adv. W.O. (Air) 6 wks. 60 60</p> <p>Closed 14 June 45 (FTC/S.80587/Org.I (32) 17.5.45)</p>

APPENDIX 40

WORLD FLIGHT BY THE EMPIRE AIR NAVIGATION SCHOOL
TO AUSTRALIA AND NEW ZEALAND
21 OCTOBER 1944 TO 14 DECEMBER 1944 (1)

1. Before departure the tour was scheduled to take approximately 49 days, and was completed in 53 days in spite of a temporary delay of 48 hours in New Zealand awaiting the arrival of a new main landing tyre from Australia.
2. The total flying time was 202 hours and the distance covered was some 36,000 nautical miles or an average cruising speed of approximately 179 knots. The aircraft was flown on 40 days out of the total, or more than 1,000 statute miles per day, for an average fuel consumption from start to stop of approximately 1.12 nautical miles per gallon.
3. Weather approximating the four seasons was experienced in less than 8 weeks and flight temperatures varied from below zero to more than 120° F in the shade, and cabin temperatures on the ground exceeded 150° F.
4. The longest stage was 2,710 nautical miles, and 13 stages exceeded 1,000 nautical miles of which 6 stages were more than 2,200 nautical miles. The longest time in the air was 15 hours 08 mins., and on one stage of more than 2,200 nautical miles, 800 miles were flown without an airspeed indication due to icing. Amongst some of the fast times and non-standard routes are included:-
 - (i) United Kingdom to New Zealand in 67 hours flying time,
 - (ii) San Francisco to Auckland in less than 60 hours elapsed time,
 - (iii) The first non-stop Fiji to Melbourne flight,
 - (iv) One of the fastest Australia - Ceylon Flights (15 hours),
 - (v) The first Ceylon - Masira flight,
 - (vi) The first Masira - Cairo, via Aden, non-stop flight,
 - (vii) Australia to U.K. in $71\frac{3}{4}$ hours elapsed time or more than 50 hours less than the previous official record.
 - (viii) The first British Service aircraft to fly around the world by the longest route.
5. Whilst not all of these can be claimed as records they are indicative of what can be achieved with standard equipment and without elaborate prior planning. Only one flight crew was carried.

(1) Appendix 'J' to E.A.N.S. Report No. 45/1.

APPENDIX 4.1

(1) FORECAST OF ALLOCATION OF AIR ARMAMENT STATIONS

UNIT	FUTURE USE (2)
No. 1 A.O.S. North Coates	1½ A.O.S.s to meet needs of all regular personnel, i.e. 160 Service and 560 direct entry per year (as present establishment).
No. 2 A.O.S. Acklington	1½ A.G.S.s after 24 March 1940.
No. 3 A.O.S. Aldergrove	1½ A.G.S.s after 4 April 1940.
No. 4 A.O.S. West Freugh	1 A.G.S. 21 A.T.S.s for S.F.T.S.) after 4 April 1940.
No. 5 A.T.S. Penrhos	1 C.G.S. as soon as aircraft, staff and personnel can be provided. Alternatively at Porthcawl early if Penrhos not large enough for bomber aircraft.
No. 6 A.T.S. Warmwell	1½ A.G.S.s.
No. 8 A.T.S. Evanton	Remain A.T.S. for Scottish F.T.S. until March 1940, then hand over to Navy.
No. 9 A.T.S. Porthcawl	1 A.T.S. for S.F.T.S. and 1 A.G.S. (subject to building site not being occupied by armourer courses).
No. 1 A.T.S. Catfoss	1½ A.G.S.s.
No. 3 A.T.S. Sutton Bridge	Remain A.T.S. for advanced training squadrons of S.F.T.S.
No. 1 (Temp-y) A.T.S. Leuchars	For operational units until March 1940, then A.T.S. for S.F.T.S. in Scotland.
No. 5 A.O.S. Jurby	1 A.O.S. (militia) 1 A.G.S. (militia) as soon as extra buildings, etc., are available.
No. 1 A.G.S. Pembrey	1 A.G.S. (militia) move to Jurby when that station is prepared and then revert to 1½ A.G.S.s.

(1) Agreed upon by sub-committee appointed at a conference held at the Air Ministry on 24 August 1939.

(2) This was to provide for the training of 5,000 air gunners in 12 months plus 700 air gunners already in Bomber and Coastal Commands.

Note: The opening of hostilities produced drastic modifications and no single item was effected as planned. Five stations immediately changed to operational duties, namely North Coates, Acklington, Catfoss, Sutton Bridge and Leuchars. At three stations (Pembrey, Porthcawl and Jurby) construction was delayed for several months partly because of prior needs for operational stations. Towards the end of 1941 parts of the plan were used to build an organisation on a large scale for training air gunners and wireless operators/air gunner.

APPENDIX 42BOMBING and GUNNERY SCHOOLS

No.	Location	Formed	Capacity	Remarks
2	Millom	November 1940	210	Reorganised as No.2 A.O.S. in August 1941: No.1(0) A.F.U., February 1942.
3	Aldergrove	1 December 1939	100	Formerly No.3 A.O.S. Trained Naval air observers and air gunners in addition to R.A.F. Disbanded 30 June 1940. (1)
4	West Freugh	November 1939	160	Reorganised as No.4 A.O.S. January 1941.
5	Jurby	July 1940	170	Reorganised as No.5 A.O.S. July 1941.
7	Porthcawl	July 1940	130	Renamed Stormy Down and reorganised as No.7 A.G.S. in June 1941.
8	Evanton	September 1939	140	Formerly Armament Training Camp, Novar. Reorganised as No.8 A.G.S. in June 1941.
9	Penrhos	September 1939	170	Formerly Armament Training Camp. Reorganised as No.9 A.O.S. in June 1941. Its satellite at Llandwrog extended to No.9 A.G.S. in July 1841.
10	Warmwell Dumfries	September 1939 July 1940	100	Reorganised as No.10 A.O.S. in September 1941.

(1) The pupils were dispersed from Aldergrove as follows:-

- (a) All R.N. personnel and aircraft to No. 8 B. & G.S.
- (b) Twenty air gunners (R.A.F.) to No.5 B. & G.S.
- (c) No. 6 Course of air observers to O.T.U.
- (d) No. 7 Course divided between Nos. 7 and 10 B. & G.S.

The station was handed over by Training Command a few months later to Headquarters R.A.F. Northern Ireland.
(Unit O.R.B.)

APPENDIX 43

DAILY RATES OF PAY AND ALLOWANCES TO NON-COMMISSIONED
AIRCREW, NOVEMBER 1939

	Rank	Pay	Flying Allowance	Total
Pilot	Sergeant	s d 12 6		s d 12 6
	Sergeant over 4 years	13 6		13 6
	Flight Sergeant	15 0		15 0
	Flight Sergeant over 4 years	15 6		15 6
	Warrant Officer	16 6		16 6
Air Observer	Acting Sergeant	9 0		9 0
	Sergeant	12 6		12 6
	Sergeant over 4 years	13 6		13 6
	Flight Sergeant	15 0		15 0
	Flight Sergeant over 4 years	15 6		15 6
	Warrant Officer	16 6		16 6
Aircrew-Wireless Operator or Flight Mechanic/ Flight Rigger	A.C.2	3 6	Crew Pay 1/- and Air Gunner Pay 6d.	5 0
	A.C.1	4 3		5 9
	L.A.C.	5 0		6 6
	L.A.C. over 3 years	5 6		7 0
Air Gunner (Group V)	A.C.2	2 0	Crew Pay 1/- and Air Gunner Pay 6d.	3 6
	A.C.2 over 1 year	2 9		4 3
	A.C.2 over 2 years	3 0		4 6
	A.C.1	3 6		5 0
	L.A.C.	4 0		5 6
Crew-Fitter * (Group I)	Sergeant	9 6	Crew Pay 1/-	10 6
	Sergeant over 4 years	10 0		11 0
Crew-Wireless and Electrical Mechanic * (Group I)	A.C.2	3 9	Crew Pay 1/-	4 9
	A.C.1	4 6		5 6
	L.A.C.	5 6		6 6
	L.A.C. over 3 years	6 0		7 0

* Employed on flying boats only.

Reference: A.M. File S.60457, Encl. 3A and Minute 3.

APPENDIX 44

WAR TRAINING SCHEME FOR FLYING PERSONNEL

Summary of position at 28 March 1940

Schools	Ultimate requirements	Dominion Training Scheme	Existing - to remain	Existing - to be replaced	Planned, or under construction	Outstanding
Army Co-operation	3	-	2	-	-	1
Air Navigation	6	3	-	1	1	2
Air Observer Navigation	40	14	7	8	7	12
Bombing and Gunnery	27	14	6	1	3	4
Flying Instructors	3	1	1	-	1	-
Flying Training (Elementary)	60	25	15	4	10	10
Flying Training (Service)	60	25	7	8	18	10
General Reconnaissance	2	-	-	1	2	-
Torpedo Training	2	-	1	-	1	-

(Copies from note by A.M.S.O. for E.P.M. 37(40), 30 March 1940).

APPENDIX 45

POSTINGS TO GUNNERY SCHOOLS

School	Trade	Capacity	Intake fortnightly	Course Length (Weeks)
No.1 A.G.S. Pembrey (After Oct.1942 ground gunnery)	W.O./A.G.	240	60 W.O. 50 F.E.	5
No.8 A.G.S. Evanton	W.O./A.G.	240	75(Summer) 60(Winter)	4
No.3 A.G.S. Castle Kennedy	W.O./A.G.	180	60	5
No.10 A.G.S.Barrow	W.O./A.G.	240	60	4
No.2 A.G.S. Daloross	A.G.	240	50	6
No.4 A.G.S. Morpeth	A.G.	240	60	6
No.9(0) A.F.U. Llandwrog	A.G.	60	30	6
No.7 A.G.S. Stormy Down	A.G.	260	50 or 60	6
No.1 A.A.S. Manby	A.G.	100	50	6
No.7 A.G.S. Stormy Down	A.G. ex E.A.T.S. (Refresher)	260	60 per week	3 (Summer) 4 (Winter)
No.10 A.G.S.Barrow (Until end Oct.1942)	F.E./A.G.	240	45 per week	4

Note: Collated from D.T.F. programmes 91-97 inclusive, covering the period July 1942 to March 1943.
(A.M. File A.891042/46).

APPENDIX 46
AIR GUNNERY SCHOOLS

Mid-1943

No.	Location	Formed	Capacity	Ceased	Remarks and References
1	Pembrey	June 1941	240 360(July 1943)	21 June 1945	X
2	Dalcross	July 1941	240 360(March 1944) 240(May 1945)	24 Nov. 1945	X Y Z
3	Castle Kennedy Mona Castle Kennedy	July 1942 Dec. 1942 Nov. 1943	240 240 360(March 1944)	21 June 1945	X
4	Morpeth	April 1942	180 240(July 1943)	19 Dec. 1944	W
7	Stormy Down	June 1941	240 360(July 1943)	2 Sept. 1944	W Former No. 7B. & G.S.
8	Evanton	June 1941	240	26 Aug. 1944	W Former No. 8B. & G.S.
9	Llandwrog	July 1941	90 120(Nov. 1941)	25 Nov. 1944	W Former satellite of Penrhos
10	Castle Kennedy Barrow	July 1941 Dec. 1941	90 180(Dec. 1941) 240(July 1943)	30 June 1946	X
11	Andreas Jurby	May 1943 Oct. 1946	240 99(Oct. 1946)		Continued under post-war plan
12	Bishops Court	July 1943	240 160(Nov. 1944)	31 May 1945	X

References:- W = Org. Memo in A.M. File A. 891042/46.
X = Org. Memo in A.M. File S. 101247/47/II.
Y = S.D. 155.
Z = S.O.M. No. 1180/45 dated 29 May 1945.

APPENDIX 47

OUTPUT OF FLIGHT ENGINEERS FROM
No. 4 SCHOOL OF TECHNICAL TRAINING.
5 MAY TO 1 DECEMBER 1943 (1)
(A.M. File S.70262/II)

Date 1943	Sunderland	Catalina	Liberator	Stirling	Lancaster I	Lancaster II	Halifax	Fortress	York	Weekly Total	Monthly Output
<u>May</u>											
5	16	-	-	9	18	-	31	-	-	74	
12	3	-	-	14	24	-	24	-	-	65	
19	-	18	-	19	33	-	43	-	-	113	
26	-	-	-	12	45	-	32	-	-	89	341
<u>June</u>											
2	-	3	-	32	30	-	51	-	-	116	
9	13	-	-	37	23	7	31	-	-	111	
16	-	14	-	26	43	-	51	-	-	134	
23	10	1	-	33	64	7	54	-	-	169	
30	2	-	6	37	49	2	46	-	-	142	672
<u>July</u>											
7	4	-	-	38	64	8	7	-	-	121	
14	6	-	-	31	54	7	42	-	-	140	
21	8	-	5	28	68	4	50	-	-	163	
28	1	-	-	35	67	-	14	53	-	170	594
<u>August</u>											
4	-	10	19	12	28 ^x	6	46	-	-	121	
11	11	2	21	12	43	8	40	-	-	137	
18	2	12	3	25	61	14	50	13	-	180	
25	9	11	35	27	67	15	20	1	-	185	623
<u>September</u>											
1	12	7	20	27	17	1	56	20	-	160	
8	1	5	14	16	43	8	59	1	-	147	
15	2	2	42	28	41	-	54	2	-	171	
22	-	9	22	29	55	9	56	1	-	181	
29	9	2	28	28	59	1	66	12	-	205	864
<u>October</u>											
6	1	13	27	21	44	11	68	2	7	264	
13	9	-	20	21	57	-	72	7	-	186	
20	-	-	29	26	86	8	65	4	10	228	
27	8	8	31	16	55	-	62	2	-	182	860
<u>November</u>											
3	6	-	29	20	59	12	49	-	9	182	
10	3	-	22	20	68	-	59	-	-	172	
17	-	-	27	17	41	6	39	-	9	139	
24	6	-	24	20	35	11	34	2	1	133	
<u>December</u>											
1	2	6	21	17	39	9	40	2	-	136	762
Total - 7 calendar months											4,716

^x Included a few Lancaster Mark III

APPENDIX 48

AIR GUNNERY COURSES IN THE UNITED KINGDOM (1)
- OUTPUT, SEPTEMBER 1943 TO DECEMBER 1945

AIR GUNNERS

Date	Number of Schools	Duration of course (days)	Intake	Output	Wastage as % of intake	Notes
<u>1943</u> Sept.	6½	43 85*	1,079 60	962 54	10·8 10·0	* One straight-through course as an experiment at No. 7 A.G.S.
Oct.	6½	42	1,607	1,396	13·1	
Nov.	6	48	490	434	11·4	
Dec.	6	56	1,073	929	13·4	
<u>1944</u> Jan.	6	61	575	513	10·8	
Feb.	6	58	908	813	10·5	
Mar.	5	65	988	841	14·9	
Apr.	9	55	1,620	1,415	12·7	
May	9	50	1,337	1,193	10·8	
June	9½	50	1,550	1,357	12·5	
July	8½	54	1,548	1,385	10·5	
Aug.	8	58	1,177	994	15·6	
Sept.	6½	57	1,093	958	12·4	
Oct.	5	60	409	354	13·4	
Nov.	2½	76	187	176	5·9	
Dec.	4	79	462	423	8·4	
<u>1945</u> Jan.	3	81	263	241	8·4	Included some Nav. 'W'.
Feb.	2	76	249	221	11·2	
Mar.	3	81	463	439	5·1	
Apr.	3	113	373	358	4·0	
May	3	67	368	346	6·0	
June	3	53	224	206	8·0	
July	-	-	-	-	-	No return
Aug.	2	84	87	87	-	Allies not included
Sept.	2	85	152	147	3·3	
Oct.	2	85	122	119	2·5	
Nov.	2	85	172	172	-	
Dec.	1	86	34	34	-	

(1) From T.P. monthly summaries. (A.M.T. Folder Training 3 and T.P. Folder U.K. 9/15).

WIRELESS OPERATORS (AIR)

Date	Number of Schools	Duration of course (days)	Intake	Output	Wastage as % of intake	Notes
<u>1943</u> Sept.	3	42	427	417	2.3	
Oct.	3	48	488	474	2.9	
Nov.	2½	48	378	361	4.5	
Dec.	3½	50	571	548	4.0	
<u>1944</u> Jan.	3½	53	411	382	7.1	
Feb.	3½	57	526	482	8.4	
Mar.	3½	56	322	301	6.5	
Apr.	2	54	183	166	9.3	
May	-	-	-	-	-	Nil Return
June	-	-	-	-	-	Nil Return
July	1	50	122	112	8.2	
Aug.	1	49	74	72	2.7	
Sept.	1	57	141	131	7.2	
Oct.	1	50	130	123	5.4	
Nov.	1	57	120	114	4.0	Included some Nav. 'W'
Dec.	1	57	184	168	7.1	
<u>1945</u> Jan.	1	57	61	59	3.3	Included some Nav. 'W'
Feb.	1	57	131	124	5.2	
Mar.	3	56	399	369	7.5	Included Nav. 'W' and F.E.
Apr.	2	57	177	159	10.1	Included some Nav. 'W' and F.E.
May	2	59	259	223	14.0	Included some Nav. 'W'
June	1	60	104	101	3.1	Included 44 Flt. Eng.
July	1	51	4	4	-	
Aug.	-	-	-	-	-	Nil Return
Sept.	1	85	23	18	21.7	Included some F.E.
Oct.	1	83	69	69	-	Included some F.E.
Nov.) Dec.)	-	-	-	-	-	Nil Return. Course extended to 5 Jan. 1946.

FLIGHT ENGINEERS

Date	Number of Schools	Duration of course (days)	Intake	Output	Wastage as % of Intake	Notes
<u>1943</u> Sept.	1	20	117	113	3.6	At A.A.S. Manby. Records of these short 'emergency' courses not kept by T.P.
<u>1944</u> Sept.	1	52	74	63	14.6	Full A.G. courses at No. 12 A.G.S.
Oct.	1	56	126	108	14.2	
Nov.	1	56	90	67	34.0	Included Nav. 'W' and W.O. (Air).
Dec.	1	56	75	67	16.8	
<u>1945</u> Jan.	1	55	110	99	9.4	Included Nav. 'W' and W.O. (Air).
Feb.	1	56	70	61	11.5	
Mar.	-	-	-	-	-	Concealed in totals of W.O. (Air)
Apr.	1	57	18	16	11.1	
May	1	56	85	83	2.5	

Note: On closing No. 12 A.G.S. no separate record of air gunnery courses was retained for Flight Engineers. A few were included with W.O. (Air) - generally at No. 10 A.G.S.

APPENDIX 49

AUXILIARY AIR FORCE SQUADRONS ON THE OUTBREAK OF WAR

SQUADRON	NAME	LOCATION ON 3.9.39	DATE FORMED	TYPE	AIRCRAFT	CONVERTED FROM BOMBER SQDN
No.500	County of Kent	Detling	16. 3.31	G.R.	Anson	7.11.38
No.501	County of Gloucester	Felton	14. 6.29	Fighter	Hurricane	1.12.38
No.502	Ulster	Aldergrove	15. 5.25	G.R.	Anson	21.11.38
No.504	County of Nottingham	Digby	14.10.28	Fighter	Hurricane	31.10.38
No.600	City of London	Northolt	14.10.25	Fighter	Blenheim	12. 8.34
No.601	County of London	Hendon	14.10.25	Fighter	Blenheim	12. 8.34
No.602	City of Glasgow	Abbotsinch	15. 9.25	Fighter	Spitfire	(To Army Co-op 31.10.38 To Fighter 14. 1.39)
No.603	City of Edinburgh	Turnhouse	14.10.25	Fighter	Spitfire	27.10.38
No.604	County of Middlesex	Hendon	17. 3.30	Fighter	Blenheim	23. 7.34
No.605	County of Warwick	Tangmere	5.10.26	Fighter	Gladiator Hurricane	1. 3.39
No.607	County of Durham	Usworth	17. 3.30	Fighter	Gladiator	1.11.36
No.608	North Riding	Thornaby	17. 3.30	G.R.	Anson	
No.609	West Riding	Catterick	10. 2.36	Fighter	Spitfire	24.11.38
No.610	County of Chester	Hooton Park	10.2.36	Fighter	Spitfire	1. 1.39
No.611	West Lancaster	Duxford	10. 2.36	Fighter	Spitfire	1. 1.39
No.612	County of Aberdeen	Dyce	1. 6.37	G.R.	Anson	(From Army Co-op 1.11.38)
No.613	County of Manchester	Ringway	1. 2.39	Army Co-op	Hector	
No.614	County of Glamorgan	Llandow	1. 6.37	Army Co-op	Lysander	
No.615	County of Surrey	Croydon	1. 6.37	Fighter	Gladiator	(From Army Co-op 7.11.38)
No.616	County of Yorkshire	Fimmingley	1.11.38	Fighter	Spitfire	

Note:- No.503 Squadron disbanded on 31 October 1938.

THE RESERVE TRAINING ORGANISATION
- SCHOOLS

1923 - 1924

SCHOOL	DATE OPENED	A I R C R A F T		C A P A C I T Y		OPERATING COMPANY
		ELEMENTARY	SERVICE	REQUAL- IFYING	ANNUAL	
Stag Lane	1.5.23	Avro - 3	D.H.9 - 3	70	40	De Havilland Aircraft Co., Ltd.
Filton	28.5.23	P.T.M.* - 3	Bristol Fighter - 3	70	40	Bristol Aeroplane Co., Ltd.
Coventry	31.7.23	Avro - 3	D.H.9 - 3	70	40	Armstrong Whitworth Aircraft Ltd.
Brough	21.5.24	Avro - 3	Kangaroo - 3	70	40	North Sea Aerial and General Transport Ltd.
Renfrew	24.7.23	Avro - 3	D.H.9 - 3	70	40	William Beardmore and Co., Ltd.

* Bristol Preliminary Training Machine

Note:- By 31 December 1923 a total of 205 pilots had passed through the
Civil Schools:- (1)

	<u>Requalifying</u>	<u>Annual</u>
Stag Lane	79	11
Filton	53	9
Coventry	17	3
Renfrew	26	7
	<u>175</u>	<u>30</u>

(1) Reference:- A.M. File 374397/22, Encl. 65A.

1928

SCHOOL	A I R C R A F T		C A P A C I T Y			TOTAL
	ELEMENTARY	SERVICE	AB INITIO	ANNUAL (LANDPLANE)	ANNUAL (SEAPLANE)	
Stag Lane	Moth - 5	D.H.9. - 4	96	404	-	500
Filton	P.T.M. - 5	Bristol Fighter - 4	96	404	-	500
Brough	Avro - 5	Dart (Landplane - 4) (Seaplane - 3)	48	412	120	500
Coventry	Avro - 5	Wolf - 5	-	500	-	500
Total			240	1,720	120	2,080

Note:- Courses to be carried out over a four year period (1929 - 1933)

1933

SCHOOL	AIRCRAFT	C A P A C I T Y			TOTAL
		AB INITIO	ANNUAL (LANDPLANE)	ANNUAL (AMPHIBIAN)	
Hatfield	Tiger Moth - 12	60	470	-	530
Filton	Tiger Moth - 12	60	470	-	530
Hamble	Tiger Moth - 12	60	470	120	650
	Amphibian - 2				
Brough	Blackburn B. 2 - 12	60	470	-	530
Total		240	1,880	120	2,240

AB INITIO TRAINING FACILITIES - 1936

SCHOOL	DATE OPENED	AIRCRAFT	ANNUAL CAPACITY	OPERATING COMPANY
Hatfield	1 May 1923	Tiger Moth - 12	120	De Havilland Aircraft Co., Ltd.
Filton	28 May 1923	Tiger Moth - 12	120	Bristol Aeroplane Co., Ltd.
Hamble	1 April 1931	Tiger Moth - 14	180	Air Service Training Ltd.
Brough	21 May 1924	Blackburn B.2 - 14	180	Blackburn Aircraft Ltd.
Hanworth	10 June 1935	Blackburn B.2 - 12	120	Flying Training Ltd.
Sywell	10 June 1935	Tiger Moth - 14	180	Brooklands Aviation Ltd.
Desford	25 November 1935	Tiger Moth - 14	180	Reid and Sigrist Ltd.
Reading	25 November 1935	Miles Hawk - 14	180	Phillips and Powis Ltd.
Ansty	6 January 1936	Aero Cadet - 14	180	Air Service Training Ltd.
Yatesbury	6 January 1936	Tiger Moth - 14	180	Bristol Aeroplane Co., Ltd.
Perth	27 January 1936	Tiger Moth - 14	180	Airwork Ltd.
Prestwick	17 February 1936	Tiger Moth - 14	180	Scottish Aviation Ltd.
White Waltham	18 November 1935	Tiger Moth - 14	180	De Havilland Aircraft Co., Ltd.

Total Capacity (ab initio) - 2,100 pupils per year approximately of which 300 were reservists and 1,800 were regular personnel. In addition annual refresher training facilities were provided at all schools for an overall total of roughly 1,500 reservists per year.

APPENDIX 52

PROPOSALS FOR A DIRECT ENTRY RESERVE

(Memorandum by Mr. W.L. Scott of S.7, February 1936)

1. The demands made on the time of volunteers must be strictly moderate. It is proposed for the purpose of this discussion, to assume that we shall be able to get one continuous fortnight a year, frequent week-ends and evenings. This does not, of course, exclude getting more from those who are willing, or can be encouraged, to give more.
2. The training centres must be located within convenient range of reservists. The primary centres must clearly be aerodromes and the provision of these is discussed below. In London and the largest cities where the aerodrome must be fairly distant it is contemplated that town centres will be provided for evening lectures and social life.
3. The financial conditions must be such as to offer recruits a monetary inducement which is a material sum in their yearly incomes. Travelling, subsistence and incidental expenses will be involved and, though these should be kept to a minimum by maintaining a modest standard, it is necessary to ensure that they are fully covered. Over and above such payments there must be a retainer which it is well worth while the class of man recruited to get.
4. Socially the reserves must be made a great success in the sense that the reservists enjoy themselves and look forward to attendance at the centres. This is discussed further below.
5. The co-operation of employers must be secured. Co-operation is required primarily in giving extra leave to employees who are in the reserve. When the scheme is more nearly ready for launching this aspect will require discussion with the S. of S. who, it is understood, is willing to approach employers.
6. Adequate and continuing publicity. The publicity for the new scheme through the press and with employers and schools can await discussion in connection with (5) above.

APPENDIX 53

PROPOSALS FOR A CITIZEN AIR FORCE

(Air Commodore Chamier, March 1936)

1. The present reserve is hardly more than a facade. Existing conditions do not permit those who have passed through the R.A.F. to maintain themselves efficient in flying Service types.

The Direct Entry Reserve is in no better state of training, and unattractive to the young men. Many who would like to join find the two months initial training an unsurmountable obstacle and the complete sacrifice of their 14 days holiday deters others.

The airmen of the reserve are faced with somewhat similar difficulties and get little opportunity to practise their skilled trades.

And yet there is an enormous body of young and active men eager to fly. The correspondence files of the Air League show considerable numbers who have obtained 'A' certificates but whose means no longer permit them to remain efficient, let alone improve their skill.

The Young Pilots Fund of the Air League, in spite of the limited publicity which the League can command, had over 1,000 applications from young men who were willing to pay half the cost of their tuition. It is quite certain therefore that all the young men required to form a welcome backing to the R.A.F. and its reserve can be obtained without difficulty if the scheme is adapted to their needs.

2. The word 'backing' is chosen because I am entirely convinced that it is inadvisable to perpetuate the name of 'Direct Entry Reserve'. This type of reserve should be built up in the name, as well as on the lines of, a Citizen Air Force, without military commitments other than that of general compulsory service. As a matter of good business advertisement the choice of a correct label for an article is of vast importance (instance the Flying Flea): the publicity which the Press will freely give to a 'modified reserve training scheme' will only be a fraction of that which can be obtained for the 'Creation of a Citizen Air Force', which is a head line story.

/Moreover

Moreover the public is, to my knowledge, already confused by the regulations for the Reserve and muddled by the different classes. The Direct Entry class is believed to be under-strength and it is better to restart it under altered conditions with a new and attractive title - The C.A.F. - which marks the breakaway from previous methods.

Reserves are accustomed to some form of pay or bonus, and will continue to enjoy that remuneration: the Citizen Air Force will require substantially less financial inducement, and will prove much more economical.

3. Appealing as we must to those with limited spare time, the C.A.F. must train at week-ends and, to an extent limited by daylight and distances, in the early and late hours of the summer day. Aerodromes must be chosen in the neighbourhood of large towns, preferably University towns.

Training must be progressive, and the C.A.F. schools must therefore have both elementary and Service training aeroplanes.

It is suggested that the citizen pilot should have 50 hours in the first year on elementary trainers and 30 hours in the second year on a Service type: in his subsequent years he should only require 10 hours yearly 'refresher' training on a Service type supplemented by 10 hours if possible with an allied Service squadron to learn the rudiments of military (applied) flying.

APPENDIX 54

R.A.F.V.R. PROGRESS, 26 DECEMBER 1937

District	Aerodrome Centre and Operating Company	E. & R.F.T.S. No.	Commenced Training - 1937	Capacity	Strength	Aircraft		Town Centre	
						Elementary	Service	Premises	To Commence Training
Birmingham	Castle Bromwich (Airwork Ltd.)	14	1 July	50	30	4	3	Under consideration	
Brighton	Shoreham (Brooklands Aviation Ltd.)	16	1 July	100	42	6	6	Occupied	Mid-February 1938
Bristol	Filton (Bristol Aeroplane Co., Ltd.)	2	1 April	50	26	4	3	In operation	
Coventry	Ansty (Air Service Training Ltd.)	9	1 April	50	48	6	6	Under consideration	
Glasgow	Prestwick (Scottish Aviation Ltd.)	12	1 April	150	62	8	7	Selected	Mid-February 1938
Hull	Brough (Blackburn Aircraft Ltd.)	4	1 April	50	35	4	3	Selected	March 1938
Leicester	Deaford (Reid and Sigrist Ltd.)	7	1 April	50	31	4	3	Occupied	
London	Fairoaks (General Aircraft Ltd.)	18	1 October	100	29	6	6	In operation	
	Gatwick (Airports Ltd.)	19	1 October	100	40	6	6		
	Gravesend (Airports Ltd.)	20	1 October	100	41	6	6		
	Hanworth (Flying Training Ltd.)	5	1 April	100	79	6	6		
	Hatfield (De Havilland Aircraft Co., Ltd.)	1	1 April	100	62	6	6		
	Redhill (British Air Transport Ltd.)	15	1 July	100	42	6	6		
	Stapleford Abbots ⁽¹⁾ (Reid and Sigrist Ltd.)	21	-	100	6	6	6		
	White Waltham (De Havilland Aircraft Co. Ltd.)	13	1 April	100	55	6	6		
	Barton (Airwork Ltd.)	17	1 October	50	27	4	3		Being sought
	Sywell (Brooklands Aviation Ltd.)	6	1 April	50	28	4	3		Occupied by Commandant and Staff only
Perth	Perth (Airwork Ltd.)	11	1 April	50	23	4	3	Under consideration	
Reading	Reading (Phillips and Powis Aircraft Ltd.)	8	1 April	100	42	6	6	Occupied	Mid-February 1938
Southampton	Hamble (Air Service Training Ltd.)	3	1 April	100	66	8	7	Occupied	Mid-February 1938

(1) Did not actually commence training until 1 January 1938.

Note:- Total Strength of R.A.F.V.R.:-

Strength of the 20 centres	-	814
Pilots Abroad	-	4
Members of University Air Squadrons	-	27
Total		<u>845</u>

There were 19 Aerodrome Centres (E. & R.F.T.S.) and two Town Centres in operation by the end of 1937.

R.A.F.V.R. - PROGRESS OF SCHEME 'F' UP TO 31 DECEMBER 1938 AND
EXPANSION PROPOSALS UNDER SCHEME 'L'

Aerodrome Centre	E. & R.F.T.S.					Town Centre	
	No.	Date opened	Capacity - Scheme 'F'	Strength 31.12.38	Proposed capacity under Scheme 'L'	Location	Opened by
Hatfield	1	1. 4.37	100	100	100	London	March 1938
Filton	2	1. 4.37	50	51	50	Bristol	March 1938
Hamble	3	1. 4.37	100	146	150	Southampton	August 1938
Brough	4	1. 4.37	50	103	100	Hull	March 1938
Hanworth	5	1. 4.37	100	100	100	London	March 1938
Sywell	6	1. 4.37	50	52	100	Northampton	March 1938
Desford	7	1. 4.37	50	87	100	Leicester	August 1938
Reading	8	1. 4.37	100	71	100	Reading	August 1938
Ansty	9	1. 4.37	50	113	150	Coventry	August 1938
Perth	11	1. 4.37	50	54	100	Perth	December 1938
Prestwick	12	1. 4.37	150	121	200	Glasgow	March 1938
White Waltham	13	1. 4.37	100	126	200	London	March 1938
Castle Bromwich	14	1. 7.37	50	40	50	Birmingham	-
Redhill	15	1. 7.37	100	121	150	London	March 1938
Shoreham	16	1. 7.37	100	93	100	Brighton	August 1938
Barton	17	1.10.37	50	68	50	Manchester	-
Fairoaks	18	1.10.37	100	96	100	London	March 1938
Gatwick	19	1.10.37	100	110	200	London	March 1938
Gravesend	20	1.10.37	100	91	150	London	March 1938
Stapleford Abbots	21	1. 1.38	100	107	150	London	March 1938
Cambridge	22	1. 2.38	50	89	100	Cambridge	August 1938
Rochester	23	1. 4.38	50	61	100	Rochester	-
Sydenham (N. Ireland)	24	1. 1.39	50	-	150	Belfast	December 1938
Grimsby	25	24. 6.38	100	35	100	Grimsby	-
Oxford	26	24. 6.38	50	60	100	Oxford	-
Tollerton	27	24. 6.38	50	66	100	Nottingham	-
Meir	28	1. 8.38	100	30	100	Stoke-on-Trent	-
Luton	29	1. 8.38	100	71	150	Luton	-
Derby	30	29. 9.38	50	32	100	Derby	-
Gloucester	31	29. 9.38	50	31	100	Gloucester	December 1938
West Hartlepool	32	-	100	-	100	West Hartlepool	-
Whitchurch	33	3.12.38	50	22	100	Bristol	December 1938
Southend	34	1. 1.39	100	11	100	Southend	-

Note:- The aerodrome centre at West Hartlepool together with the town centres at Birmingham, Manchester, Rochester, Grimsby, Oxford, Nottingham, Stoke-on-Trent, Luton, Derby, West Hartlepool and Southend were expected to be in operation by 30 April 1939.

Strength, 31 December 1938

Total pilots on strength of V.R. centres - 2,358 *

Pilots not on strength of centres:-

Present members of U.A. Squadrons	46
Non-training list	57
Instructors	19
Training abroad	3
Provisionally accepted for S.S.C.s	14

Total 2,497

* Including transfers from Classes 'AA' and 'F' of the R.A.F. Reserve.

R.A.F.V.R. PROGRESS, 1 May 1939

Aerodrome Centre	R. & R.F.T.S. No.	Pilots		Aircrew		Town Centre
		Capacity	Strength	Capacity	Strength	
Hatfield	1	200	128	100	49	London
Filton	2	50	57	100	12	Bristol
Hamble	3	200	175	100	25	Southampton
Brough	4	150	121	100	15	Hull
Hamworth	5	150	163	100	65	London
Sywell	6	100	60	100	19	Northampton
Desford	7	100	111	100	21	Leicester
Reading	8	100	103	100	14	Reading
Ansty	9	150	150	200	23	Coventry
Perth	11	100	71	50	15	Perth
Prestwick	12	200	218	200	62	Glasgow
White Waltham	13	200	163	200	8	London
Castle Bromwich	14	50	51	100	36	Birmingham
Redhill	15	150	154	200	35	London
Shoreham	16	100	106	100	46	Brighton
Barton	17	50	80	100	28	Manchester
Fairoaks	18	100	110	150	17	London
Getwick	19	200	172	200	10	London
Gravesend	20	150	151	200	15	London
Stapleford Abbots	21	150	153	200	33	London
Cambridge	22	100	127	100	21	Cambridge
			(including 17 U.A.S. personnel)			
Rochester	23	100	83	100	15	Rochester
Sydenham (N. Ireland)	24	150	40	200	7	Belfast
Grimby	25	100	60	100	14	Grimby
Oxford	26	100	96	100	16	Oxford
			(including 14 U.A.S. personnel)			
Tollerton	27	100	110	100	36	Nottingham
Meir	28	100	62	100	14	Stoke-on-Trent
Luton	29	150	105	200	21	Luton
Derby	30	100	68	100	33	Derby
Gloucester	31	100	56	100	11	Gloucester
West Hartlepool	32	100	15	100	1	West Hartlepool
Whitchurch	33	100	56	100	-	Bristol
Southend	34	100	80	200	53	Southend
		4,050	3,455	4,300	790*	

* This total consists of 477 Observers and 313 W/T Operators/Air Gunner

Strength 1 May 1939

Total Pilots on strength of V.R. Centres - 3,455

Pilots not on strength of centres:-

Present members of U.A. Squadrons 34

Non-training list 67

Instructors 32

Training abroad 3

Provisionally accepted for S.S.C.s 13

Total 3,604

Reference:- EP.M.76 (39). (A.H.B./Ic/2/2).

APPENDIX 57

R.A.F.V.R. EXPANSION - SCHEMES 'L' AND 'M'

1 JULY 1939

Scheme 'L'

The following aerodrome centres and town centres, additional to those listed in Appendix 56, had opened by 1 July 1939:-

Aerodrome Centre	E. & R.F.T.S. No.	Town Centre
Grangemouth	35	Edinburgh
Carlisle	38	Carlisle
Newcastle	43	Newcastle
Elmdon	44	Birmingham *
Ringway ^δ	-	-

* Already serving Castle Bromwich.

^δ Ringway opened on 1 June 1939 and was amalgamated with Barton in July 1939.

Altogether there were 38 aerodrome centres and 38 town centres. The establishment of the aerodrome centres was 5,500 pilots and 5,450 aircrew and on strength and under training there were 4,500 pilots and 2,200 aircrew.

Scheme 'M'

Aerodrome Centres

		<u>Training Capacity 1940-41</u>	
		<u>Pilots</u>	<u>Aircrew</u>
(a) Centres under Scheme 'L' to be expanded to maximum capacity	(58)	9,000	10,000
(b) New Centres to be established at various dates in 1940	(20/25)	4,000	3,200
	<u>Totals</u>	78/83	13,000
			13,200

Town Centres

(a) Centres under Scheme 'L' to be expanded where necessary	59
(b) New Centres to be established	20
	<u>Total</u>
	79

Reference E.P.M. 109 (39). (A.H.B./Ic/2/2).

R.A.F.V.R. TRAINING CAPACITY, 1 SEPTEMBER 1939

AERODROME CENTRES

E. & R.F.T.S. No.	Aerodrome Centre	Capacity		Aircraft Establishment				Remarks																												
				Ab initio (Pilots)		Advanced (Pilots)	Aircrew																													
		Pilots	Aircrew	Elementary	Service	Battle	Anson																													
1	Hatfield	150	200	8	7	3	6	(a) Elementary aircraft - Tiger Moth, Magister and Blackburn B.2. Service aircraft - Hart, Hind, Audax and Demon.																												
2	Filton	50	100	4	3	-	3																													
3	Hamble	200	200	10	10	4	6																													
4	Brough	150	200	8	7	3	6	(b) All the E. & R.F.T.S.s were scheduled to carry out advanced pilot training, but less than half of them ever received any Battles or Ansons, and as they did not arrive at the schools until July 1939 or later very little flying training was carried out on these types.																												
5	Hanworth	150	200	8	7	3	6																													
6	Sywell	50	100	4	3	-	3																													
7	Desford	150	200	8	7	-	6																													
8	Reading	100	100	6	6	1	3																													
9	Ansty	150	200	8	7	3	6																													
11	Perth	100	100	6	6	1	3																													
12	Prestwick	200	200	10	10	4	6																													
13	White Waltham	200	200	10	10	-	6																													
14	Castle Bromwich	50	100	4	3	-	3																													
15	Redhill	200	200	10	10	4	6	(c) The establishment of Service and elementary aircraft was to increase and decrease respectively at these schools after the first year of operation as the reservists gained experience, but the outbreak of war interrupted this scheme.																												
16	Shoreham	100	100	6	6	3	3																													
17	Barton and Ringway	200	200	10	10	-	6																													
18	Fairoaks	150	200	8	7	3	6																													
19	Gatwick	200	200	10	10	4	6																													
20	Gravesend	200	200	10	10	4	6																													
21	Stapleford Abbots	200	200	10	10	4	6																													
22	Cambridge	150	200	8	7	3	6																													
23	Rochester	100	100	6	6	-	-																													
24	Sydenham	150	200	4	3	-	3	(d) The following aerodrome centres were planned to open but had not actually formed by the outbreak of war:-																												
25	Grimsby	100	100	6	6	-	3																													
26	Oxford	100	100	6	6	-	3																													
27	Tollerton	100	100	6	6	-	3																													
28	Meir	100	100	6	6	-	-																													
29	Luton	150	200	8	7	-	6																													
30	Derby	100	100	6	6	-	-																													
31	Gloucester	100	100	6	6	-	-																													
32	West Hartlepool	100	100	6	6	-	-																													
33	Whitchurch	100	100	6	6	-	3																													
34	Southend	200	200	10	10	-	6	<table><tr><th>E. & R.F.T.S. No.</th><th>Aerodrome Centre</th></tr><tr><td>36</td><td>Sherburn-in-Elmet</td></tr><tr><td>41</td><td>Dyce</td></tr><tr><td>48</td><td>Bagington</td></tr><tr><td>49</td><td>Preston</td></tr><tr><td>50</td><td>Marlow</td></tr><tr><td>51</td><td>Abbotsinch</td></tr><tr><td>52</td><td>York</td></tr><tr><td>53</td><td>Yeadon</td></tr><tr><td>54</td><td>Southampton</td></tr><tr><td>55</td><td>Speke</td></tr><tr><td>57</td><td>Coventry</td></tr><tr><td>58</td><td>Braunstone Frith</td></tr><tr><td>59</td><td>Cardiff</td></tr></table>	E. & R.F.T.S. No.	Aerodrome Centre	36	Sherburn-in-Elmet	41	Dyce	48	Bagington	49	Preston	50	Marlow	51	Abbotsinch	52	York	53	Yeadon	54	Southampton	55	Speke	57	Coventry	58	Braunstone Frith	59	Cardiff
E. & R.F.T.S. No.	Aerodrome Centre																																			
36	Sherburn-in-Elmet																																			
41	Dyce																																			
48	Bagington																																			
49	Preston																																			
50	Marlow																																			
51	Abbotsinch																																			
52	York																																			
53	Yeadon																																			
54	Southampton																																			
55	Speke																																			
57	Coventry																																			
58	Braunstone Frith																																			
59	Cardiff																																			
35	Grangemouth	200	200	10	10	-	-																													
37	Exeter	-	100	-	-	-	3																													
38	Carlisle	100	100	6	6	-	-																													
39	Weston-Super-Mare	50	100	4	3	-	-																													
40	Norwich	100	100	6	6	-	-																													
42	Blackpool	200	200	10	10	-	-																													
43	Newcastle	200	200	10	10	-	-																													
44	Elmdon	200	200	10	10	-	-																													
45	Ipswich	100	100	6	6	-	-																													
46	Portsmouth	100	100	6	6	-	-																													
47	Doncaster	100	100	6	6	-	-																													
56	Kenley	100	100	6	6	-	-																													

R.A.F.V.R. TOWN CENTRES, 1 SEPTEMBER 1939

Town Centre	E. & R.F.T.S. No.	Aerodrome Centre
Belfast No. 1	24	Sydenham
Birmingham No. 1	14	Castle Bromwich
	44	Elmdon
Blackpool	42	Blackpool
Brighton	16	Shoreham
Bristol No. 1	2	Filton
	33	Whitchurch
	39	Weston-Super-Mare
Cambridge	22	Cambridge
Carlisle	38	Carlisle
Coventry No. 1	9	Ansty
Cheltenham	31	Gloucester and Cheltenham
Derby	30	Derby
Doncaster	47	Doncaster
Edinburgh	35	Grangemouth
Exeter	37	Exeter
Glasgow No. 1)	12	Prestwick
Glasgow No. 2)		
Grimsby	25	Grimsby
Hull	4	Brough
Ipswich	45	Ipswich
Leicester No. 1	7	Desford
London No. 1	1	Hatfield
London No. 2	5	Hanworth
London No. 5	13	White Waltham
London No. 6	15	Redhill
London No. 8	18	Fairoaks
London No. 9	19	Gatwick
London No. 10	20	Gravesend
	21	Stapleford Abbots
	56	Kenley
Luton No. 1)	29	Luton
Luton No. 2)		
Manchester No. 1	17	Ringway and Barton
Newcastle	43	Newcastle
Northampton	6	Sywell
Norwich	40	Norwich
Nottingham	27	Tollerton
Oxford	26	Oxford
Perth	11	Perth
Portsmouth	46	Portsmouth
Reading	8	Reading
Rochester	23	Rochester
Southampton No. 1	3	Hamble
Southend	34	Southend
Stoke	28	Meir
West Hartlepool	32	West Hartlepool

Total - 42 town centres

The following town centres were planned to open but had not been formed by the outbreak of war:-

Belfast	No. 2	Manchester	No. 2
Birmingham	No. 2	Southampton	No. 2
Bristol	No. 2	Birkenhead	
Coventry	No. 2	Bradford	
Leicester	No. 2	Cardiff	
London	No. 3	Leeds	
London	No. 4	Liverpool	
London	No. 7	York	

Total - 16 town centres - making a total of 58 in all under Scheme 'L'

FLYING CLUBS OPERATING WITH THE CIVIL AIR GUARD

<u>Club</u>	<u>Aerodrome</u>
Airwork Flying Club	Heston
The Autogyro Flying Club Ltd.	Hamworth
Bedford School of Flying Ltd.	Barton
Border Flying Club Ltd.	Carlisle
Bournemouth Flying Club	Bournemouth
Bristol and Wessex Aeroplane Club Ltd.	Bristol
Cambridge Aero Club and Marshalls' Flying School	Cambridge
Cardiff Aeroplane Club Ltd.	Cardiff
Cinque Ports Flying Club Ltd.	Lymington
Cotswold Aero Club Ltd.	Gloucester
County Flying Club Ltd.	Rearsby
Coventry Aeroplane Club	Whitley
Doncaster Aero Club	Doncaster
Edinburgh Flying Club Ltd.	Macmerry
Exeter Aero Club	Exeter
Hampshire Aeroplane Club	Southampton
Herts and Essex Aero Club	Broxbourn
Hull Aero Club Ltd.	Hedon
Insurance Flying Club Ltd.	Gatwick
Ipswich Aero Club	Ipswich
Isle of Wight Flying Club Ltd.	Lea
Kent Flying Club	Canterbury
Lancashire Aero Club	Woodford
Leamington, Warwick and District Aero Club	Leamington
Leicester Aero Club Ltd.	Leicester
Lincolnshire Aero Club	Grimsby
Liverpool and District Aeroplane Club	Speke
London Aeroplane Club	Hatfield
London Air Park Flying Club Ltd	Hamworth
London Transport (Central Omnibuses) Sports Association Flying Club	
Luton Flying Club	Broxbourn
Malling Aero Club	Luton
Midland Aero Club	West Malling
Newcastle-upon-Tyne Aero Club Ltd.	Castle Bromwich
Norfolk and Norwich Aero Club Ltd	Woolston
Northamptonshire Aero Club Ltd.	Norwich
North British Aero Club Ltd.	Sywell
North Devon Flying Club	Dyce
North of Ireland Aero Club	Barnstaple
North Staffordshire Aero Club	Newtownards
Northern Aviation School and Club Ltd.	Meir
Nottingham Flying Club	Barton
Old Etonian Flying Club	Tollerton
Plymouth and District Aero Club	Heston
Portsmouth Aero Club Ltd.	Plymouth
Reading Aero Club Ltd.	Portsmouth
Redhill Flying Club	Reading
Romford Flying Club Ltd.	Redhill
Scottish Flying Club Ltd.	Romford
Sheffield Aero Club Ltd.	Renfrew
South Coast Flying Club	Firbeck
South Staffs Aero Club	Shoreham
Southend Flying Club	Walsall
Strathtay Aero Club Ltd.	Southend
Thanet Aero Club	Perth
Weston Aero Club	Ramsgate
Wiltshire School of Flying Ltd.	Weston-Super-Mare
Witney and Oxford Aero Club	Salisbury
Yorkshire Aeroplane Club Ltd.	Witney
Yapton Aero Club Ltd.	Yeadon
	Portsmouth

APPENDIX 60

SYLLABUS OF FLYING INSTRUCTION FOR CLASS I

MEMBERS OF THE CIVIL AIR GUARD

First Year Syllabus

	Hours			
	Dual	Solo	Test	Total
Flying Accurate Compass Courses	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$1\frac{1}{2}$
Forced Landings	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$1\frac{1}{2}$
Map Reading	-	1	$\frac{1}{2}$	$1\frac{1}{2}$
Cross Country Flying	-	3	-	3
Aerobatic Flying	1	1	$\frac{1}{2}$	$2\frac{1}{2}$
Total				10
<u>Second Year Syllabus</u>				
Flying Accurate Compass Courses	-	1	-	1
Forced Landings	-	1	-	1
Map Reading	-	-	-	-
Cross Country Flying	-	$7\frac{1}{2}$	-	$7\frac{1}{2}$
Aerobatic Flying	-	$\frac{1}{2}$	-	$\frac{1}{2}$
Total				10