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R. A. F. NARRATIVE

(First Draft)

PHOTOGRAPHIC RECONNAISSANCE

VOLUME II

MAY 1941 TO AUGUST 1945

Written by Sqn Off K.F. Bagley (584)

AIR HISTORICAL BRANCH (1)

AIR MINISTRY.

R. A. F. NARRATIVE

PHOTOGRAPHIC RECONNAISSANCE

VOLUME II

MAY 1941 TO ~~Aug~~ 1945

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The following documents should also be consulted in connection with this narrative:-

- AP3131A - Handbook for officers concerned with examination and Interpretation of Air Photographs.
- Report on Tactical Reconnaissance in 2nd T.A.F. 1944-1945.
- Report on Ground Organisation in Support of Air Photographs in 2nd T.A.F. 1944-1945.
- "Evidence In Camera". (Many examples of varying types of air photography).

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CHRONOLOGY OF PRINCIPAL EVENTS

	<u>Date</u>
Formation of No.1416 (Army Co-operation) Reconnaissance Flight	March, 1941.
Central Interpretation Unit ^{formed} reorganised and moved to Medmenham ^{at}	April, 1941.
Control of C.I.U. passed from A.C.A.S.(G) to A.C.A.S.(I)	May 12th, 1941.
Amalgamation of Nos.1 and 3 P.R.U.S. authorised	June 16th, 1941.
First P.R. sortie from Gibraltar (Maryland)	June 25th, 1941.
First routine 'D' type Spitfire delivered to P.R.U.	April July 3rd, 1941.
No.3 P.R.U. arrived at Benson	July 21st, 1941.
First P.R. Mosquito (Mark I) delivered to P.R.U.	August, 1941.
Amalgamation of Nos.1 and 3 P.R.U.s completed	August 15th, 1941.
Introduction of F.8 camera with 250 exposure magazine	August, 1941.
School of Photographic Intelligence ^{interpretation} established - Benson	September 14th, 1941.
First successful operation by P.R. Mosquito - (to Boulogne)	September 20th, 1941.
Longest flight to date by P.R. Spitfire (Danzig and Gdynia)	September 29th, 1941.
Bomber Command Photographic and Damage Assessment Sections become part of C.I.U.	September, 1941.
First time 36" lens used on operations	November, 1941.
Middle East Central Interpretation Unit formed	November, 1941.
First Aircraft fitted for P.R. sent West Africa	December, 1941.
First photographic interpreters sent West Africa	January, 1942.
Introduction of F.52 camera	January, 1942.
School of P.I. moved to Nuneham Park	January 22nd, 1942.
Section of A.D.I. (Ph.) located at Headquarters, Coastal Command	February 7th, 1942.
First P.R. sortie to Königsberg	March 27th, 1942.
No.3 P.R.U. and Central Photographic Interpretation Unit, India formed	March, 1942.
First use of 500 exposure magazine (F.52 camera)	May 3rd, 1942.
First P.R. sortie to Narvik. (Mosquito Mark I)	May 15th, 1942.
Formation of No.8 (P.R.), O.T.U.	May 18th, 1942.
Peenemunde photographed for first time	May, 1942.
First P.R. sortie to Russia and back in one day	July 7th, 1942.
Disbandment of No.1 P.R.U. and reformation as 5 P.R. Squadrons - Nos.540, 541, 542, 543 and 544 Sqdns. authorised	August 15th, 1942.

	<u>Date</u>
First P.R. detachment in N. Russia	September, 1942.
No.4 P.R.U. formed (North Africa)	October, 1942.
1st U.S. (P.R.) Squadron arrives in U.K.	October, 1942.
Formation of Nos. 540-544 Sqdns. completed	October, 1942.
Return of A.D.I. (Ph.) Section from H.Q. Coastal Command to Air Ministry	November 29th, 1942.
First operational use of Mk. IX Spitfire	November 30th, 1942.
First operational use of Mk. XI Spitfire	December 10th, 1942.
First night P.R. operation (Wellington)	December 12th, 1942.
First sortie with P.R. Mosquito Mk.IX	December, 1942.
Nos. 2 and 4 P.R.Us disbanded and replaced by Nos. 680 & 682 (P.R.) Squadrons	January 7th, 1943.
No. 683 (P.R.) Sqdn. formed at Malta	January 7th, 1943.
No. 3 P.R.U. disbanded and replaced by No. 681 (P.R.) Sqdn.	January, 1943.
North African Central Interpretation Unit formed	February 23rd, 1943.
North African P.R. Wing formed (embracing N.A.C.I.U. and all P.R. Sqdns. in North Africa (R.A.F. and U.S.))	March, 1943.
7th Photographic Group (U.S.) commences operations from Mount Farm	March, 1943.
No. 106 (P.R.) Wing formed	June 26th, 1943.
No. 34 (P.R.) Wing reformed under 2nd T.A.F., with Nos. 140 and 16 Squadrons	July, 1943.
Second P.R. detachment in Russia	September, 1943.
No. 543 (P.R.) Squadron disbanded	September, 1943.
North West Africa P.R. Wing becomes Mediterranean Allied P.R. Wing (Embracing all P.R. Sqdns. in Mediterranean Air Command, including No. 60 S.A.A.F. Squadron)	September, 1943.
No. 336 (P.R.) Wing formed in M.A.C.	October, 1943.
No. 684 (P.R.) Sqdn. formed in India	November, 1943.
No. 171 (P.R.) Wing formed in India	November, 1943.
First photographs of Flying Bomb at Peenemunde	Taken: November 28th, 1943.
	Interpreted: December 1st, 1943.
First sortie to Bangkok from India	December 15th, 1943.
P.R. Force (R.A.F. Element) A.C.S.E.A. formed	February, 1944.
First P.R. sortie over Poland from Italy	February 22nd, 1944.
Third P.R. detachment to N. Russia	March, 1944.
First modified Flying Bomb sites discovered	April 27th, 1944.

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Date

Mosquito XVI first used on operations	April, 1944.
No.69 Squadron reformed as P.R. Sqdn. in No.34 (P.R.) Wing	May 5th, 1944.
Formation of No.106 (P.R.) Group	May 15th, 1944.
Formation of Joint Photographic Reconnaissance Committee	May 15th, 1944.
C.I.U. retitled Allied Central Interpretation Unit	May 15th, 1944.
Moving film strip camera first used operationally	May 15th, 1944.
Forward facing oblique camera first used operationally (Mosquito)	June 12th, 1944.
Spitfire XLX first used on operations	June 15th, 1944.
First sortie to Alten Fjord from U.K. base (Mosquito XVI)	July 12th, 1944.
First interception of Allied aircraft (Mosquito XVI) by German jet-propelled fighter	July 25th, 1944.
P.R. Operations from Continental bases commenced	August, 1944.
Highest monthly total operational P.R. sorties from U.K.	August, 1944.
P.R. Force A.C.S.E.A. incorporated U.S. P.R. units, and No.171 (P.R.) Wing disbanded	September, 1944.
Mediterranean Allied P.R. Wing disbanded	October, 1944.
No.104 (P.R.) Wing formed for Continent	February, 1945.
Longest P.R. Flight by Mosquito XVI) India/Malaya, 2,493 miles	March 22nd, 1945.
All operational P.R. tasks on Continent cancelled	May 5th, 1945.
A.C.I.U. reverts to original title and American Element disbanded	August, 1945.

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Vol II Part I

Written by Sgt J. K. Bagley (580)

1
PHOTOGRAPHIC RECONNAISSANCE

VOLUME II

MAY 1941 TO AUGUST 1945

PART I

ORGANISATION AND DEVELOPMENT

1. INTRODUCTION

no there is a gap!

A milestone in the history of Photographic Reconnaissance and Intelligence was reached in April 1941, the date which marked the limit of events recorded in the previous volume.

The unorthodox and complex structure of the old Photographic Interpretation Unit had been eliminated, and its successor - the Central Interpretation Unit - was being moulded into a normal R.A.F. formation under a regular Air Force officer. The last traces of the civilian atmosphere of the Aircraft Operating Company were now swept away as its members put on R.A.F. uniform. With the move to Medmenham, the Central Interpretation Unit entered upon a new era, and the progress of its development from May 1941 forms one of the subjects of this narrative.

The Photographic Reconnaissance Units were also at the crossroads. With the centralisation of all P.R. units in the United Kingdom under A.C.A.S.(I), Air Ministry, came the end of any attempt by an operational Command to build up an individual Photographic Reconnaissance organisation for itself. The decision to amalgamate No. 1 P.R.U. in Coastal Command with Bomber Command's No. 3 P.R.U. wrote 'Finis' to this phase - and from thenceforth all strategical Photographic Reconnaissance requirements were co-ordinated by one authority, not only for the three Services, but for all operational Commands of the R.A.F. at home. Thus June 1941, when the amalgamation of the P.R. Units was actually achieved, marked the first step towards the formation of an independent Photographic Reconnaissance Group for the fulfilment of all strategical photographic requirements in the European theatre of war.

By this time a start had also been made in the founding of an overseas Photographic Reconnaissance organisation with the approval of the establishment of No. 2 P.R.U. for Middle East in September 1940, aircraft for which were in course of preparation by March 1941.

*incorporated with
C.I.U. 1941*

The first routine type of aircraft built specifically for Photographic Reconnaissance - the 'D' type Spitfire - had been successfully operated in April 1941, and was to be the forerunner of the many marks of P.R. Spitfire employed with the P.R. units throughout the war period. The F. 8 camera, with long focal length lens and consequent larger scale photography had been introduced afresh into the Service in 1940 and was in general use by April 1941, representing only the first of many improvements in photographic equipment which all contributed to the success of Photographic Reconnaissance during the war.

From May 1941 the history of the Photographic Reconnaissance organisation is one of both operational and technical development, during which the procurement and interpretation of air photographs became an exact science and an essential component of our intelligence organisation.

2. ORGANISATION AND CONTROL OF PHOTOGRAPHIC RECONNAISSANCE(A) Introductory

The P.R.U. Organisation had been developed during the first two years of war to fill the ever growing need for strategical photographic reconnaissance for all three Services. By 1941 it had become the principal means of obtaining intelligence of enemy movements and intentions on the Continent now that the greater part of Europe had been enveloped by the Axis powers, and in consequence the demands upon its resources had grown out of all proportion to the means available for meeting them. It was for this reason that the Chiefs of Staff agreed, in February 1941, that all strategical photographic intelligence resources should be centralised to make the best possible use of the organisation. The amalgamation of the Photographic Reconnaissance Units and the provision of a central body - A.D.I.(Ph) - to co-ordinate requests and control priorities for photographic reconnaissance seemed easy of achievement, but as forecast in the previous section this did not prove so easy to put into effect when the amalgamation was authorised with effect from the 16th June 1941.

(B) Coastal Command Control

In the first place the A.O.C.-in-C. Bomber Command objected to the instruction that he should make requests for photographic intelligence to Coastal Command Headquarters, and even more did he object to the loss of his control of No.3 P.R.U. and his own Bomb Damage Assessment Section. He stated that No.3 P.R.U. was "a special Unit trained and equipped for bomb damage assessment and almost exclusively concerned with the requirements of Bomber Command. The Section was specially created to work with Bomber Command, the aircraft are flown by Bomber Command pilots and it has been an integral part of the Command since its formation. Indeed, it is practically the only means at my disposal of discovering the effect of my bombing attacks. Under the scheme now promulgated I shall have to deal with it through another Command, and I am quite sure that the introduction of this uneconomical piece of mechanism can only retard an organisation essentially designed for speed, and cause needless friction". The method of dealing with requests for photographic intelligence from Bomber Command was further reviewed by the Air Staff, in consequence of which it was agreed that Bomber Command should have direct access to the Commanding Officer of the P.R.U. at Benson in connection with requests for bomb damage assessment. Still dissatisfied, Bomber Command took no action to hand over No.3 P.R.U. to Coastal Command, with the result that the latter did not know where it stood and a great deal of work continued to be duplicated. Stern measures were taken by the Air Ministry, but at a meeting in July presided over by V.C.A.S. it was agreed that should the A.O.C.-in-C. Bomber Command find, after prolonged trial, that the Bomb Damage information received was unsatisfactory, the question of the Control of No.1 P.R.U. should be reviewed.

C.S.
9635
14A

Ibid.
18A

Ibid.
21A

Ibid
27A

On the 5th August the R.A.F. Station Benson was transferred from Bomber Command to Coastal Command and placed in No.16 Group, the amalgamated and reorganised No.1 P.R.U. coming into being on the same day, operating from Benson and its nearby satellite Mount Farm. Although it was intended that the Photography and Damage Assessment Sections of Bomber Command should be amalgamated with the C.I.U. concurrently with the transfer of No.3 P.R.U. to Coastal Command, unfortunately this could not be achieved in August owing to

the lack of suitable accommodation and necessary equipment. In September, however, this move was put into effect and two P.I. officers from C.I.U. were attached to Bomber Command to give first phase interpretation direct to the Command intelligence staff. This removal from Bomber Command of the aspect of interpretation which they had always regarded as their own province was not accomplished without some of the "needless friction" to which their A.O.C.-in-C. had referred.

The A.O.C.-in-C. Bomber Command continued to believe that the service he received from the P.R.U. was given secondary place to that accorded to the Admiralty, and all through the Winter of 1941 there was an undercurrent of dissatisfaction between the two Commands. This rose to the surface when, early in 1942, the A.O.C.-in-C. Bomber Command requested that once again he might be given control of his own Damage Assessment P.R.U. Flight, a request which was not granted.

(C) Air Ministry Control

The A.O.C.-in-C., Coastal Command was also somewhat dissatisfied with the existing control of photographic reconnaissance. In the Air Ministry letter of June 7th, 1941 announcing to all concerned the amalgamation of the Photographic Reconnaissance Organization under the operational and administrative control of Coastal Command, it had been laid down that whereas the Admiralty and Bomber Command were accorded the right to make requests direct to Headquarters Coastal Command, all other authorities were to make their demands for photographic reconnaissance and intelligence through A.D.I.(Ph) at Air Ministry. The "outside customers", such as the War Office, the Ministries of Supply and Economic Warfare; the Combined Operations Headquarters, etc., increased their requests for photographic reconnaissance and Coastal Command felt that their Headquarters should be the focal point for all P.R.U. requests and should consequently be allowed to assess relative priorities so as to obtain the best results from the P.R. aircraft which they controlled operationally. This could not be agreed, however, and C.A.S. himself wrote to the A.O.C.-in-C. Coastal Command in an endeavour to explain that it was essential, for operational reasons, that the Air Ministry should be able to exercise their right of dealing direct with the P.R.U.

As a result of further discussions and correspondence between Coastal Command and Air Ministry, in October the A.O.C.-in-C. Coastal Command put forward a scheme to A.C.A.S.(I) to operate a portion of A.D.I.(Ph) Branch from Coastal Command Headquarters. Here it could co-ordinate the work of P.R.U. and C.I.U. and carry out the duties of the operational side of the Branch, leaving the Intelligence section of the Branch at Air Ministry. Various hindrances to the scheme prevented it from being put into operation immediately, but on the 7th February, 1942, a Section of A.D.I.(Ph)⁽¹⁾ took up its location at Coastal Command Headquarters. All Commands, as well as the other Services, were then informed that from henceforth all requests for photographic reconnaissance were to be made direct to this Section who would then be responsible for -

(i) examination of the request from the operational aspect;

(ii) co-ordination of the operation and the intelligence required;

(1) Under W/Cdr. T. N. Mc.Neil, O.B.E., later A.D.I.(P.R.).

V.C.A.S.
146

A.D.I./Ph./3/
Air (passim)

Ibid.
29A
& 30A

Ibid.
47A
and
C.S. 9635
E. 31A

- (iii) submission to the A.O.C.-in-C. Coastal Command of the accepted request in operational form;
- (iv) ensuring that the information obtained was passed as rapidly as possible from the C.I.U. to the Department concerned.

In order to ensure the maximum co-operation, the Officer Commanding No. 1 P.R.U. was also instructed to refer all operational matters to A.D.I.(Ph) at Headquarters, Coastal Command.

For nine months this arrangement worked to the general satisfaction of Coastal Command and Air Ministry, and if occasionally complaint was made by the Admiralty or the War Office that the P.R.U. did not produce all the photographic intelligence required, in most cases the limiting factor was the weather and the range of the aircraft available, and was not due to any lack of co-ordination between the P.R.U. and the C.I.U. One minor change in Air Ministry control during this period, which helped to further co-ordination, was the placing of A.D.I.(Ph) under the control of the Director of Intelligence (Operations) on the 1st July 1942, on the grounds that the majority of its tasks required co-ordination with operational intelligence under a single head.

In November 1942 the officer holding the post of A.D.I.(Ph) (Group Captain P. G. Stewart) was posted to Command the R.A.F. Station, Medmenham, and his place at Air Ministry was taken by the erstwhile head of the A.D.I.(Ph) Section at Headquarters Coastal Command. In spite of the arguments which had led to this Section being located at Headquarters Coastal Command, the new Assistant Director succeeded in persuading the A.O.C.-in-C. that the return of his entire Branch from Coastal Command to Air Ministry would be an equally satisfactory arrangement, and on the 29th November the whole of A.D.I.(Ph) returned to Air Ministry (Monck Street), retaining the same responsibility for co-ordination of photographic reconnaissance requests as they had hitherto exercised from Coastal Command. A.D.I.(Ph) continued to be responsible for the control and co-ordination of all requests for photographic reconnaissance until early in 1944, when the presence of an American Photographic Reconnaissance and Photographic Intelligence organisation in strength in this country made further adjustments in control essential.

(D) Proposed Formation of Photographic Reconnaissance Group

From the early days of the war it had been felt by many that a Headquarters was required to control all the Units concerned with photographic reconnaissance, and that in order to provide an organisation of sufficient size to meet the requirements of all the Services, a Photographic Reconnaissance Group should be formed "to direct and supervise all photographic activities throughout the R.A.F."

It will be remembered that such a proposal was put before V.C.A.S. in October 1940 but met with opposition in various quarters. In different guises and with various adjustments this plan was brought forward at intervals by several Air Ministry Departments and by Coastal Command, but on every occasion there was opposition from some quarter, and it was not until 1944 that the original objective was at last achieved. Nevertheless, the basic arguments put forward in support of such a Group could not be denied at any time, and it was firstly the opposition of the other two Services

C.S.
9635
39A

to the operational control of their requirements by the R.A.F., and secondly the feeling in certain quarters that such a Group was savoured of unnecessary "Empire building", that prevented the plan from attaining fruition at an earlier date.

In May 1941, almost at the moment when the Defence Committee were giving their decision that the P.R.U. would be controlled by Coastal Command, D.D.Photos put forward a Paper to V.C.A.S. and A.C.A.S.(I) recommending that since the Flying and Interpretation Units were part of the same machine they should come under one central organisation and not be placed, as intended, in two separate Commands. In the following

A. D.I.PH. /3/
Air. Intros
E.14A

J.I.C.(41)
312

July a Report by the Joint Intelligence Committee (Sub-Committee) stressed the extreme importance of aerial photographic reconnaissance for intelligence purposes and recommended that the P.R.U. should be confined to "its specific role, namely long-range strategic photographic reconnaissance", and should not be used for visual reconnaissance. Meanwhile, a reconnaissance flight had been provided to meet the requirements of the G.O.C.-in-C. Home Forces, in the event of invasion. This Reconnaissance Flight, No.1416 Flight (later No.140 Squadron) had been formed in March 1941 in Army Co-operation Command, and although its primary role was visual reconnaissance, the aircraft provided - six 'G' Type Spitfires - were each fitted with one oblique and two "split" F24 cameras for special photographic tasks. In August 1941, the C.-in-C. Home Forces agreed with the Chief of the Air Staff that it would be excellent practice for the Flight to take over certain tasks from the P.R.U. These tasks were, however, allotted direct by G.H.Q. Home Forces and details were unknown to A.D.I.(Ph). In consequence, this resulted in an unnecessary duplication of effort and uneconomical use of aircraft and crews.

Moreover, on several occasions during 1941 and 1942 the Navy had cause to request reconnaissances of enemy bases on the Norwegian coast, and whenever enemy fighters were present the Naval authorities stated that the duties were too hazardous to be carried out by the G.R. aircraft then in service in Coastal Command. They were, therefore, forced to rely for both photographic and visual reconnaissance of such bases upon the P.R.U., which created a difficulty in face of the Air Ministry directive based upon the J.I.C. recommendation that photographic reconnaissance aircraft were not to be used for visual reconnaissance unless the requirement was of vital importance. At no time had it been contemplated that the P.R.U. should undertake reconnaissance in areas where the normal type of G.R. and Army Co-operation reconnaissance planes could operate, but it now seemed impracticable to divorce the role of photographic reconnaissance from that of general reconnaissance which, particularly as far as the Admiralty was concerned, were both of equal importance in obtaining rapid intelligence of enemy operations.

C.A.S. Minute
1423
28.2.42

In March 1942 the Chief of the Air Staff called a meeting of the Commanders-in-Chief to discuss the control of the P.R.U.s, including No.140 Squadron, as the result of a complaint from Bomber Command that they "obtained daily photographs of the Scharnhorst and Gneisenau and other targets of a naval nature, whilst for two-and-a-half months they have failed to obtain a single photograph of Huls, to confirm impressions that the blitz there was a particularly successful one". It may be seen from this that each Command and Service which had need of photographic intelligence considered that their claims should have priority over that of any other customer, and all these complaints led to both the A.O.C.-in-C. Coastal Command and the Assistant Chief of Air Staff (Intelligence) again recommending the formation of a Reconnaissance Group, either to carry out both long-range photographic

and visual reconnaissance or as a formation to control all aspects of photographic reconnaissance and photographic intelligence, directly responsible to A.C.A.S.(I) for operations.

A.D.I.Ph/3/
Air (passim)

By this time No.1 P.R.U. had eight operational Flights at Benson, Mount Farm, Wick, Leuchars, St.Eval and Gibraltar, a Maintenance Unit at Benson for conversion of aircraft to full P.R. standards, and a Training Unit in which specially selected G.R. pilots were converted to Spitfires and Mosquitos and given special photographic training. As a first step towards the formation of a Reconnaissance Group, Coastal Command felt that the P.R.U. should put its own house in order, and that Benson should be formed as far as circumstances permitted into an ordinary operational station to take the place of the unwieldy organisation existing there at the time. It should be pointed out that the Commanding Officer of the P.R.U. had control of a unit equivalent to more than four Fighter Squadrons and was responsible direct to Coastal Command, a growth of responsibility which had arisen through rapid development of the P.R.U. without concurrent attempts at re-organisation. To assist in placing the P.R.U. on an orthodox footing, proposals put forward by Headquarters Coastal Command in April 1942 and approved by Air Ministry, included:-

- (i) The formation of a special P.R. O.T.U. - No.8 P.R. O.T.U. - to be formed at the R.A.F. Station Fraserburgh (17 Group) with effect from the 18th May, 1942, to provide P.R. trained pilots for all home P.R. Squadrons and to meet the needs of Overseas P.R. Units formed or about to be formed.
- (ii) The formation of No.1 P.R.U. into five squadrons - Nos.540, 541, 542, 543 and 544; - one Mosquito Squadron, three Spitfire Squadrons and a "miscellaneous" Squadron to include the Gibraltar P.R. Flight and a Night Photography Flight. Although authority for these establishments was given on the 15th August, the actual reorganisation was not completed until October, 1942.
- (iii) The P.R. Squadrons, all located at Benson, to come under the operational and administrative control of the Station Commander, the Wing Commander post previously provided as Commanding Officer of the P.R.U. to be transferred to the Station Staff as Wing Commander Operations.

A.D.I.Ph/2/
Air (passim)

C.O.S.(42)
265

C.O.S.(42)
322

In an endeavour to make a renewed case for the provision of a Reconnaissance Group, early in 1942 the Inspector-General was invited to examine the organisation for the control and operation of the Photographic Units and the C.I.U. with a view to ascertaining whether some improvement in efficiency could be effected by a reorganisation of control and administration. Hardly had this examination taken place than the Chief of Naval Staff tabled a Memorandum before the Chiefs of Staff Committee on the 18th May 1942 recommending that No.140 Squadron should be placed under the operational control of the P.R. organisation. This gave C.A.S. the opportunity he required, and he asked for further time to examine the matter as he had certain proposals to bring forward. As a result, a Paper was put forward to the 196th Meeting of the Chiefs of Staff on the 3rd July 1942 recommending the formation of an independent Reconnaissance Group to include the Photographic Reconnaissance Operational and Training Units including No.140 Squadron, the C.I.U., and strange as it may seem certain other miscellaneous units such as the Special Duty Squadrons and the Meteorological Flights.

C.A.S. in his Paper pointed out that the activities of No.140 Squadron now included operations on the Continent, and in effect there was a repetition of the 1941 situation with two organisations for photographic reconnaissance - P.R.U. and No.140 Squadron. The same difficulties of mutual interference between aircraft of the same units were being experienced and the difficulties of allocating priorities were even greater than before. Furthermore, C.A.S. pointed out that preparations were being made to co-operate with the American P.R. Units soon to arrive in this country, and he was convinced that if economy of force and efficiency of effort were to be achieved an independent Reconnaissance Group should be formed to include all P.R.U. Units and the C.I.U., which step would result in centralisation of control, the existing system of divided administration and control having been found unsatisfactory and uneconomical. This recommendation was backed by the proposal of the Chief of Naval Staff that No.140 Squadron should be included in the P.R.U., and in support of the Paper V.C.A.S. pointed out that unless our P.R. resources were pooled, facilities to meet requirements could not be satisfactorily expanded. C.I.G.S., whilst agreeing with V.C.A.S. as to the necessity for the closest co-ordination of effort, regarded it as essential that No.140 Squadron should remain part and parcel of the Army Co-operation Command. The First Sea Lord stated that he must insist on responsibility for all reconnaissance north of 54°N remaining with the Admiralty, and it was for this reason that he was putting forward a request for a special long-range reconnaissance unit to be formed in Coastal Command to meet the needs of the C.-in-C. Home Fleet. C.A.S. was asked to reconsider his recommendation in the light of the statements made by the First Sea Lord and C.I.G.S., and it was found that neither the Army nor the Navy wished to relinquish any of their authority to a central control, C.A.S. decided to drop his proposal rather than indulge in an acrimonious battle with the War Office and Admiralty. Nevertheless, the Air Staff had it "ever in their mind to make a further attempt to form a Reconnaissance Group if a suitable opportunity arose".

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As might be anticipated, the opportunity soon arose. During the Summer of 1942 No.140 Squadron was engaged in a special task for G.H.Q. Home Forces, carrying out photographic reconnaissance over a large area of France and obtaining data regarding beach gradients in connection with the planning for an invasion of the Continent. This work was hampered by lack of aircraft, and although four Spitfires and a Mosquito from P.R.U. had been lent to the squadron in September, General Paget made a personal appeal to C.A.S. for additional aircraft for his Reconnaissance Squadron. C.A.S. replied - "Requests such as yours seem to me to support the view which I have long held that we can combine maximum efficiency and flexibility with economy only by pooling our resources and forming a Reconnaissance Group. My proposal received no support from you nor from C.N.S.....I am considering raising the matter again".

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But there was already another antagonist in the field who wished to regain control of a Section of the P.R.U. This was the A.O.C.-in-C. Bomber Command. It has already been related that, on several occasions he had complained that the arrangements for obtaining information on bomb damage were unsatisfactory, but the friction between the two Commands reached its height in October 1942 when the A.O.C.-in-C. Bomber Command reminded V.C.A.S. of the agreement made in July 1941 that the question of the control of No.1 P.R.U. might be reviewed if he was not satisfied with the results obtained over a prolonged period. He stated that in his opinion as long as he was precluded from direct control of the

Bomb Damage Assessment aircraft he would not obtain the results necessary to enable him adequately to direct his bombing policy. Although the shortcomings to which the A.O.C.-in-C. alluded were caused, in most cases, by bad weather conditions alone, and no mention had been made of the many successful sorties carried out by the P.R.U. on behalf of Bomber Command, V.C.A.S. decided to permit a change of organisation in the P.R.U. Hitherto there had been three Bomb Damage Assessment Flights, one Flight in each of Nos. 541, 542 and 543 Squadrons, earmarked primarily for this task and allotted a specified area of responsibility. On the 28th October, 1942, V.C.A.S. requested the C.-in-C. Coastal Command to arrive at an agreement with Bomber Command to meet operational needs for photographic reconnaissance, either by forming a Special Bomb Damage Assessment Unit under a Commander designated by the A.O.C.-in-C. Bomber Command and controlled by him, or by the appointment of an officer, selected by Bomber Command, to No. 1 P.R.U. to issue instructions for bomb damage assessment direct to the appropriate Flights. As was to be expected, the A.O.C.-in-C. Coastal Command would not agree to a Special Bomber Command Flight unless there was a complete separation of authority, as in the case of No. 140 Squadron, and he pointed out that in the second alternative there was a considerable amount of danger incurred if a Bomber Command officer could order P.R. sorties without co-ordination with coastal and fighter operations. As the C.-in-C. Coastal Command was quick to realise, the arrangement asked for by Bomber Command cut right across the recommendations of the Air Staff for a centralised control, and after further discussion between the interested parties the matter was left sub judice.

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Early in 1943, for reasons which have nothing to do with this narrative, the Director of Intelligence (Liaison) put forward a proposal for the formation of an R.A.F. Group or other operational staff to co-ordinate the work of the Special Duties Squadrons engaged in clandestine operations in Europe. Their position was somewhat analogous to that of the P.R. Unit, in that they were both in operational commands who took little interest in their work and had no specialist knowledge of their tasks. This proposal brought forth a recommendation to V.C.A.S. from A.C.A.S.(P) and A.C.A.S.(I) that the time was now opportune to reintroduce the subject of a Reconnaissance Group which could include not only the P.R. Units but also the Special Duty Squadrons. After a study of the proposals, and discussions on a high level, V.C.A.S. suggested that the immediate object to improve the efficiency of P.R.U. might well be achieved without going to the extent of forming a new Group Headquarters, but that he would ask the Inspector-General to report on the whole problem. In the meantime he was in favour of upgrading the post of the Officer Commanding the R.A.F. Station Benson, as had already been suggested by the A.O.C.-in-C. Coastal Command, so that he might be made responsible for the general co-ordination and supervision of the operation of P.R. Units throughout the United Kingdom.

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Air

A.C.A.S.(P)
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V.C.A.S. was then presented with some independent criticism of the P.R. organisation through the medium of a minute, written by Dr. Merton of the Ministry of Supply, alleging that a "lack of co-ordination in the P.R. organisation prevented obtaining the best results." V.C.A.S.'s answer to this charge was that he was willing to agree that there was room for improvement in the P.R.U. and an immediate strengthening of the establishment at Benson had been recommended with this in view. The proposals put forward, in various guises, for the formation of one operational Group to

bring together P.R.U. and C.I.U. were still under discussion but apart from opposition in certain quarters "the position of C.I.U. was delicate and the susceptibilities of the other Services were involved."

The Inspector-General made a full investigation and report into the problem, after which he recommended an alternative proposal put forward by V.C.A.S. to establish a separate functional Wing Headquarters under which the C.I.U. and P.R.U. would be controlled, to be commanded by an Air Commodore at Benson. This recommendation was submitted to the Secretary of State for approval on the 6th June, 1943, who agreed that an autonomous Wing should be formed to control the activities of photographic reconnaissance. V.C.A.S., however, decided to visit the Units concerned before giving the final authority for the formation of the Wing, and after further discussions with A.C.A.S.(I) he reached the conclusion that it would be premature to include the C.I.U. in the P.R. Wing until experience had been gained as to what could be done on a basis of co-operation, as although better co-ordination was needed, the authority that could be exercised by the Wing would be very limited. He suggested, therefore, that the Wing should be allowed to concentrate on improving P.R.U. operations, whilst demanding the closest contact with C.I.U. and that the Air Ministry should continue to rely upon A.C.A.S.(I) for operational direction of both Units. It was intended that the Air Officer Commanding the new Wing should have operational control of all P.R. Units in the United Kingdom, but in addition that there should be a Station Commander at Benson so that the local administration of the P.R. Units should not be a burden upon the Wing.

On the 26th June, 1943 instructions were given by Air Ministry that No.106 P.R. Wing was to form forthwith at the R.A.F. Station, Benson, to compose:-

- (i) The R.A.F. Station, Benson.
- (ii) Five P.R. Squadrons - Nos. 540 ~~and~~ 544.
- (iii) No. 309 Ferry Training and Air Despatch Unit, already at Benson (used to prepare P.R. aircraft for overseas and to train P.R. pilots in ferrying duties).
- (iv) No. 8 P.R. O.T.U. Dyce.

The officer selected to command the new Wing was the one already chosen to fill the temporarily upgraded post of Station Commander at Benson - Air Commodore J. N. Boothman, A.F.C. It was decided that the Wing should be given the responsibility for the operational control and training of all its Units, but that the operational policy was to remain under the direction of A.C.A.S.(I) acting through Headquarters Coastal Command.

(E) Formation of No.106 (Reconnaissance) Group and the Joint Photographic Reconnaissance Committee

The new P.R. Operational Wing Headquarters was found satisfactory in practice for the first six months of its existence, and though the control of C.I.U. was still operated independently the co-ordination between the two Units was excellent.

Co-ordination with the U.S.A.A.F. on the subject of photographic reconnaissance requirements was also excellent during 1943. The American co-operation is described more fully elsewhere, but the situation is briefly outlined here in

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order to understand the circumstances leading up to the formation of a Reconnaissance Group. The U.S. 7th Photo Group was located at Mount Farm in order that its Commanding Officer should be in constant touch with the A.O.C. of 106 Wing, and U.S. Controllers were employed upon the Wing staff. Photographic reconnaissance tasks for the U.S. Air Forces in the United Kingdom were handled, as with the other Services, by A.D.I.(Ph), and although American requirements were carried out as far as possible by the American P.R. Wing, a very close liaison was maintained between Benson and Mount Farm to avoid a duplication of effort. American photographic interpreters were attached to the C.I.U. at Medmenham, and by the end of 1943 no less than 60 U.S. officers were employed there, all information and resources being pooled for the joint use of both the American and British Air Forces.

The Americans, however, were building up their P.R. organisation preparatory to the invasion of the Continent and had planned that their 7th Photo Group should become a part of a newly-formed Command - the 8th Reconnaissance Wing - whose purpose was to organise and control all P.R. requirements of the U.S. forces in the U.K. To command this new Reconnaissance Wing Lieut.-Col. Elliot Roosevelt, (who had been in command of the 3rd Photo Group of the U.S. 12th Air Force in the Mediterranean and the North African P.R. Wing), was transferred to England where it was proposed that he should command the new Reconnaissance organisation directly under the control of the Commanding General, United States Strategical Air Force. In January 1944 these changes were begun and General Doolittle made it known that he would require more direct control of P.R. facilities for the 8th Air Force and that as his American personnel at C.I.U. were not under his effective control he proposed to withdraw them to form the nucleus of a U.S. P.R. and P.I. organisation at Pinetree, whence all American P.R. aircraft in the United Kingdom would be controlled and all phases of interpretation carried out.

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At the request of U.S.S.T.A.F. a meeting was called at Air Ministry to hear the American proposals. This meeting, which took place on the 3rd February, 1944, was presided over by A.C.A.S.(Ops) and attended by representatives of No.106 Wing, D. of I.(O) and A.D.I.(Ph) for the R.A.F., and by Colonel Elliot Roosevelt and other representatives for U.S. Strategical Air Force and the 8th Air Force. Colonel Roosevelt, on behalf of U.S.S.T.A.F., outlined the proposed organisation, which included a new American C.I.U. to centralise all photographic intelligence for American consumers and to take over the production of all target material for U.S.S.T.A.F. It was considered that it would take 45 days for the new organisation to become fully operational. This in itself was alarming, when considering that the target date for "Overlord" was less than four months ahead. It was pointed out that the American proposal would result in a loss of efficiency both in C.I.U. and in the American organisation which would be difficult to overcome before D-Day. A commensurate reduction of C.I.U. commitments would not be brought about as a result of a separation, and the withdrawal of the 60 U.S. officers from Medmenham would need compensating by the addition of at least 30 R.A.F. officers, who could not be produced at short notice. In addition, there would be an increased consumption of photographic materials through separation, since additional sets of prints of every reconnaissance would have to be supplied to both British and American C.I.U.s, and duplication of all existing P.I. records would also be essential, quite apart from the administrative difficulties of housing the separate American Unit and providing adequate machinery and

equipment. It was difficult to appreciate the U.S. requirement for independence, since where British and American forces were operating over the same main areas they both required the same strategic intelligence and their operations were planned as one at higher formations by combined staffs. The Americans undoubtedly had a legitimate complaint in that they had no share in the control of the C.I.U., but this could be achieved without a split in the organisation. From every point of view, the best way of achieving the requirements of the Americans was through the medium of an Anglo-American Reconnaissance Group of which there had already been an excellent example in the Mediterranean Allied Photographic Reconnaissance Wing. For the next two weeks negotiations continued between D. of I.(O) and U.S.S.T.A.F., but Colonel Roosevelt remained adamant that he must have a separate C.I.U.

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On the 16th February the Permanent Under-Secretary of State for Air was invited to lunch with His Excellency the U.S. Ambassador and General Carl Spaatz, Commanding-General of U.S.S.T.A.F., for the purpose of discussing the question of an independent American P.R.U/C.I.U. organisation. Briefed by D. of I.(O), P.U.S. attended the luncheon. It should be mentioned here that he was accompanied by the Senior Interpreter of the C.I.U., who was attending at the express wish of the U.S. Ambassador. Strange as it may seem that so junior an officer should attend an Ambassadorial Luncheon, the reason for this became apparent at a later date. General Spaatz made it clear to P.U.S. that he was not prepared to apply to Air Ministry (A.D.I.(Ph)) for permission for photographic reconnaissance to be undertaken by his own Units, and asked for a greater measure of control, but he did not appear anxious to remove his interpreters from C.I.U., as had been proposed by Colonel Roosevelt, provided that first phase interpretation was available at his Headquarters as soon as possible after an attack. The two incompatible requests, both emanating from authoritative representatives of the U.S.A.A.F., placed Air Ministry in rather a quandary, particularly as Colonel Roosevelt, upon being approached by D. of I.(O), repudiated General Spaatz' more moderate view of American requirements and stated categorically that he would not be satisfied with anything less than an independent American C.I.U. established at some place other than Medmenham. During the whole of these negotiations, although they had been conducted in an atmosphere of cordiality, there had been nothing in writing from U.S.S.T.A.F. and at the end of February it still seemed impossible to reach an agreement which would meet the American requirements without detriment to the joint war effort.

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C.A.S., who was formally opposed to any action that would tend to disintegrate the C.I.U. or prejudice its capacity for the efficient performance of its role for both British and American forces, asked General Spaatz to meet him on March 1st, in an endeavour to determine the real American requirement. C.A.S. pointed out that a split in C.I.U. would have the most serious repercussions upon the success of "Overlord" and attacks upon enemy industry, in which photographic intelligence was playing so large a part. General Spaatz undertook to see that there should be no splitting of C.I.U., and it was obvious that he only wished for three things:-

- (i) more direct control of his P.R. Group and additional interpretation services at the Headquarters of the 8th Air Force;
- (ii) an efficient Field organisation for photographic reconnaissance requirements of the 9th U.S. Air Force on the Continent;

(iii) the American representation in the joint P.R. organisation, and in particular in the C.I.U., to be as complete as possible so that in the event of removal of the U.S. forces to another theatre they would have the essentials of a complete P.R. organisation capable of operating independently.

These requirements were very different from those put forward originally by Colonel Roosevelt, and V.C.A.S. instructed that everything practicable should be done to assist the Americans to these ends.

The A.O.C. No.106 Wing and D. of I.(O) accordingly drew up a plan to meet General Spaatz' requirements, outlining a Photographic Reconnaissance organisation with posts for British and American officers so that they might exert an equal sphere of influence. The main point of the plan was the integration of 106 Wing and C.I.U., together with its associated Units, into one centralised R.A.F. Command empowered to co-ordinate the forces under its control with those of the 8th Reconnaissance Wing.

Negotiations were then resumed on this basis with U.S.S.T.A.F. through Colonel Roosevelt and Colonel Macdonald, U.S.S.T.A.F. Director of Intelligence, but the Americans did not appear fully to appreciate the problem, either administratively or operationally, and the negotiations dragged on for several more weeks.

It should be mentioned here that Colonel Roosevelt's attitude was considered peculiar by various R.A.F. representatives with whom he had discussions, and it was later ascertained that his reaction was rather more violent than it might otherwise have been by virtue of the fact that he resented the interference of the U.S. Ambassador in the controversy and felt that he had been "approached by some member of the Air Staff. When it was discovered that this theory was unfounded, he made further enquiries and it was then revealed that the Senior Interpretation Officer at Medmenham was the unwitting cause of the ill-feeling. Having met the American Ambassador he presumed on his acquaintanceship to the extent of telling his Excellency the trouble being experienced at the C.I.U. as a result of the proposed withdrawal of its U.S. personnel, which resulted in Mr. Winant telephoning Colonel Roosevelt and informing him that the action he was taking "might jeopardise the whole future of Anglo-American relations." It was unfortunate that this personal interference made more difficult the negotiations between the R.A.F. and U.S.S.T.A.F. before final agreement was reached in the formation of a Reconnaissance Group.

Nevertheless, at the end of March a Directive was issued empowering the Commanding Officer of the 8th Reconnaissance Wing(1) to co-operate with the A.O.C. No.106 Wing in working out the organisation necessary to obtain the best results from co-ordination of the efforts of U.S. and R.A.F. P.R. resources. The proposal to form a centralised R.A.F. Command was then accepted by Colonel Roosevelt, and it was agreed that this Command should be formed from the nucleus of 106 Wing and be known as No.106 (Reconnaissance) Group. It was then ascertained that the American authorities proposed to go direct to such a Group with their requests for photographic reconnaissance tasks as they had no intention of asking Air Ministry "for permission to despatch their own aircraft on missions". This created an anomalous position for the R.A.F.

(1) Later re-numbered 325 Reconnaissance Wing.

since if they continued to apply to A.D.I.(Ph) for their photographic requirements someone at 106 Group Headquarters would have to co-ordinate these requirements with those received direct from U.S.S.T.A.F. In effect, this would mean two A.D.I.(Ph) organisations, one at Benson and one at Air Ministry. It was necessary, therefore, to have at Benson a body which could make immediate decisions regarding the priority of photographic sorties and the Unit which was to undertake them. Air Ministry agreed to locate alongside the operational Headquarters an Inter-Service and Inter-Allied body which would take over the functions of A.D.I.(Ph) and be responsible to the Joint Intelligence Committee. This body was to have serving on it representatives of all three Services and to co-opt on an equal footing representatives of the American Fighting Services, who would jointly examine all requests for photographic reconnaissance and allot tasks to the A.O.C. of No.106 Group, for implementation. This new body was given the title of the "Joint Photographic Reconnaissance Committee" (J.P.R.C.).

With effect from the 15th May 1944 the two organisations came into operation. No 106 (Reconnaissance) Group was formed for the co-ordination of all photographic intelligence activities in the United Kingdom other than those undertaken by the Allied Expeditionary Air Force, and comprised all those Units previously controlled by No.106 Wing and, in addition, the newly-titled Allied Central Interpretation Unit. The Joint Photographic Reconnaissance Committee was formed in the place of A.D.I.(Ph) insofar as concerned photographic reconnaissance and intelligence in the European theatre, but it was agreed that the R.A.F. members of the Committee should continue their function as A.D.I.(Ph) in respect of general P.I. matters affecting the R.A.F. The J.P.R.C., as a sub-committee of the Joint Intelligence Committee, was a non-operational body and thus could not control operations. The A.O.C. of No.106 Group was given operational responsibility on behalf of the J.P.R.C. and empowered to appoint as Chairman of the Committee any member of it, British or American.

By agreement with the Commanding General, U.S.S.T.A.F., the A.O.C. No.106 Group was also responsible for co-ordinating the work of the forces under his control with that of the U.S. 8th Reconnaissance Wing and for arranging the mutual allocation of flying tasks and production facilities as and when the requirements of either formation made it necessary, and for this purpose he was to carry on his staff certain officers of the U.S.A.A.F. The administration of the Group remained with Coastal Command but its operation was now completely divorced from any Command.

Thus the long struggle for a representative Operational Reconnaissance Headquarters to control all P.R. and P.I. seemed complete, even though a completely independent Group had not been achieved, but there was to be one more clash of personalities before the Group finally settled down to carry out its responsibilities. When everything appeared to be settled to the satisfaction of the U.S.A.A.F. and R.A.F. alike, U.S.S.T.A.F. again raised the "bogey" of separate photographic intelligence, and threatened to withdraw from their participation in the joint organisation of J.P.R.C. There appeared to be no adequate reason for this last minute change of mind, but upon investigation it was found that the Americans were not prepared to co-operate with an organisation of which the senior R.A.F. member was the officer then holding the post of A.D.I.(Ph). Colonels Macdonald and Roosevelt were emphatic upon this point, and without any reflection upon this officer's undoubted capabilities it was realised that as he was not persona grata with the Americans it would be folly to inflict

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him upon them. As soon as U.S.S.T.A.F. were informed of his withdrawal from the J.P.R.C. in favour of the S.A.S.O. of No.106 Group they withdrew all their objections. From thenceforward the organisation functioned smoothly and with complete co-operation until the withdrawal of the American Photographic Reconnaissance organisation from the United Kingdom after victory in Europe had been won.

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et sequa

In spite of this, during the course of the European war still one more attempt was made to modify the organisation. In January 1945 the A.O.C.-in-C. Coastal Command put forward recommendations for further reorganisation of No.106 Group. He pointed out that the existence of an Operational Group within a Command which had no authority to direct the operations of that Group could not be wholly satisfactory by virtue of the fact that either the Command was uninterested in the activities of a Group for which it had no operational responsibility, or felt diffident about offering advice or direction for fear of trespassing upon the preserves of those who were operationally responsible. He therefore recommended that either a Reconnaissance Group should be established independent of any Command, or that entire responsibility should be vested either in his or another operational Command.

The opinions of the Assistant Chiefs of Air Staff and of D.G.O. were sought by V.C.A.S. on the points raised. The consensus of opinion was that whilst No.106 Group was a very specialist organisation and did not fit into any Command, for the rest of the war it would suffer least by being controlled under existing arrangements, and the A.O.C.-in-C. Coastal Command was informed accordingly.

It must always be remembered when reading the foregoing description of the evolution of the Photographic Reconnaissance organisation that it was in a peculiar position, being required to serve all Branches of the Fighting Services as well as a number of Government Departments, and these requirements were affected independently by the needs of other Services and the calls of higher strategy. Had the organisation been on a larger scale it is almost certain that it would have become an independent, self-administered Command, and there is no doubt that in the post-war period every endeavour will be made to reorganise photographic reconnaissance on more orthodox lines. The system of control was evolved gradually throughout the war and had to be largely dictated by operational expediency. Undoubtedly there were disadvantages in the system, but so rapid was the growth that it was difficult to see what could have been done to improve the control without affecting, still more than it did, the susceptibilities of the R.A.F. Operational Commands, the other Services, and the U.S. Air Forces.

3. TECHNICAL DEVELOPMENTS IN PHOTOGRAPHIC
RECONNAISSANCE

(A) Photographic Reconnaissance Aircraft - Development and
Increase

The latter half of 1941 saw an increase of photographic reconnaissance aircraft in No. 1 P.R.U. and the production of a new aircraft - the Mosquito.

J.I.C.(41)
draft 114 and
J.I.C.(41) 312.

The Joint Intelligence Committee at their meeting on the 30th July paid tribute to the work of photographic reconnaissance stating that "We have practical proof⁽¹⁾ of the value of air photography as this enabled the front of the German attack on 10th May 1940 to be predicted with accuracy more than one month before the attack took place". In view of this value they draw attention to the need for the "long range" type of aircraft for future requirements, and whilst the threat of invasion remained, the increased scale of effort required. To meet these needs the Committee recommended that the highest priority should be given to the provision of special P.R. aircraft, and that all future deliveries of such aircraft should be of the "long range" variety.

The first special P.R. Spitfire (D. Spitfire prototype)⁽²⁾ which had been operating from Benson since October 1940 was lost over Italy early in 1941, but not before a second prototype aircraft of the same Mark had been produced and prepared for operations. During the summer of 1941 the normal production models of P.R. Spitfires began to be delivered from the factory direct to Benson, where cameras were fitted and final preparations made for their operation. Until 1941 all Marks of Spitfire used for photographic reconnaissance were unprovided with heating of any description and pilots suffered from the intense cold experienced at very high altitudes. During February 1941 the installation of Merlin 45 engines in P.R. Spitfires was begun, and with this installation a cockpit heater was fitted. It was generally agreed that this improvement had a greater effect on the morale of the pilots than had any other modification to date. The P.R. Spitfire, however, still had certain drawbacks and whole sections of enemy-held country were beyond its range, whilst the very fact that it was a single-seater and had no wireless installation had obvious disadvantages.

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No. 1 P.R.U.
records.

In August 1941 some of these disadvantages were overcome by the introduction of a new photographic reconnaissance aircraft - the Mosquito Mark I. In December 1939 a model of this new two-seater, high-speed, unarmed reconnaissance bomber had been introduced by De Havillands. Fifty of these aircraft were ordered by Air Ministry for trial purposes, and in November 1940 the Air Staff decided that one role of the new aircraft should be that of photographic reconnaissance. The following month, twenty P.R. version Mosquitoes were authorised, to form part of the initial order of fifty. Two of these aircraft (W.4055 and W.4056) were delivered to No. 1 P.R.U. at Benson during August 1941 and after the installation of cameras the first Mosquito photographic sortie was undertaken on the 18th September. This was unsuccessful owing to

(1) It is not clear to what air photographs this refers, but aerial photographs taken from French bases during April/May 1940 gave indications of the enemy movements towards the Low Countries. See Vol. I.

(2) See Volume I, page 201.

electrical trouble, but on the 20th September a successful operation was undertaken by a P.R. Mosquito⁽¹⁾ covering the Bay of Biscay and Bordeaux.

The Mosquito was found to be capable of great speed, and being of longer range and endurance than the Spitfire⁽²⁾, enabled photographs of objectives to be taken which had never before been covered. Other advantages of this aircraft were the improvement in navigation and target location consequent upon the provision of a navigator, additional cameras and wireless aids.

The introduction of V.H.F. to P.R. aircraft during the Autumn of 1941 was of great benefit to P.R. pilots and by the end of 1941 work had been completed upon the fitting of this device new to P.R. Spitfires.

Within six months of the first operational sortie of a P.R. Mosquito a further eight aircraft were delivered to Benson direct from the Hatfield factory, and upon the amalgamation of Nos. 1 and 3 P.R.U.s a new establishment was drawn up for the reconstituted No. 1 P.R.U. consisting of:-

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1941.

Spitfires Mk. V and 'G' Mk. I - 25 + 5,
Mosquitoes - 5 + 3,
Blenheims - 5 + 3,
Marylands - 2 + 1,
(for Gibraltar flight)

In addition to the long range P.R. (D) Spitfires Mk. V. the armed Spitfire I - 'G' Type (afterwards replaced by the Mark VII) was used for photography in cloud conditions and at low altitudes.

By April 1942 a daily average of 49 aircraft was available to No. 1 P.R.U., the bulk of them 'D' Type Spitfires, and the average daily sorties had increased from 4.1 (April 1941) to 9.6. The Mosquito began to replace the Spitfire on most of the longer reconnaissance sorties, enabling flights to Norway and the furthestmost German Baltic ports to be carried out on a routine basis. A Mosquito Flight for these operations was allocated to Leuchars and took over a considerable amount of the work previously performed by the Spitfire detachment at Wick.

In July 1942 when there were six P.R. Mosquitoes at Leuchars and seven Spitfires at Wick, the Admiralty began to press for an extensive reconnaissance of the Norwegian coast to obtain all possible information about enemy shipping, preparatory to raiding coastal defences during the autumn and winter. They complained that there were insufficient P.R. aircraft to carry out their requirements and pressed for an increase in establishment. As a matter of fact, in addition to six long range Mosquitoes which were capable of a safe range of 2,350 miles, a total of 47 'D' Type Spitfires was available in the P.R.U. which could undertake a trip of 1,700 miles and were thus capable of reaching Trondheim, Oslo and Stettin from a northern base. A shortage of aircraft was not the limiting factor, therefore, in carrying out the Admiralty requirements, but it was agreed that weather was the greatest drawback to successful sorties and there was an insufficient number of Mosquitoes to take full advantage of the favourable weather,

(1) Pilot-Flt/Lt. Taylor.

(2) Spitfire 'D' type - Safe range of 1700/1800 miles.
Mosquito Mark I - Safe range of 2,350 miles.

particularly as those in service suffered from a high unserviceability rate. The Air Staff therefore agreed to increase the Mosquito establishment by three more Bomber/P.R.U. types fitted with long range tanks.

In October 1942 when No. 1 P.R.U. was reorganised into five squadrons, Nos. 541, 542 and 543 Squadrons were each equipped with 12 + 4 Spitfires Mark IV, as well as 4 armed Spitfire 'G's, whilst No. 540 Squadron was to be the first Mosquito Squadron equipped with 9 + 2 Mosquitoes. The planned target force for P.R. Squadrons in the United Kingdom to be reached by 1944, was then estimated at 2 Squadrons each of Mosquitoes and Spitfires, all of 16 + 4 aircraft, to be increased to five Squadrons, by the addition of another Mosquito squadron in early 1945. The performance of the Mosquito had been improved during 1942 by the replacement of the original Merlin Mark 21 engines by Mark 23's, and by the introduction of a new type - the Mosquito Mark IV. It was the intention that No. 540 Squadron should be re-equipped with Mark IV Mosquitoes as soon as these were available, whilst yet a third model - the Mosquito Mark IX - was scheduled to be in operation before the end of 1942.

By the end of 1942 the Spitfire IV was becoming rapidly outmoded, and was replaced by the Spitfire IX, which only showed a very slight improvement. The superior performance of enemy fighters, such as the Me.109G over these existing Spitfire models made it necessary to consider a change of long-term programme, although the Spitfire Mark XI was already scheduled to replace the earlier types. In December therefore, D.D. Photos put forward a suggestion to the Air Staff that the P.R.U. should be converted to 100% Mosquitoes. A reason in support of this proposal was the fact that the provision of P.R. Spitfires encroached upon fighter production, as each P.R. Spitfire represented 133% more manhours, as compared to the fighter Spitfire, owing to the fitting of the special wings. A.C.A.S.(TR) expressed the opinion that the new Mosquito Mark IX fitted with Merlin 61 engines would do all that was required for photographic reconnaissance, and accordingly V.C.A.S. agreed that provided the Mosquito wooden construction could withstand hot climates, 90% of P.R. Spitfires should be replaced by Mosquitoes. The remaining 10% were to be Spitfire XIs allocated for tasks for which a Mosquito was unsuitable or uneconomical. The production line was to be adjusted accordingly, and it was considered that the change-over could take place by September 1943.

In March 1943, however, the A.O.C.-in-C. Coastal Command, made a vigorous protest against this decision which had not been communicated to him officially. He asked that Nos. 540-543 Squadrons should become a pattern of 2 Spitfire Squadrons and 2 Mosquito Squadrons for the following reasons:-

- (i) The quicker rate of climb of the Spitfire gave shorter warning of approach to enemy R.D.F. systems thus reducing the risk of interception on short range tasks.
- (ii) Greater manoeuvrability and smaller size of the Spitfire facilitated evasion of enemy fighters at high altitudes and decreased vulnerability to A.A. fire at low altitudes.
- (iii) The small size and the comparative quietness of the Spitfire increased the chance of passing undetected through enemy R.D.F. network, sound location, and visual reporting systems.

ACAS(P)
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142
(Passim)

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Quite apart from the fact that the Spitfire was more economical than the Mosquito for short range tasks, he felt that there would always be a need for a single-engined P.R. aircraft for low altitude tasks. In addition, he pointed out that the P.R.U. was not supplied with sufficient Mosquitoes to maintain its ever increasing commitments, and asked for the production of Spitfire XIs. to be increased and speeded up. The Air Staff weighed up these arguments very carefully and decided that there was justification in asking for the retention of Spitfires for Photographic Reconnaissance. In spite of a complaint from A.M.S.O. on the conflicting views that had been expressed on this point, V.C.A.S. ruled that the Spitfire XI production must be increased, even at the cost of future fighter production. By September 1943 the Spitfire Mark IV had been relegated to training, and Nos. 541 and 542 Squadrons had begun re-equipment with the improved Spitfire Mark XI. In addition they held Spitfires Mark XIII for low flying photography, as successors to the old Mark VII. As both Spitfire and Mosquito squadrons were now re-equipping to the new establishment of 20 aircraft per Squadron, the 1943/44 target had been reached, and in consequence No. 543 Squadron was disbanded as surplus to the target total of P.R. Squadrons.

By the Autumn the needs of A.E.A.F. and 2nd T.A.F. were coming to the fore. P.R. Squadrons were needed for the invading air forces and the Mosquito was required for a variety of vital tasks. The photographic reconnaissance needs of A.E.A.F. were assessed by them at 100 aircraft - 50 Spitfires and 50 Mosquitoes - and it was difficult to see how these needs could be satisfied except at the expense of No. 106 Wing. The A.O.C. 106 Wing agreed that provided 2nd T.A.F. did not require to utilise the P.R. effort of his Wing he could sacrifice one Squadron of Mosquitoes from his ultimate target. In other words, provided 2nd T.A.F. could obtain all the photographic information they might require with whatever force of P.R. aircraft they might have, the needs of No. 106 Wing could be fulfilled by the four Squadrons then in existence - forty Mosquitoes and forty Spitfires.

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(passim)

A.C.A.S.(P)
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(passim)

The A.O.C. in C., Coastal Command, having obtained his wish for retention of the Spitfire in the P.R.U., then began to press for an improved type of single-engined aircraft for the Spitfire Squadrons in No. 106 Wing. In a letter dated October 1943, he stressed the importance once again of the single-engined aircraft being maintained in service for P.R. Squadrons, pointing out that they were often unmolested in areas which provided a warm welcome for twin-engined aircraft. It should be mentioned here that the speed at height of the Spitfire XI was so much greater than that of previous types that tactics had to be altered to make full use of its improved performance. It was found that the higher this type flew the greater was its superiority over enemy fighters, such as the FW.190 and the Me109G, and pilots using these new tactics sometimes flew as high as 42,000 feet. Medical authorities had proved that pilots suffered considerable discomfort, with resultant loss of efficiency, when flying between 38,000 and 40,000 feet. The A.O.C. in C. therefore pressed for all P.R. single-engined aircraft to be provided with pressure cabins, an improvement already in course of incorporation in the latest Mark of Mosquito - the Mark XVI. In addition, he felt that 50% of Spitfires should have Griffin engines installed, for the reason that these gave superior speed and altitude in medium range sorties over heavily defended areas, which would tend towards greater security. Investigations by M.A.P. showed that two existing types - the Spitfire X with pressure cabin, and the Spitfire XIV with Griffon engine - could be modified for P.R. work, and it was

agreed to allot ten of each kind to No. 106 Wing as soon as they could be made available, to be used for special missions which justified the highest performance.

By this time it was known that the enemy was making headway with the provision of jet-propelled fighters and that constant development would be required if our P.R. aircraft were not to be outclassed by them. It should be recorded here that when eventually the enemy used jet-propelled fighters in the summer of 1944, they outclassed our P.R. aircraft in speed alone.

By early 1944 P.R. Squadrons were supplied with the Mosquito XVI, capable of a range of 2,090 miles at 30,000 feet when fitted with two drop tanks. This in its turn was replaced by the Mark XXXII, whose performance showed a great advance on previous marks, and by the end of the European war in 1945 the Mark XXXIV fitted with Merlin 114 engines and capable of longer range than any of its predecessors had already proved its worth. These last three models were all fitted with pressure cabins, with a consequent increase of comfort for the crew which resulted in increased efficiency.

During the later half of 1944 however, the use of the enemy jet-propelled fighters caused heavy losses of Mark XVI P.R. Mosquitoes⁽¹⁾, and additional tasks were therefore given to Spitfires, fitted with larger drop tanks to increase their range for the purpose. The newer types of Spitfire in use in 1944 were Marks X and XI - capable of a range of 1,290 miles at 30,000 feet without drop tanks - and the Spitfire XIX which came into use towards the end of 1944. This latest model had a pressure cabin, Griffin 65 engine and five-bladed propeller, and though it was only capable of a range of 950 miles without drop tanks, a later production model introduced before the end of the war in Europe had improved its performance to a safe range of 1,160 miles, by the introduction of 20-gallon fuel tanks built into each main plane. This mark however had one drawback in connection with the heating of the camera compartments, which could not be regulated owing to difficulties connected with the pressure cabin.

No mention has been made here of the excellent work accomplished by the various types of aircraft which had, perforce, to be adapted by overseas Commands to meet their Photographic Reconnaissance requirements owing to lack of specialist P.R. aircraft in the years up to the end of 1942. These will be dealt with in the appropriate overseas sections, but cannot be regarded in the light of technical developments in Photographic Reconnaissance since they were for the most part necessary makeshifts.

Reference should be made, however, to the excellent photographic work carried out by the Mustangs and Typhoons of 2nd T.A.F. (previously Army Co-operation) Squadrons in their somewhat limited tactical sphere.

It is a tribute to the Spitfire and Mosquito that they should have remained throughout the war the best and most suitable aircraft for strategic photographic reconnaissance. Only twice did the enemy succeed in introducing a fighter which was a match for them and gave a superior performance.

(1) In September 1944 the percentage of losses per sortie over Germany rose to 2.95%.

It was found possible to regain the ascendancy in 1943, and there is no doubt that we should have done so again in 1944, had the war not been won before jet-propelled aircraft were available for photographic reconnaissance work.

B. Air Camera Developments

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None of the successes achieved by each new and improved type of P.R. aircraft could have been possible without a corresponding improvement both in the air camera and its installations. The development of British air cameras followed closely upon the changes in operational types of aircraft used for photographic reconnaissance and the varying tactics that they employed to obtain photographs of a diversity of targets.

With the confirmed efficiency of the high performance fighter for photographic reconnaissance work, typified first in the Spitfire and a little later in the Mosquito, it was obvious that the original type F24 camera with which they were fitted was inadequate for obtaining completely satisfactory results at the high altitudes at which reconnaissance was carried out by these aircraft. The difficulty of interpretation on the very small scales obtained from F24 cameras made it necessary to provide lenses of longer focal length and negatives of larger size. The magazine capacity of the F24 was only 125 exposures, which did not allow for the amount of photography per sortie of which the long-range aircraft were capable.

To meet the demand for improved photographic equipment, the F8 camera was re-introduced into the Service in April 1940, although several months elapsed before the new camera came into general operational use.

The original F8 Camera had been produced in 1926 to meet a limited survey requirement. Only a small number had been made, and owing to the high cost of production these had been allowed to drift out of the Service.

In early 1940 a few were discovered in India, brought home and after reconditioning at the Royal Aeronautical Establishment they were handed over to the P.R. Unit. The F.8 was fitted with either 20" or 36" lens, and in August 1941 it was further improved by the provision of a magazine capable of taking up to 250 exposures. This was followed, in January 1942, by the F52, which had an advantage over the F8 in having a gear box practically identical with the F24, which simplified production problems. It gave contact print of 7" x 8 $\frac{1}{2}$ ", as compared with the F24's 5" x 5" and a scale of 1/10,000 at 30,000 feet, the minimum scale suitable for adequate and detailed interpretation. The F52 employed lenses of 14", 20" and 36" focallengths, and in May 1942 it was fitted with a larger magazine capable of taking up to 500 exposures.

To supply the ever-increasing need of photographic reconnaissance under difficult weather conditions and to provide the best possible photographs of varying types of target, many new camera installations were evolved. The original installation in the Spitfire was two F24 vertical cameras, one in each wing, while the low-level Spitfire G was fitted with two F24 vertical cameras and one F24 14" oblique. The original installation in the Mosquito was one vertical F8 20" and one F24 8" or 14" oblique, but before long the addition was made of a "split" pair of F24 cameras arranged at angles from the vertical to take pairs of photographs with a 60 per cent overlap. The longer focal length cameras

presented a new problem of installation as they were too large to fit into the wings, and space had to be found for them in the fuselage.

On the types of Spitfire used during 1941 and 1942 and on the Mosquito I it was only possible to install a single vertical long focal-length lens camera for assessing bomb damage. This meant that the area covered was comparatively narrow owing to the large scale required for damage assessment photographs. The long focal-length lens camera was used to photograph the objective, therefore, whilst a pair of "split" F24s operated simultaneously to obtain smaller scale cover over a wider field. The longer the focal lens the narrower the cover obtained became, so to increase the lateral cover a method of installing "split" long focal-length lens cameras was successfully introduced into the Spitfire Mark XI and the Mosquito IX, both of which were first used operationally at the end of 1942. This new installation meant the doubling of large scale cover of each successful sortie, and thus reduced the number of sorties or runs necessary to cover one target. From the camera point of view, this installation represented the greatest advance so far made in photographic reconnaissance.

With the fitting of the cameras in the fuselage of the aircraft electric heaters had to be supplied to prevent freezing up and the formation of condensation on the lenses, but with the introduction of the Spitfire XI this method was replaced by an improvement, whereby a closed camera compartment was provided, heated by the process of leading in hot air from the cooling system. During this period, too, fouling of camera windows was frequently caused by dirt or mud on take-off or by oil and petrol during flight. Mud flaps and oils traps were therefore introduced into the camera compartments, which proved an effective remedy against these faults.

The need for stereoscopic oblique cameras for low level use was illustrated as early as 1941, for example, by the importance of studying structural details of enemy radar stations where photographs of the installation had to be taken from heights as low as 50 feet. Great skill and daring was needed by the pilot to use these cameras as he had to fly below the level of his target to obtain successful results. In the months immediately preceding D-Day the installation of oblique cameras for low level work was taken a step further. Operational necessity made it imperative to fly photographic sorties irrespective of weather hazards and enemy opposition. This entailed more low level sorties and led to the introduction of forward facing oblique cameras fitted in the bulges of Spitfire wings and in the wing drop tanks of Mosquitoes. Later in 1944 a single forward-facing oblique camera was fitted into the nose of the P.R. Mosquito in order that the pilot could fly straight on to his target.

Both for certain invasion tasks and when photographs of flying-bomb installations were required at a low level and on a very large scale in order that they might be easily identified, it was found that the speed of the aircraft across a target was so high that movement was shown on the negative. This led to F52 cameras of 8" and 5" focal length being developed, based upon an American idea which incorporated a moving film strip, thus compensating for the additional movement due to the velocity of the aircraft. An F52 camera was also modified and known as the F63, which enabled the film to move at the desired compensating speed and was fitted with a focal plane shutter giving runaway exposures approximately every second.

With the F63 a 60 per cent overlap was achieved by using two cameras wired as "master" and "slave" to effect a very short interval between successive exposures.

The most frequently employed camera installations were normally:-

<u>Spitfire XI</u>	(i) Split F24s 14" or 20" plus F24 8" or 14" oblique
	(ii) Split F8 or F52 20"
	(iii) Split F52 36"
<u>Mosquitoes IX and XVI</u>	Split F8 20" or F52 36" plus split F24 14" plus one F24 8" or 14"
<u>Mosquito XXXIV</u> (short range)	Split F52 14", 20" or 36" plus one vertical K17 16" or one F24 14" oblique
	Split F52 14" cameras were also carried in the bomb bay
<u>Mosquito XXXIV</u> (very long range version)	The installation was similar to the short range with the exception of the last item.

For special tasks a multitude of varying installations were employed, of which the following are examples:-

For small scale mapping - F24 5" in both wings for vertical or split use.

For low level sorties - forward-facing F24 8" in each wing giving stereoscopic relief up to 2-3,000 feet.

Survey installation (in Mosquitoes I and IV) - one vertical K17 16" plus one vertical K8AB 12" plus one F24 8" or 14" oblique.

For stereoscopic cover in Mosquito Mark XVI - two forward-facing F24 14" one in each 50 gallon drop tank.

Where Typhoons were used for the tactical role they were fitted with two forward facing F24s plus two F24 5" moving film strip cameras.

Remote controls for all cameras were fitted in the pilot's cockpit so that an individual selection might be made which would be best suited to each specific target.

Even before the entry of the United States into the war, various types of American cameras began to be introduced into the R.A.F. The two main American types used were the K8AB 12" for survey and mapping photography, and the K19 for night photography. The K19 night camera was first used in the R.A.F. in the night photography trials with the Wellingtons of No. 544 Squadron, and proved to be superior to the existing British night cameras, but R.A.F. cameras remained throughout the war the best and most suitable types for normal day photographic reconnaissance.

Improvements in cameras and camera installations were closely followed by improvements in photographic processing, and the photographic machinery in use at the commencement of the war was developed and improved to handle the ever-increasing numbers of films to be processed and printed.

To speed up film processing, a continuous film processing machine was introduced by Kodaks during 1941 which developed, dried and spooled film at the rate of 4 feet every second. During 1941, also, the Williamson Multiprinter was introduced for rapid production of prints. This produced 1,000 F52 or 1,400 F24 prints each hour, and this introduction enabled a speed up in production to be effected as well as an economy in personnel. Continual improvements were made to these processing machines, and in 1944 an ingenious electric negative grading adjustment was incorporated in the Multiprinter, by means of which negative densities could be graded and the correct exposure applied automatically at the printer head.

C. Developments in Night Reconnaissance Photography

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For several years before 1939 there had been a very gradual development of the art of taking night photographs, but it was not until the war produced the operational need to obtain photographs during darkness that any real progress was made in night photography. Its early uses were confined to the identification of targets during night attacks and the plotting of bomb bursts and fires in the target area, and as such responsibilities were mainly the concern of Bomber Command, much importance was attached to its development in that Command. Bomber aircraft were fitted with night cameras, and photographs were taken automatically by the release of the bombs over the target. The Reconnaissance Squadrons of Coastal Command also undertook night photographic reconnaissance from time to time of such subjects as ports, shipping movements and convoys, and in these instances the camera mechanism was set in motion by the action of a flash bomb⁽¹⁾.

L.M. G202/
O.1.
15.6.41.

At the beginning of 1941, development work was being undertaken in Bomber Command by the Wellington Flight of their No. 3 P.R.U., but upon its amalgamation with No. 1 P.R.U. in the Summer of 1941 the night photography Wellingtons were deleted from the establishment and sent to the Aircraft & Armament Experimental Establishment at Boscombe Down, so that experimental night photography might be continued in an experimental unit rather than in an operational unit. The function of the P.R.U. had been laid down as "photographic reconnaissance requiring deep penetration into enemy occupied territory and photographic reconnaissance of heavily defended areas which could not be carried out by ordinary reconnaissance aircraft", and although it had never been laid down that this function was confined to the hours of daylight, the amount of daylight work which the P.R.U. carried out, coupled with the shortage of night photographic equipment, precluded the introduction of special night photographic reconnaissance into the role of the P.R.U. during 1941.

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3A.

Nevertheless, in July 1941 the A.O.C. in C. Coastal Command asked for supplies of night photographic equipment for the P.R.U., on the grounds that frequent cases arose where night photography was the only means of obtaining information, such as the night moves of enemy concentrations of aircraft, shipping and troops, to avoid being bombed in the position in which they had been located by day.

Unfortunately, the 'D' type Spitfire was quite unsuited for night photography, chiefly owing to the difficulty of one-man night navigation without wireless aids. The experience of Bomber Command was that for night photography a pilot, a navigator with W/T aids, and a bomb-aimer/camera operator were

(1) See Vol. I - page 194.

all required, and although when the Mosquito became available for photographic reconnaissance it was to be provided with W/T aids and a navigator, in the absence of any experience of this new type of aircraft it was felt that night photography could only be undertaken satisfactorily by a bomber aircraft. In view of the shortage of bombers in 1941 it seemed wasteful to use them for night photography at the expense of Bomber Command, and the Albemarle was suggested as an alternative. In December 1941 it was agreed that night photography and night photographic reconnaissance should be introduced into the role of No. 1 P.R.U. and that a Flight of Albenarles should be established for the purpose, as soon as a suitable installation of the night camera equipment could be arranged. Unfortunately tests made at the Royal Aeronautical Establishment, Farnborough, with trial installations were found to be unsatisfactory as the range and performance of the aircraft was barely acceptable for P.R. work without any latitude for improvement. The sole alternative was the Wellington, which could only be supplied to P.R.U. at the expense of Bomber Command.

By this time several units in Bomber and Coastal Commands had developed night photography on their own initiative, and No. 140 Squadron - a Reconnaissance Squadron in Army Co-operation Command - had succeeded in taking 16 line overlaps by night with successive flashes carried on the light rack series of a Blenheim, a method which did not interfere with normal bomb stowage. It was considered by the Air Staff that results obtained could be repeated by any Bomber or Coastal aircraft which had the light series bomb carrier fitted, and that such aircraft would be invaluable to cover some of the important objectives, such as shipping in harbours, and rolling stock at railheads, which up to that time had been photographed only by day.

V.C.A.S. was asked to give his support to this suggestion, and he recommended that Bomber Command should be asked to try out night photographic reconnaissance (as opposed to mere night photography) to the full, to avoid the necessity of allotting any bomber aircraft for this purpose to the P.R.U. However, the A.O.C.-in-C. Bomber Command was not willing to co-operate, as in his experience none but the most skilled crews could obtain the night photographs now desired, and this would mean their withdrawal from the Bomber effort. There seemed little object in forcing Bomber Command to carry out the task as it needed enthusiasm to develop a new technique, and as in the opinion of the Air Staff the time had now come to develop night photographic reconnaissance, there was no alternative but to allocate suitable bomber aircraft to the P.R.U. for the purpose. V.C.A.S. therefore instructed that two Wellington IVs should be allotted to No. 1 P.R.U. to be fitted at Benson for the night photographic role.

With the reorganisation of No. 1 P.R.U. into five squadrons in August, 1942, these Wellington aircraft were allocated to the "Miscellaneous" P.R. Squadron - No. 544 Squadron. By the end of the year, camera installations had been completed, initial tests carried out, and the first operational reconnaissance took place on the 12th December, 1942.

It was soon found that the Wellington was not a very suitable aircraft for its new role; it was too slow and too large to operate successfully between 8,000 and 12,000 feet, which at that time were the limiting altitudes for night photographic reconnaissance, and in consequence it was very liable to interception by enemy fighters. It was also uneconomical in manpower owing to the size of its crew. In January, 1943, therefore, Coastal Command put forward a plea

Ibid,
(passim)

S.10618
(passim)

that the Bomber type Mosquito should be supplied for the purpose. The conversion of this aircraft for such a role was considered possible, and it would have the advantage of speed to reduce the risk of damage by anti-aircraft fire or enemy night fighter, an important point in view of the vulnerability of photographic flashes, which was the greatest hazard to night photographic tasks.

Although this solution of the problem, if agreed, would add to the already growing demands for this aircraft, it had the obvious advantage of simplifying maintenance matters, since P.R. Mosquitoes were already being operated by Benson. Benson was therefore asked to submit a detailed scheme for the conversion of the Bomber Mosquito for the night photographic reconnaissance role, in order that a decision could be given on the future aircraft to be provided for this task. Whilst this was being undertaken, experiments were being continued with the Wellingtons, and later with two Mosquitoes Mark IV of the P.R.U., and night photographs of good quality were obtained under all reasonable flying conditions. One of the difficulties experienced in perfecting the technique, however, was the need of navigational devices for inland reconnaissance to assure the arrival of the aircraft over the point to be photographed, whilst another non-photographic difficulty was still the dangerous nature of the photographic flash. It was fairly certain that if these difficulties could be overcome and suitable aircraft provided for night reconnaissance, the value of strategical photographic reconnaissance would be greatly increased, as it would then be possible to maintain a 24-hour service of strategical requirements and thus make use of all good weather periods.

To overcome the difficulty of the photographic flash, A.C.A.S.(TR) ruled that armoured protection must be given to this, and work began on the provision of an armoured container for the purpose. Scientists were also at work upon the evolution of a safe flash, which would not require armoured protection and would be proof against light anti-aircraft fire. With regard to the difficulty of navigation, certain radar aids were already scheduled to be provided in the new Mark of P.R. Mosquito - the Mark IX - but before the Air Ministry could decide the resources which could be allotted for night photographic reconnaissance and the exact form developments would take, V.C.A.S. directed that the A.O.C.-in-C. Fighter Command should be asked to provide an appreciation of the type of tactical objective which would be required to be reconnoitred at night on behalf of the Tactical Air Force. On receipt of T.A.F. requirements it would then be possible to decide how best to meet both the need for strategical and tactical night photography.

When the needs of 2nd T.A.F. were made known they emphasised the necessity for night photographic reconnaissance. To meet their requirements for tactical photographic reconnaissance of enemy troop and transport movements, railway activities and other battle area information, it was obvious that the unarmed Mosquito Bomber would be more satisfactory than the P.R. type Mark IX, since the first-named required only minor modifications to take the K.19 night camera, whereas the P.R. version had to have its existing camera installation and long range tanks removed to make room for the night camera equipment and the installation of bomb racks. All unarmoured bomber production was already required for Bomber Command, however, and the P.R. Mosquito supply position at this time was so tight that the possibility of allotting aircraft specifically for night photographic reconnaissance work had to be ruled out. In July, 1943, the A.O.C. of

106 Wing was directed to continue development on P.R. Mosquito aircraft drawn from his existing resources, with a view to forming a small night photographic flight when Mosquito production allowed.

Whilst M.A.P. and Air Ministry were still considering the best means of modifying future Mosquito aircraft for night photographic reconnaissance requirements, both 106 Wing and 2nd T.A.F. had made local arrangements for the modification of the number of aircraft they required - four and six respectively - and by the end of 1943 had succeeded in carrying out this work both on P.R. Mosquito IXs and XIVs with comparative ease. Further improvements in technique had also been made in No. 106 Wing, brought about to a large extent by the use of an improved American flash bomb. As a single exposure was taken with each bomb dropped, accurate timing was essential in order that stereoscopic pairs of photographs might be obtained, the shutter mechanism of the camera being actuated by a photo-electric cell upon the burst of each flash. Up to this time there had been difficulties in providing flash equipment to operate at heights which took full advantage of the camera and radar equipment. By means of the American flash bomb, however, before the end of 1943 it had been found possible to take night photographs from as high as 23,000 feet and obtain good results, an advance which assisted in maintaining the safety of the aircraft. In view of the success obtained, it was decided to allow the normal P.R. version Mosquito to be used for night photography, and No. 106 Wing undertook their modification, both for themselves and for the 2nd Tactical Air Force.

Unfortunately the installation difficulties in connection with armoured flash bomb containers had not been so easily overcome, and by April, 1944 these were still not approved for use in the Service. By this time, a satisfactory "safe" photo-flash had been invented and was almost ready for introduction into the Service. As there was no time to waste in further experiment in view of the forthcoming invasion operations, work on the armoured container was suspended and the safe version was brought into use at the end of April.

Good photographic results were obtained at altitudes of up to 24,000 feet by the four night photographic Mosquitoes of No. 106 Wing during the Spring of 1944, but these were on too small a scale ($1/25,000$) to allow good interpretation of detail. It is a safe rule that the limiting scales must be doubled by night and that whereas, for example, motor transport might be clearly recognised by day on a scale of $1/8,000$ to $1/10,000$, at night it would need to be increased to $1/4,000$ to $1/5,000$. Again, the radar aids in the No. 106 Wing Mosquitoes were unsuitable for the accurate location of inland targets at night and thus hampered photography other than of ports and coastal areas.

Soon after the launching of "Overlord", the pressure of day commitments became so heavy, and the number of requests for night work were so few, that the Mosquitoes were reconverted to day type P.R. aircraft, and for the rest of the war period no further development in strategical night photography was carried out in No. 106 Group. A further argument against the continuance of night photographic reconnaissance at Benson was the existence of the U.S. 25th Bombardment Group at Watton, which was equipped with Mosquito XIV aircraft fitted with multi-camera night installations and Loran radar equipment to aid navigation. It was felt that this U.S. Squadron would be available for night work if required, although little use was ever made of it in the night role.

Coastal Cd.
Review.
Nov. 1943.

106G/35/2/Air
25A

2nd T.A.F.
O.R.S.,
Rep. No. 33

Although strategical photographic reconnaissance played only a very small part in the actual mounting of 'Overlord', nevertheless the tactical aspect was not neglected by the Photographic Reconnaissance squadrons of 2nd T.A.F., and they developed the technique until night photographic reconnaissance became a valuable adjunct to the progress of operations on the Continent. Development was not rapid as technical improvements could not keep pace with the appreciation of the operational value of night photography, but by May, 1945 2nd T.A.F. had been able to demonstrate that night photographic reconnaissance was a success and had an operational future.

The one Flight of night P.R. Mosquitoes in 2nd T.A.F., increased from six to seven aircraft, had to satisfy the needs of two Armies, 21st Army Group and T.A.F. Towards the end of 1944, when the Mosquito was becoming unsuitable for day work owing to the opposition of enemy jet fighters, it was decided to convert the remaining day flight of Mosquitoes in 2nd T.A.F. for night photography. The aircraft were fitted with two K19B 12" cameras tilted, owing to the formation of the aircraft, at 18° to port and 12° to starboard respectively, and they carried twelve flashes in the bomb bay. The number of exposures was restricted by the limited flashes carried, but during early 1945 it was found possible to stow additional flashes on the light series carriers under the wings. Although this improved the performance of the aircraft it was not made standard for all the Mosquitoes in the Squadron.

As it was essential to have radar aids to navigation and target location, the Mosquitoes were fitted with Gee and Rebecca H, the latter being a radar system which showed the radar operator in the aircraft his distance from two fixed ground beacons. Unfortunately, this radar aid had only a limited range, and the lower the level at which the aircraft flew the more limited it became. From 90-110 miles at a height of 8,000 feet it fell to 60-80 miles when the aircraft operated at 4,000 feet. Rebecca H. beacons were set up in France early in July, 1944, and moved steadily forward with the advancing line of the Allied troops, so that night photographic reconnaissance might be possible over the enemy lines at all times. The bulk of night reconnaissance was carried out within 25 to 65 miles of the front line, but in the early days of the invasion penetrations were sometimes as deep as 130 miles.

It was always very desirable to know what the enemy did at night, and night photographic reconnaissance made a large contribution to the general intelligence picture. Targets varied from road strips, railway lines and areas of general movement to railway junctions, centres and bridges, and special tasks such as ports which were known only to be used at night. When the battle moved swiftly and took the form of a chase, the need for photographic reconnaissance was at a minimum, but in the long waiting periods that intervened it was essential to know the enemy's every move, many of which were carried out under cover of darkness. At the end of 1944 the launching of the enemy offensive in the Ardennes was calculated to take full advantage of heavy fogs during the day time. Day photographic reconnaissance was often impossible, but photographs taken at night were of excellent quality. The fog settled at night and the clarity of the prints was enhanced by the snow covering the ground.

These were times when night photography provided information of far-reaching importance as, for example, on the night of January 5th/6th 1945, when photographs were taken of Gorinchem Ferry, 20 miles from Rotterdam. These

provided the only confirmation of a civilian report that the Germans were moving North and were not, as had been anticipated, intending to launch an attack on the Canadian front coinciding with their Ardennes offensive. This not only led to the immediate cancellation of Army Orders to move up two divisions to hold the attack, but within ninety minutes of the photographs being taken the first interpretation report was being telephoned to Headquarters 2nd T.A.F., as a result of which aircraft were despatched immediately to bomb the area.

Another example was the night photography of the Hamburg-Duisburg road on March 2nd/3rd during the enemy's retreat over the Rhine. Interpretation disclosed more than 50 vehicles crossing the bridge and attacks were made upon them within an hour of the photographs being taken.

At the beginning of the campaign in North West Europe night photography was in a position similar to that of day photography in 1940. There was a great risk of not covering the required point, and a risk of photographs being of such poor quality or of so small a scale as to make the interpretation difficult or impossible. By 1945 these weaknesses were being overcome as the result of experience gained in 2nd T.A.F., and there is no doubt of the contribution which night photography can make, when fully developed, to any future operations.

It is of interest to note that the night Mosquitoes of 2nd T.A.F. carried out 627 sorties below 10,000 feet between June, 1944 and March, 1945, and although they met a considerable amount of enemy opposition in the shape of anti-aircraft defences, only on thirteen sorties was there opposition in the form of enemy fighters. No aircraft was lost through enemy action and only two were damaged, as compared with the loss of five P.R. aircraft from high level day sorties on the Continent during the same period.

4. DEVELOPMENT OF PHOTOGRAPHIC INTELLIGENCE AND GROWTH OF THE CENTRAL INTERPRETATION UNIT

The reorganisation of the Central Interpretation Unit, and its move to Medmenham was completed during April 1941. On May 12th the operational control of the unit passed to A.C.A.S.(I), whilst for administrative purposes it was placed in No. 6 Group (later No. 91 Group) of Bomber Command(1). A.C.A.S.(G) through D.D. Photos, retained technical control of the unit and was responsible for all matters dealing with technical equipment.

The centralisation of all 2nd and 3rd phase Photographic Intelligence under one roof necessitated the move of the Bomber Command Photographic and Photographic-Intelligence sections. This transfer was not put into effect, however, until September 1941, due to shortage of accommodation in which to instal the necessary photographic equipment.

Organisation - 1941-1942

With the move of the Central Interpretation Unit to Medmenham, the expansion of the Photographic Intelligence organisation began, and throughout its war history the Central Interpretation Unit developed concurrently with the growth of the Photographic Reconnaissance forces in order that it might meet the many and varied requirements for air intelligence. It developed the technique and application of interpretation, centralised the intelligence obtained from air photographs, and co-ordinated it with intelligence obtained from other sources and with knowledge already possessed in the Unit. It was responsible for the dissemination of all photographic intelligence to the Intelligence Departments of the Navy, Army and Air Force, as well as to certain Ministries and special organisations, and its tasks were fulfilled by the circulation of photographic prints, reports, detailed maps and plans, mosaics and models.

At the time of the move of C.I.U., its duties were laid down:-

A.C.A.S.(G)
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- (i) To make a detailed examination of air photographs taken by No. 1 P.R.U. or its detached flights in the United Kingdom and to prepare and distribute reports with the minimum of delay.
- (ii) To attach the necessary interpretation personnel to the appropriate stations for the purpose of carrying out first phase interpretation at the stations from which No. 1 P.R.U. or its detached flights operate.
- (iii) To plot air photographs by means of the Wild Stereo Plotter and prepare accurate plans.
- (iv) To maintain a library of air photographs from all sources.
- (v) To build models from air photographs of targets required by R.A.F. Commands and of areas required by Ministries of the three Services.
- (vi) To provide practice in advanced interpretation for newly trained Photographic Interpretation Officers.

In order to appreciate the work entailed in the production of photographic intelligence, it would be as well to give here a brief outline of the working system of the Central

(1) Administration passed to 28 Group, Technical Training Command w.e.f. 9/4/43.

Interpretation Unit, a system which has remained practically unchanged from its early existence to the end of the war. (1)

First phase interpretation was carried out on the airfields from which the photographic reconnaissance aircraft operated and consisted of a rapid examination of the films or photographs as soon as possible after the landing of the aircraft. This examination, together with the interrogation of the pilot, provided information on subjects of special or urgent importance. The pilot's report was signalled to C.I.U. as a warning that a developed film would be received approximately three hours later, whilst the first phase information was issued to the operational commands so that they might take immediate action, should the situation so warrant. On receipt of the film and two sets of prints at C.I.U., action was taken to provide second and third phase interpretations. The film was classified and included in the film library, and from one set of prints a Plotting Section located the site on the appropriate map, made a sortie plot with the aid of the pilot's trace in order to record the cover obtained, and forwarded the plot and prints to the second phase section, where the first phase information was amplified, and a detailed report given on all activity shown. If the sortie had been flown for a special purpose and was not merely routine cover, the second set of prints was sent to the section specialising in the type of information required.

As the C.I.U. came to specialise more and more in strategic interpretation and the long-term study of the enemy's activities in every sphere, it was found necessary to provide a number of specialist sections manned by interpreters selected for their knowledge of the subject under interpretation. Naval, Military and Air Force officers with specialised knowledge of their own profession were employed side by side with interpreters who in civil life had interested themselves in activities or industries such as geology, mining, shipbuilding, engineering or railways.

A few of these specialist sections were in existence in the old days at Wembley, though by 1941 they were in need of expansion, whilst most of the sections were organised after the move had taken place. During 1941/42 these sections were operated as enumerated below:-

A. (Naval) Section. At Wembley, first and second phase interpretation of enemy shipping had been carried out by two interpreters only. With the formation of C.I.U. the section was reformed on a geographical basis as a regular third phase section with five officers, each of whom was responsible for all aspects of Naval activity within a certain area. Many ground reports and prisoner of war statements were checked with photographs of ports and shipping to trace the movements of enemy vessels and watch the progress of ship- and U/boat-building activity, new types of enemy battleships and invasion craft. Recognition and identification aids to enemy naval and merchant shipping were compiled, and silhouette and plan views of all new vessels were prepared for the information of the Naval Intelligence Staff at Admiralty. For the most part R.A.F. and W.A.A.F. interpreters were employed in the Naval Section during this period, but were under the nominal direction of the Naval Liaison Officer.

B. (Army) Section. From September 1940 there had been a flourishing though small Army section at Wembley manned

(1) See Volume I - page 204.

by Army officer interpreters. Although moved with the C.I.U. to Medmenham, the Army Photographic Intelligence Section was a part of G.H.Q. Home Forces and did not figure on the R.A.F. establishment. Nevertheless the section maintained whole-hearted co-operation with the R.A.F. This section undertook interpretation of photography of objects of military importance. In 1941 the P.R.U. undertook little work on Army targets, but in November a considerable increase of work was occasioned by the interpretation of the vertical and oblique photographs taken by the Spitfires of No.140 (Army Co-operation) Squadron. This squadron was already embarking upon the early tasks in connection with a future invasion of the Continent, photographing enemy ports and hinterland to show the state of readiness for attack. By May 1942, the work required in this connection necessitated the formation of two separate Army Photographic Intelligence Sections in order that the requirements of the War Office should also be met. The original section severed all connection with C.I.U. and went to work at G.H.Q. Home Forces, leaving the Army Photographic Intelligence Section at Medmenham to undertake interpretation of strategical requirements for the War Office.

In addition to including items of military interest in the R.A.F. reports, the Army Section issued its own detailed reports on military subjects. For example, during 1942 they issued a complete set of overprint maps of the coast from Den Helder to Brest showing all enemy artillery defences. These maps were then kept up-to-date by the issue of Flak Intelligence Reports from information provided, both by photographs and by visual reconnaissance.

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C. (Airfields) Section. This was one of the oldest sections in C.I.U., having been formed as far back as August 1940. Its purpose was to provide detailed third phase reports of construction and development of airfields, landing craft and seaplane bases in enemy countries. A thorough check was made upon the activity of each airfield by obtaining photographic cover at stated periods, varied according to whether the airfield was under construction, in use, or disused. Reports covered every available detail, including beam approach landing systems, fuel storage points, night landing facilities, road and rail access, etc. This section's reports did not cover damage assessment, however, when attacks were made upon enemy airfields, but were confined to serviceability of landing areas and runways. They were issued in the first place to Air Ministry, A.I.2(b), who used them as a basis for distributing airfield activity reports to all interested parties.

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D. (Industries) Section. In May 1941, soon after the move to Medmenham, a section was started to obtain intelligence of enemy industries. All cover flown was examined and information sought regarding enemy factories, plants, and their products. The section was originally divided into two groups of interpreters, one group dealing with geographical areas and the other with specific industries. By 1942 the accumulation of information had reached such a pitch that the section was divided into groups according to the industries for which they became responsible:-

(i) Iron and steel, non-ferrous metals, electrical equipment, factories.

- (ii) Engineering and textiles.
 (iii) Oil, coke, coal and gas.
 (iv) Electric power, including dam construction.
 (v) Chemicals, explosives, synthetic rubber and plastics.

These groups produced detailed reports and plans giving the lay-out of industrial plants and all new buildings. These were then used for the preparation of target material and subsequently for damage assessment. The section also produced detailed industrial town plans with the aid of directories, guides, and such other ground information as became available, and in addition issued sets of electric power transmission grid maps for France and Germany.

E. (Camouflage) Section. This section was formed in April 1941 to co-ordinate camouflage on all types of targets and to issue reports for the benefit of allied camouflage designers. The work of the section was never heavy, increasing from one to three officers in the first six months. At the end of that time, when the enemy began to rely more upon decoys and smoke screens for confusing attacking forces, the section was affiliated to another dealing with those subjects (Q Section).

F. (Communication) Section. Provision for this important section was made when C.I.U. transferred to Medmenham in April 1941. It was intended to deal with all information concerning internal communications on the Continent, but at that time there were no interpreters with the necessary knowledge or qualifications to deal with the subject. In view of the importance of obtaining information of enemy movements by rail and water, authority was sought to provide an interpreter from the English railways to organise and take charge of the section. A suitable official was released by the L.N.E.R. and commissioned as a Staff Captain by the War Office. Unfortunately, when he began to organise the section there was a complete lack of documentary information such as Continental Railway Handbooks, Time Tables, etc. But these were gradually obtained from various sources, and brief reports were issued on current sorties covering railway centres. Difficulties in providing specialist-trained staff hampered the work of the section, the R.A.F. interpreters having insufficient knowledge to be of any real assistance. In consequence, in September 1941, the War Office agreed to provide three Staff Lieutenants from the R.E. Railway Depot. With this increased number of interpreters all sorties flown were examined and reports on railway and waterway activities were produced weekly. Detailed information for use as target material, was also provided on specific railway centres and a watch was kept upon the flow of rail and water traffic on certain routes for given periods.

G. (Wireless) Section. Reference has already been made in the previous volume to the importance attached to the detection of the enemy's wireless and radar installations. (1) In January 1941, when it was appreciated that such information was of first-class strategical importance, one officer was appointed to devote his attention to interpretation of enemy W/T installations.

(1) See Volume I - page 266.

During 1941 the range of enquiries extended far beyond the initial stages. New beams and radar appliances were found, and new types of W/T installations began to appear on the Continent. The authorities became more and more conscious of the important part which would be played in the war by wireless and radar, and in December 1941 a new section was formed to deal exclusively with the interpretation of these subjects. During the ensuing year, the routine work of the new section included the systematic search for major European wireless stations and radar installations. Its duties also included compilation of target material on the German navigational beam stations, in order that these should be attacked systematically. 1942 proved to be a year of far-reaching development in regard to the discovery and identification of enemy radar and W/T installations. The deployment of a great chain of G.C.I. stations was observed which took the place of the old searchlight belt and stretched from the Danish to the Swiss Frontiers. Another interesting discovery was the employment of radar by the Germans for gun-laying purposes. In addition to supplying routine data for these reports, the height of all wireless masts had to be calculated - a task which occupied a skilled mathematician for at least half an hour. To speed up this work a standard computation form was drawn up and a height finding machine devised by the section which, when completed, reduced each calculation to approximately two minutes.

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K. (Damage Assessment) Section. With the outbreak of war a Photographic Interpretation Section had been formed at Headquarters, Bomber Command, whose work was not clearly defined, but which dealt mainly with damage assessment of the raids carried out by the Command. With the transference of responsibility for damage assessment photography to No. 1 P.R.U. in June 1941⁽¹⁾ the natural sequence was a transfer of the Bomber Command Photographic Intelligence Section to the C.I.U. This transfer was effected in September 1941 when K Section was formed for the assessment of damage from whatever cause. Immediate reports were issued on the extent and success of the raid as soon as photographs of the damage had been received, and these were followed up by detailed reports both on the damage caused and the reconstruction being effected. From these Bomber Command was able to judge the effect of its bombing policy and make adjustments according to the results achieved. In the Summer of 1942, when the first Bomber Squadron of the U.S.A.A.F. appeared in this country, American interpreters were attached to the section to perform a similar service for the 8th Air Force.

L. (Aircraft and Aircraft Industry) Section. A section was formed in March 1941 with the object of building up a fund of accurate reference material regarding every aspect of the enemy's aircraft and aircraft industry by correlating all the information obtainable from air photographs with intelligence from other sources. A careful watch was kept for all new designs of aircraft, and a check was made upon their development wherever possible. Aircraft factories were located and identified in order that a comprehensive picture could be built up regarding the state of the German aircraft industry. The first report of a German aircraft factory was issued in July 1941 - the Focke Wulf Factory

(1) See Volume I - page 259.

at Bremen Flughafen. In November 1941 the Section undertook a major investigation on German gliders so that the size, performance, and design characteristics of each type found might be tabulated. In the summer of 1942 the exchange of information on new enemy aircraft types became the subject of a periodical meeting between the various Intelligence branches concerned, and as a result of this pooling of knowledge large scale routine photographic cover of factory airfields, and experimental stations was instituted, in order that the development of new types could be watched from the moment the prototype appeared from the factory.

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N. (Night) Section. The first operational night photographs had been obtained by Bomber Command in May 1940, as evidence of accuracy of bombing, and thereafter photographs of bomb bursts and ground detail taken by Bomber aircraft were forwarded to their Photographic Section to assist in Bomb Damage assessment. When Bomber Command Photographic Section became a part of C.I.U. in September 1941 as 'K' Section it undertook the interpretation of night strike photographs. At the beginning of 1942 the number of night photographs began to increase, and in February of that year a new section was formed to deal exclusively with the subject. Up to this time night photographs had been studied mainly with a view to plotting them and commenting on any interesting phenomena - after the formation of 'N' Section a more detailed and systematic study was undertaken, whilst the plots continued to be supplied to Bomber Command without detailed comment. Information derived from night photographs was then co-related for particular raids to form a picture of what actually happened during the attack, so that it was possible to trace the course and development of an operation, note the concentration of incendiaries achieved and calculate the number required to effect major damage. The effectiveness of night decoys in diverting bomber effort was also assessed, and reports made upon the effectiveness of enemy Anti-aircraft defences. As the plotted position of bombing photographs became of value in providing a rapid assessment of the success of a raid, it was decided that this work should be done at Bomber Command Headquarters, to avoid delay in distributing results throughout the Command. In April 1942 three W.A.A.F. Officers were detached from C.I.U. to Bomber Command for this purpose, whilst the Night Section continued their important task of detailed analysis of the course of the attack. By means of the fire patterns recorded on the films a technique of plotting aircraft was evolved, and mosaics were constructed showing the position of fires and incendiaries in relation to the target. These became the means of determining, at the moment of bombing, the position of aircraft who had failed to secure pictures of ground detail but had recorded fire tracks. In this way it could be proved that a crew had reached the target although they had only photographed a mass of fires.

P. (Plotting) Section. A plotting section had been started at Heston in 1940 to plot all P.R. sorties flown by the Special Survey Flight. With the move of the P.R. Unit to Benson the plotting section was transferred there but in the spring of 1941 was again transferred to Medmenham. The section prepared plots of all sorties received at C.I.U., including those of the detached P.R. flights and the Army Co-operation Command Reconnaissance Squadrons, prepared Target Maps showing the location of all Photographic Reconnaissance tasks still to be flown and

special cover maps showing the daily position of all area tasks. By this means it was possible for the Intelligence Officers at Benson to tell at a glance what targets and areas remained to be covered for general and special tasks.

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Q. (Enemy Decoys) Section. In the summer of 1941 crews returning from raids on the Continent brought back reports of varied types of decoys used by the enemy to divert bombing attacks from important targets. Accordingly air photographs were subjected to careful examination, and in July/August 1941 a special second-phase report was prepared dealing with the decoys that had been recognised on photographs for the first time. Bomber Command was particularly interested in this subject and asked that further investigations should be undertaken immediately. In September 1941 a special section was formed to deal with decoys and the study of smoke screens, which were just beginning to make their appearance at Brest as a means of night defence. The first few months after formation of the section was devoted to the recognition of decoys on air photographs, and many new types were discovered. When sufficient experience had been gained to recognise all existing types, it was decided that in addition to examining every current sortie, the tremendous task of examining all library sorties should be undertaken. This work was fully repaid by the number of decoys found and in addition embraced a number of decoy or dummy airfields. Close liaison was maintained with the night photography section, with the result that it was soon found possible to distinguish decoy fires on night photographs, and during 1942 a study was made of their appearance, duration and method of use.

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V. (Model) Section. An experimental model unit, the first experiment of its kind, was formed under the Director of Inspection of Camouflage at the Royal Aeronautical Establishment in August 1940. To provide the skilled worker required for model-making, who needed to possess a background of art training and experience, a number of professional and commercial artists, sculptors, architects, and architectural model makers were invited to volunteer for service with the unit, in the capacity of Aircrafthands General Duties. During the initial period of formation a number of operational models were produced, and in January 1941 the modelmakers were remustered to a new trade as Pattern-Makers, Architectural. In May 1941, it was decided that the Unit should become a part of the Central Interpretation Unit at Medmenham, and thenceforward the extent and scope of their work increased rapidly. At first the models produced had been merely relief reproductions of aerial or ground photographs, but soon actual three-dimensional models were used for intelligence. This work was not based upon any previously known technique, but was developed by the early members of the section, and perfected by constant experiment and experience. A series of sorties were flown over the target to be modelled and the resulting photographs carefully studied by the Photogrammetric Section (q.v.). Vertical photographs were stereoscopically inspected, and oblique photographs provided information upon elevation. Measurements were calculated from shadows of individual buildings and plans were produced for the construction of land from topographical detail. With the aid of all these details and the best maps available, the model was produced at a scale sufficient to show changes in ground level and surface detail of 3-4 feet and above. It could then be

photographed from any approach and in any required lighting conditions to simulate the original as it might appear to the attacking forces. Once the original model had been made, copies were frequently required for study by planning and operations staffs, but in the early days there was no known method of producing accurate copies. Research work to this end was carried out in the Section and the problem solved by devising a new process for the construction of the original model from which a mould could be made and subsequently used to provide as many facsimile models as might be required.

During 1942, many models were made for combined operations such as Bruneval, St. Nazaire and Dieppe; whilst by July 1942 work had already commenced upon the first models of France in preparation for a projected invasion. Later models for almost all assault operations, such as 'Torch', 'Husky', and 'Overlord' were prepared in the Model Section.

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W. (Photogrammetric) Section. The use of the Wild Plotter, with its eight times magnification, had facilitated the interpretation of the small scale photographs obtained with the F.24 camera. Improvements in the quality and scale of photographs presented material for the production of accurate plans and maps, and for this task the Photogrammetric Section was formed in May 1941. It has already been related that with the birth of the Central Interpretation Unit the civilian draughtsmen and Wild instrument operators of the Aircraft Operating Company had been transferred to the R.A.F., and these formed the bulk of the new section. The section provided photogrammetric intelligence from air photographs, including measurements in all three dimensions and basic data for the production of models, maps, plans and diagrams required as bases for operational planning or as illustrations to interpretation reports. During 1941 it was occupied mainly with the provision of plans of enemy airfields, industries, ports and wireless installations, but in 1942 the work done on the subject of industries and enemy wireless far outran the other subjects.

Z. (Second Phase) Section. The formation of the second-phase section, one of the largest in the Central Interpretation Unit, goes back to the early days of interpretation by the employees of the Aircraft Operating Company. Upon the formation of the C.I.U. the strength of the section was 19, but by 1942 it had increased to over 50 interpreters. Their function was to report fully and immediately upon all day-to-day enemy activity, and at first a composite report was issued on each sortie received, giving details of all forms of activity revealed. In June 1942 an improved method of reporting was introduced by which information extracted from photographs on any one day was assembled according to areas. Thus a separate report on each different country or section of country contained the day's information on all the targets photographed in that country.

As well as the Sections dealing with actual interpretation of photographs in all its aspects, other branches were formed to deal with such items as Photographic Intelligence reports from Overseas Commands, compilation of ground information, and intelligence from all sources. In addition, 'J' Section formed as early as 1940 dealt with all matters relating to press and publicity, and was responsible for the issue of the Service magazine "Evidence in Camera", which made its first appearance in September, 1942.

Training of Photographic Interpreters

The organisation outlined in the preceding pages could not be put into effect until a supply of officers became available, qualified in the diverse aspects of interpretation. The initial establishment of the C.I.U. allowed for 104 officers for interpretation duties, excluding those from the other Services, but there was only a handful of W.A.A.F. and R.A.F. Officers trained and sufficiently experienced to undertake the work at that time. Even the enrolment of the civilian members of the Aircraft Operating Company only brought up the total number of interpreters to approximately half the established strength.

At the time of the move of C.I.U. a School for Interpreters formed part of its organisation, and at Medmenham there was room to expand. Instructional courses were introduced with an intake of 20 pupils every three weeks, whilst each fortnight up to a total of 10 Army Officers were attached to the School to obtain experience of interpretation.

With the growth of Photographic Intelligence, and the need for a Photographic Reconnaissance organisation for each Overseas Command, it was certain that a much larger school would be required to meet the needs of the R.A.F. and the other two Services. It was not easy to operate such a School on the premises of the C.I.U., and in June 1941 proposals were put forward by A.D.I.(Ph.) for the formation of a separate School of Interpretation open to all three Services, and giving a more comprehensive syllabus of instruction than had hitherto been possible.

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Meanwhile, bearing in mind the enemy attacks on the Photographic Development Unit at Wembley, and the serious consequences which might follow any widespread damage to such an establishment, Air Ministry expressed some anxiety over the possibility of enemy bombardment of the Central Interpretation Unit. To avoid the consequences which might result from such an occurrence at Medmenham a suggestion was put forward by A.C.A.S.(I) for the provision of an alternative emergency site, which could be used in the interim to house duplicate equipment and provide accommodation for any overflow from C.I.U.

In June 1941, therefore, a search commenced for a building which would serve both to house a shadow organisation for C.I.U. and to provide a School of Photographic Interpretation. Nuneham Park, 25 miles from Medmenham, was finally selected and requisitioned. Unfortunately negotiations for the requisitioning dragged on for a considerable time and in August 1941 the accommodation problem at Medmenham was aggravated by the arrival of a number of United States Army and Naval Air Corps officer 'observers'. Although America had not then entered the war her fighting services had evinced a keen interest in Photographic Reconnaissance, and wished to have officers trained in British methods in order that they, in their turn, might set up similar schools of interpretation in the United States.

As it thus became necessary to expand the instructional Section beyond the capacity of Medmenham, a School of Photographic Intelligence was established at the R.A.F. Station, Benson with effect from 14th September 1941, to give a three weeks course in interpretation to 40 Officer students at a time, including 15 W.A.A.F., A.T.S., or W.R.N.S. By October eleven U.S. Army and Naval Officers had attended a course and returned to America to instruct further numbers in their own Schools of Photographic Intelligence. During the

autumn of 1941 the question of training large numbers of Army Officers was being considered by the War Office, the various invasion plans already in their preliminary stages having indicated that many photographic interpreters would be needed for field formations. Lack of accommodation precluded any additions to the Army Section of C.I.U., or to the number of Army trainees which could be accepted at Benson, and before the end of the year even the courses at Benson had to be temporarily suspended owing to the presence of No.140 (Army Co-operation) Squadron there, and to the continued delay in making Nuneham Park ready to accommodate the School.

It was therefore agreed between the Director of Military Intelligence and A.C.A.S.(I) that Medmenham should become the centre of strategic intelligence but that tactical interpretation should be decentralised and undertaken at the Headquarters of those Commands requiring it, once sufficient interpreters were available. The War Office further agreed that whilst their strategical interpreters should continue to be trained in C.I.U., a separate School of Army Photographic Intelligence should be formed to train interpreters for tactical purposes. These decisions led to the formation of a Branch at War Office under the Director of Military Intelligence to supervise Army interpretation requirements⁽¹⁾ and ultimately, in May 1942, to the removal of the G.H.Q. Home Forces portion of the Army Interpretation Section ^{from} at the Central Interpretation Unit.

The School of Photographic Intelligence recommenced work in its appointed home at Nuneham on 22nd January 1942. Each course was increased to a duration of five weeks, and accommodated 40-50 officer trainees. Printing, indexing and storing photographs was undertaken by the pupils under training; all second priority reprints of photographs were done at Nuneham to relieve the burden on Medmenham, which was becoming a heavy one by this time as in addition to Photographic Reconnaissance photographs, all operational air photographs were now being examined at C.I.U. The strength of operational aircraft was steadily increasing, and a larger percentage of these aircraft carried cameras, a factor which made it more important than ever to provide and train interpreters to fill the establishment at Medmenham as speedily as possible, in addition to providing for overseas requirements. When it is realised that in the first 6 months of 1942 an average of 797 photographs were examined every 24 hours, and on one record day the phenomenal number of 4,964 negatives was received, the number of interpreters required to undertake the work, based on an average rate of six prints per hour, was a formidable one! From August 1940 up to V.J. day a total of 1,395 officers of all Services attended the Photographic Intelligence Course, of which 1,068 were successful in qualifying.

Command of C.I.U.

When the constitution of the Central Interpretation Unit was first under consideration in early 1941, it was agreed that its Commanding Officer should be responsible, both operationally and technically, direct to Air Ministry. The rank of the Commanding Officer was a controversial point, however, between the various Air Ministry Directorates concerned. The Director-General of Organisation was of the opinion that the appointment to command an establishment of this kind would not merit a rank higher than Wing-Commander,

(1) Officer selected as head of this new Branch, M.I.4. was Lt. Col. T. B. L. Churchill, M.C., formerly Army Liaison Officer with A.D.I.(Ph.) - see Volume I, page (259).

A.D.I/Ph/5/
Air (passim)

Smedley Hydro
M.L. Co. etc.

new Para

[This needs to
be reorganised]
M.

A.D.I/Ph/5/
Air (passim)

whilst A.C.A.S.(G) felt that in the preliminary stages of reorganisation at least, a Group Captain as Station Commander was essential to effect a satisfactory transfer of command from the head of the Aircraft Operating Company, together with completion of the move and organisation of the unit on an orthodox basis. Eventually a compromise was reached and a Group Captain was appointed⁽¹⁾ to overbear the Wing Commander Commanding Officer's post for the first two months, whilst order was being "evolved out of chaos."

By July 1941 Medmenham was progressing satisfactorily as an R.A.F. Unit and in accordance with the agreement made, the Group Captain was succeeded by a Commanding officer with the rank of Wing Commander⁽²⁾. By the end of the year the added responsibilities of the post and the increase in work, coupled with the necessity for the Commanding Officer to be enabled to talk with Intelligence representatives of the other Services on equal terms, led to reconsideration of the post, and in February 1942, it was upgraded to that of Group-Captain⁽³⁾. A further and unusual step was taken in June 1942 when A.C.A.S.(I) tried the experiment of placing A.D.I.(Ph.)⁽⁴⁾ in the Commanding Officer's post at Medmenham, and making the two posts the responsibility of the one individual. At the time there were a number of critics of the co-ordination and liaison maintained between P.R.U. and C.I.U., and the appointment of A.D.I.(Ph.) as Commanding Officer of the Central Interpretation Unit was designed to improve this liaison by giving the control of the unit to an officer who was conversant with requirements from all angles. The work of the two sections he now controlled were complementary in many respects, and certain of the work of A.D.I.(Ph.) could as well be undertaken from Medmenham as from Air Ministry. As might be anticipated however, the balance of A.D.I.(Ph)'s work became more than could be handled by the remaining Air Ministry staff of the branch, and in November 1942 the Commanding Officer's post at Medmenham was divorced entirely from the work of A.D.I.(Ph.) and a new Group Captain appointed to undertake Air Ministry control⁽⁵⁾.

From thenceforward until the end of the war, a Group Captain⁽⁶⁾ continued in command of the Central Interpretation Unit, the only alteration to his responsibility being that with the formation of Headquarters 106 Group in May, 1944, the C.I.U. came under the operational control of that Group, and in consequence the Commanding Officer became responsible to the Air Officer commanding No. 106 Group.

Further development of the Central Interpretation Unit

The work and scope of Photographic Reconnaissance and Intelligence continued to increase throughout 1943. Whereas in the earlier years it was an aid of a defensive nature - an eye through which we could watch enemy attempts to invade and attack - from the autumn of 1942 onwards it became more and more a guide to the vulnerable points in the enemy's armour which could be attacked.

- (1) G/Capt. Carter, D.S.O., O.B.E., D.F.C., later S.A.S.O. West Africa see Section V(E).
- (2) W/Cdr. A. T. Laing.
- (3) G/Capt. J. H. Woodin.
- (4) G/Capt. P. G. Stewart.
- (5) G/Capt. T. M. McNeil, O.B.E., formerly A.D.I.(Ph.) representative at Headquarters, Coastal Command.
- (6) G/Capt. Gator, O.B.E.

When the American VIIIth Air Force commenced operations from the United Kingdom in September 1942, co-operating with Bomber Command in a 24-hour battle against enemy targets, the securing and interpreting of bomb damage assessment data became more important than ever before. Attacks on enemy industrial plants and railway centres were put into effect with the aid of detailed reports of the targets obtained from air photography and as German war factories and installations dispersed as the result of damage to their original locations, their dispersal areas were tracked down, and a close check kept upon their activities to ensure that they were too attacked and the work disrupted. The introduction of the ~~split~~ long focal length lens cameras into the Spitfire Mk. XI at the end of 1942 did much to assist in obtaining the photographic evidence for these tasks, and sections of Central Interpretation Unit were reorganised and enlarged to meet the changing needs of the operational forces.

With the American Air Forces came fully equipped P.R. Squadrons and Photographic Interpreters. No separate Interpretation Unit was set up by the United States Forces, their interpreters working in the Central Interpretation Unit as part of a combined Allied team all co-operating in the interpretation of photographs from whatever source - American or R.A.F. By June 1943, 30 American Officer interpreters were working at Medmenham, in addition to the normal R.A.F. establishment of 314 officers strengthened by 30 Army Officers and 11 Naval Officers. American enlisted men also worked as Modellers in the Modelling Section.

One new section of C.I.U., founded in August 1942, (R.2 section) was formed to deal with special interpretation reports on the coastal areas of North Africa for Operation 'Torch'. Until September 1944, when the section was disbanded, it specialised in reports for secret operations and landings in countries as far apart as Sumatra, Singapore, Norway, Southern France and the Channel Islands, and issued details of topography, defences, oil installations etc., both in connection with operational plans and for advance planning.

Some of the existing sections were reorganised to deal with fresh requirements or as the result of experience gained. These included the Naval and Army 3rd phase sections and the Second Phase (Z) Section. When information of enemy secret weapons first came to light in April 1943, a separate sub-section of the Army section was formed to handle this important work, which became one of the busiest branches of C.I.U. Every detail of information regarding secret weapons, together with their manufacturing and experimental locations was sought, and everything that could be extracted from photographs was co-ordinated with ground intelligence to provide as full information as could be obtained of the various enemy devices which threatened Britain.

As the result of experience the Naval Section was reorganised in October 1943 on a functional, in place of a regional basis, each division reporting upon one function of enemy naval activity such as shipbuilding, ship repair, mine-sweeping, port facilities and boom defences. As the War in the Far East intensified additional work was undertaken by the Section in the preparation of recognition material on Japanese warships and the preparation and revision of plans of Japanese-held ports.

Until the latter half of 1943, all the interpreters in the second phase section could be called upon to examine photographs and produce reports upon photographs taken in any area of Europe from Norway to Italy. In due course it was realised that a more specialised knowledge of a smaller area

would produce superior interpretation, and in October 1943 the section was reorganised into three geographical areas - France, Scandinavia and East Baltic Germany, Western Germany and the Low Countries. The improvement in the quality of the reporting following this change was most marked.

When the intensified bombing of railway centres was commenced in 1943, special photographic sorties were flown immediately following raids and the Communications section were asked to give an appreciation of the effect of damage caused. This information was used by a special committee to study the effects of bombing of railway centres, and to advise on further raids. TN

1943 saw a vast increase in the work of the Wireless Section. The Germans were continually producing new types of radar, modifying their existing apparatus and altering the disposition of installations. A greater amount of ground information on wireless and radar also reached C.I.U. during this period, and the work of dealing with this, checking and co-ordinating it with air intelligence placed a heavy burden upon the Section. A

The damage done by the Allied Bomber Offensive to the German aircraft industry, and the knowledge that the enemy was experimenting with types of jet-propelled aircraft gave the Aircraft section its most important tasks during 1943. July 1943 marked the beginning of the search for dispersed aircraft factories and the Section was also engaged in the search for 'pilotless' aircraft, the first of which was discovered at PEENEMÜNDE in October 1943. L

The Night Photography section was also busily engaged during this period, as Bomber Command developed the Pathfinder technique, and more particularly the marking of targets by special Target Indicators. The plotting of these target indicators became priority work for the section and the reports were used both in determining the relative success of a raid and in planning future raids. The method of marking the target with coloured markers led to the need for colour film, and the number of aircraft carrying colour film rapidly increased. During 1943 the monthly intake of night films increased to 4,000, exactly four times the amount received in 1942, and it was to increase as much again during 1944. The use of Target Indicators by our Pathfinder Force also led to an increase in the work of the Decoy Section, since the enemy retaliated by the use of decoy Target Indicators, which became a serious threat to the success of our raids. It was found possible to identify decoy Target Indicator apparatus as it appeared on already existing decoys, and the investigation of these from both day and night photographs became the most important work of the Section. N

Special mention should also be made of an interesting and highly secret task undertaken by Z Section. From the end of 1942 onwards a few selected interpreters from this section prepared a number of topographical reports for Special Duty operations on the Continent. Detailed reports were required on the terrain of certain areas in enemy-held territories where suitable landing grounds could be found for the purpose of picking up and landing secret agents, or for dropping agents and supplies by parachute. In 1943 requests for such information increased enormously and between January and August 128 reports of this nature were issued entailing descriptions of 267 areas. Where cover of the locality required was not already available special sorties were usually flown to obtain the necessary photographs. In view of the highly confidential nature of the work not more than Z1

eight or nine officers at a time were ever concerned with detailed interpretation, which called for extreme accuracy particularly in the case of potential landing grounds. Not only had areas to be found in the desired locality suitable for landing the aircraft used - Hudsons or Lysanders - but every small obstruction, the heights of surrounding trees and buildings and the presence of enemy defences had to be carefully noted, as one omission might spell disaster to a landing or take-off. On the other hand exaggeration of something which was in reality no serious obstacle might be sufficient to cause abandonment of a vital operation. A special technique was evolved for the accurate description of the area, including types of crops, land-surfaces, and depths of ditches or furrows.

Examples
See AHB II.6/85/46

Formation of Allied Central Interpretation Unit

1944 was a year of such momentous events that the Central Interpretation worked at full pressure in preparing requirements for the invading forces, as well as carrying out its part in the supply of general air intelligence. The work at this time could be divided into three broad divisions - invasion tasks, the tracking down of V.1 and V.2 sites, and the battle against the German war industries.

B2

In the first division came such tasks as reports on the coastal areas of France, the defences and disposition of troops, and the types of country to be found in the Brittany area. The Second-phase section was busy with statistics on such subjects as the varying widths of all rivers and streams in Brittany, as a guide to what class or quantity of bridging material would be needed, and on details of French chateaux and their environs assumed to be used as German Headquarters. The wireless section was combatting the strong efforts being made by the enemy to increase the scope and density of his radar network by the introduction of new stations and the use of new and modified apparatus. From September 1943 onwards almost the entire output of the Modelling section was devoted to Models required for the planning of Overlord in all its diverse aspects. The Communications section watched troop movements and rolling stock movements for S.H.A.E.F. so that a day-to-day disposition of enemy forces could be checked, and also supplied details of railway facilities in the invasion area.

2

F

Meanwhile the battle against the Flying Bomb was gaining strength, and a separate offshoot of the Army section handled the tremendous work of tracking down and pinpointing the launching sites as they appeared, so that they might be destroyed or damaged before they were ready for use. In connection with this work W. Section was responsible for the large numbers of detailed plans and diagrams required, which involved immense numbers of measurements. Such measurements as the angle of the launching ramps were deduced from photographs, and it is of interest to note that when opportunity had arisen for measurements to be taken on the actual sites, these were proved to have been very accurate.

B2

W

The damage assessment section was fully occupied in the work entailed by the powerful day and night offensive of the Allied Bomber Forces, and the aircraft section continued to track aircraft dispersal factories and jet-propelled fighters. In February the Me.262 was first identified on a photograph of Lechfeld, whilst about the same time a composite plane was first seen at Peenemunde.

K

In all this work the American contingent at the Central Interpretation Unit took their share. By January 1944 60 U.S. interpreters were working there, whilst 50 enlisted men were employed in the modelling section. All information

and resources were thus pooled for the benefit of both the American and British Air Forces and provided an excellent example of Anglo-American co-operation. U.S.S.T.A.F. had no voice in the control of C.I.U. however, and unfortunately this led to the situation already described in a previous section, when the Americans announced their intention of setting up a separate Photographic Reconnaissance and Intelligence organisation of their own. One reason for this announcement was the desire to have a complete Photographic Intelligence section capable of operating as an independent unit in the event of the removal of U.S. forces to another theatre. When it is considered that the American Air Forces had access to all the C.I.U. records compiled during four years of operation, the necessary task of duplicating them for an independent organisation can be appreciated. Moreover it would have been necessary to compensate for the general contribution of the American interpreters to the work of C.I.U. by the establishment of more R.A.F. interpreters a difficult task at a time when every trained interpreter was already fully occupied. Happily the loss of efficiency which such a breakaway would have entailed was prevented by the agreement made at the end of March 1944 to co-ordinate the efforts of U.S. and R.A.F. resources, and to form a Reconnaissance Group to which the Central Interpretation Unit was to be responsible. 106

On 15th May the new Group, No. 106 Group, came into operation, and with the strengthening of the American representation on the Photographic Intelligence side, the newly-titled Allied Central Interpretation Unit took its place in the Group. Every effort was made to develop American participation at Medmenham, without prejudice to the efficiency of the joint organisation. First-stage phase interpreters were supplied to assist IX Air Force from the American contingent at A.C.I.U., and gradually the U.S. interpreters at Medmenham were formed into their own sub-sections with their own Duty Interpretation officers in charge, so that they might, whilst still carrying on their co-operative work at C.I.U., be prepared to move to another theatre as complete sections should the occasion arise. With the exception of the interpretation of American bomber strike photographs and the study of smoke screens, all the strategic photographic intelligence for the United States forces operating from United Kingdom and upon the Continent continued to be carried out at the Allied Central Interpretation Unit throughout the remaining period of the war in Europe.

As the invasion date drew nearer one of the outstanding tasks completed by A.C.I.U. was the preparation of complete target material for all known enemy radar stations along and within 20 miles of the Channel coast of France from the Belgian frontier to beyond St. Malo and the Channel Islands. In anticipation of the Allied landings it was necessary to put out of action every aircraft or ship detection radar installation in the area to be invaded, as well as all the German radar-jamming sections. To ensure surprise, every existing radar station had to be put out of action, and for the fortnight before D-Day the installations reported by the Wireless Section of A.C.I.U. were continually attacked from the air. Then from photographs taken immediately after each attack, Damage Assessment reports were issued by the Section in order to judge the need for further attacks on individual installations. To A.C.I.U. must go the initial credit for the destruction of every radar station in the invasion area - a step which enabled our forces to take the enemy by surprise on 'D' Day. To the modelling section particular credit is also due; 109 original models and 250 copies were completed in time for the 'D'-day landings, which allowed the landing

forces to be fully briefed on the points they were scheduled to attack.

With the progress of the Allies upon the Continent, various minor changes took place in the organisation of the Allied Central Interpretation Unit. Information was called for by the Allied Control Commission upon which they could base their plans for administering Germany, and a section was formed in July 1944 for this specific task. They reported upon German defences, from the point of view of demolition, and upon storage installations and accommodation provided by certain buildings, barracks and hutted camps in specified areas. Prior to the actual occupation most of this information was only available from air photographs and in consequence was of great value to the Control Commission.

B6
CARAPACE

In September 1944 a section was formed to study underground factories in Germany, particularly those believed to be used for the manufacture of V-weapons. By October some 20 underground factories had been discovered and photographs and ground reports indicated a large scale underground dispersal of German war industries. A careful study was also made of the standard semi-buried concrete industrial buildings developed by Organisation Todt.

SI Army Group
P.I. Unit

Tactical interpretation for the Allied advance was undertaken by the Photographic organisation on the Continent, but from time to time A.C.I.U. was called upon to provide information for special tasks. For instance, just before the attack on the Rhine in March 1945, it was called upon to report the serviceability of the German transport system and airfields, and later as the Allied drive into Germany progressed, information was also called for on the "Redoubt area" in Southern Germany, where it was thought the enemy might make a last stand.

After V.E. day, the need for urgent photographic interpretation vanished, but much remained for the Allied Central Interpretation Unit to do in the field of the air survey of Europe. By August 1945 the American Photographic contingent was beginning to leave this country, and as there was no further military requirement the American interpreters were withdrawn from A.C.I.U. With this step the unit resumed its original title of Central Interpretation Unit.

The fact that the Photographic Intelligence organisation was born and grew up during the war of 1939/45 must be borne in mind when reading the above account. From the outset it had no precedents or principles to guide its formation or hamper its growth, and was therefore readily adaptable to the circumstances of the moment or of the future. Not only did the Central Interpretation Unit mould its organisation to fit the requirements of every branch of a Government at war, but also to produce all the intelligence possible on its own initiative from photographs originally taken for entirely unrelated purposes.

The essential principle of all Photographic Interpretation is a good system, and it is hoped that the above account has shown briefly how the system evolved in C.I.U. was capable of fulfilling the varied needs for air intelligence in the prosecution of the war.

5. THE FORMATION OF PHOTOGRAPHIC RECONNAISSANCE
UNITS AT HOME AND OVERSEAS

1. HOME COMMANDS

(A) United Kingdom and Gibraltar

In May 1941, when it was proposed to have one Central Photographic Reconnaissance Unit to secure photographic cover for all operational commands and the three Services, the amalgamation of Nos. 1 and 3 P.R.U.s was ordered by the Defence Committee (Operations), and an increase in the total establishment of the P.R.U. was forecast by the requirements then laid down by the Joint Intelligence Committee. At that time No. 1 P.R.U. was still awaiting delivery of routine 'D' Type P.R. Spitfires to replace the various 'C' and 'F' Type Spitfires, and it was anticipated that Mosquitoes would soon be available to replace the few remaining Blenheims held. At Benson, three Flights of Spitfires were established, totalling twelve aircraft in all including three armed 'G' Spitfires, whilst St. Eval and Wick had one Flight each of three 'D' Type Spitfires with an additional armed Spitfire at St. Eval.

S.7054
28A

A requirement then arose for photographic aircraft for Gibraltar. Soon after the outbreak of war, in November 1939 the British Government had given the Spanish Government an undertaking not to base aircraft on Gibraltar other than for Fleet Air Arm or training purposes. In February 1941, the Admiralty stressed the importance of obtaining regular information of the disposition of enemy warships and merchant vessels in North Africa and asked Air Ministry to carry out periodical photographic reconnaissance of the North African coast and ports between Oran and Biserta. Certain of these operations could be covered by reconnaissance aircraft from Malta, but for those lying further westward it would be necessary to base an aircraft on Gibraltar. Whilst the Foreign Office was anxious not to take any step which would conflict with the undertaking given to the Spanish Government, the importance of obtaining the information for the Admiralty was paramount if the Malta supply line was to be maintained. From time to time French Glenn Martin aircraft had arrived at Gibraltar from French North Africa, and for this reason the presence of an aircraft of this type was not likely to be remarked upon by the Spaniards; in addition it was the intention of Air Ministry to re-equip the General Reconnaissance Unit at Malta (later No. 69 G.R. Squadron) with similar aircraft. It was therefore decided that photographic reconnaissance from Gibraltar should be carried out by a Glenn Martin aircraft. After considerable discussions and negotiations with the Foreign Office, two Glenn Martins (Maryland I) were added to the establishment of No. 1 P.R.U. in May 1941. A small detachment of photographers from Benson and of interpreters from the Central Interpretation Unit were sent to Gibraltar, but for security reasons and to allay Spanish suspicions, the aircraft were based at Benson and were to be operated for short periods only from Gibraltar. The Interpretation Section at Gibraltar was to function in a similar manner to the detachments at Wick and St. Eval, first phase interpretation being completed on the spot, prints and films then being forwarded to the C.I.U. for record and detail interpretation.

S.8472
(passim)

D. 18
47
109

S.8472/0.1.
15. 5.41.

C.S.9635
27A.

In June 1941 the amalgamation of Nos. 1 and 3 P.R.U.s was put into effect, the P.R. Spitfires of Bomber Command moving to Benson to form an additional flight in No. 1 P.R.U., whilst the night photography Wellingtons were removed to the Experimental Unit at Boscombe Down. In the following August, when the R.A.F. Station, Benson, was handed over by Bomber Command to

Coastal Command, the amalgamated and reorganised No. 1 P.R.U. commenced operations from Benson and from the nearby satellite of Mount Farm. It was necessary to use Mount Farm owing to the restricted size of Benson, but expansion of this Station to a full Class 'A' size was put in hand immediately.

There was one other unit in the United Kingdom employed in photographic reconnaissance at this time. Until March 1941 any Army requirements for photographic reconnaissance on the Continent had been carried out by No. 1 P.R.U., but six armed Spitfires of No. 140 Squadron in Army Co-operation Command were also fitted with cameras for special photographic tasks. This squadron, originally formed at Hendon in March 1941 as No. 1416 Flight to meet the requirements of the G.O.C.-in-C. Home Forces in the event of invasion, was primarily engaged on strategic visual reconnaissance tasks. As the possibility of a German invasion of England began to fade the Unit was used more frequently in a photographic reconnaissance role to secure air intelligence for the Army. In August 1941 the Commander-in-Chief Home Forces agreed with C.A.S. that the Army Co-operation Unit might take over certain Army tasks from No. 1 P.R.U., which would afford his crews excellent practice in photographic reconnaissance. Unfortunately, these tasks were allotted to No. 140 Squadron direct from G.H.Q. Home Forces, and a certain amount of duplication and wasted effort resulted, although No. 140 Squadron moved to Benson to operate side by side with No. 1 P.R.U.

The interim aircraft establishment of No. 1 P.R.U. now consisted of 25 + 5 Spitfires, 5 + 3 Mosquitoes, 5 + 3 Blenheims IV, and the Gibraltar Detachment of Marylands was increased to 2 + 1. In addition, a Training Flight was formed within the Unit, as No. 1 P.R.U. was responsible for the training of all photographic reconnaissance pilots. In October 1941 this establishment was further increased to a total of 33 + 10 Spitfires Mark V and 5 + 2 Spitfires G spread over five Flights, in addition to two Flights of four Mosquitoes each at Leuchars and Benson, the Gibraltar Flight of 2 + 1 Marylands and two Training Flights of Spitfires, Ansons and one Mosquito each.

By December 1941 No. 1 P.R.U. was up to its established strength of 53 Spitfires and was only short of two operational Mosquitoes. The total aircraft was fast approaching the target figure laid down by the Air Staff to be achieved in 1943/44, which at that time was given as 20 Spitfires and 60 Mosquitoes.

In February 1942 when an additional Flight of 8 + 2 Spitfires was added to No. 1 P.R.U. the establishment totalled 71 aircraft in 11 Flights, the equivalent of 4 Squadrons. Owing to its rapid expansion it had become so unwieldy a Unit that early in April 1942 Coastal Command put forward a request that No. 1 P.R.U. should be split into squadrons of approximately 20 aircraft, each commanded by a Squadron Leader. It was proposed that the Wing Commander commanding No. 1 P.R.U. should become the Wing Commander Operations on the R.A.F. Station Benson, and that the Intelligence and Photographic Sections of No. 1 P.R.U. should be absorbed into the Benson establishment. The detached Flights at Leuchars and St. Eval could then become detachments of the parent squadrons based at Benson.

Two other changes in formation were also proposed. All training of P.R. pilots had been carried out in No. 1 P.R.U. since November 1940 (with the exception of a short conversion course at a School of General Reconnaissance), and all

S. 7054
81A.

Ibid. 88A

Ibid.
(passim).

P.R. aircraft had been prepared and modified by the R.A.F. Station, Benson. Although up to February 1942 few P.R. aircraft had been sent overseas, Middle East had already been promised an establishment of 12 Mosquitoes and this was likely to be followed up by further overseas Photographic Reconnaissance Units which would also necessitate the preparation of reinforcement aircraft. Trained crews for these aircraft would be required, and the time had now come to relieve Benson's normal station staff of these responsibilities. It was therefore proposed to establish at Benson a Special Photographic Reconnaissance Aircraft Installation Section, (later to be known as the Initial Preparation and Installation Party), to prepare P.R. aircraft for both home and overseas commitments. To provide the aircrews it was strongly recommended that a separate P.R. O.T.U. should be formed for the purpose. Prompt agreement was given to the formation of an Aircraft Preparation Party at Benson, which took place in March 1942, and this was soon followed by the authorisation of a special P.R. O.T.U. No. 8 O.T.U. was formed at the R.A.F. Station, Fraserburgh, in No. 17 Group in May 1942 for the purpose of providing P.R. trained pilots for all home P.R. Squadrons and to meet the needs of overseas P.R. Units as they were formed.

In order to understand the training system at No. 8 P.R. O.T.U. it is necessary to interpolate a brief description of the P.R. training arrangements up to the time of the O.T.U.'s formation. Pilots posted to P.R. duties were very experienced and required little operational flying training, and in 1940/41 an average of ten flying hours was all that was given in the P.R. training Flight, including conversion to Spitfire types, and photographic training flights. When the establishment of the enlarged No. 1 P.R.U. was reorganised in the Autumn of 1941, two Training Flights were established, and in January 1942 one of these Flights moved to Detling, where a revised syllabus was inaugurated, including thirty hours flying and a considerable number of lectures. In February 1942, when P.R. pilots were first selected from Advanced Flying Units and were therefore less experienced than their predecessors, a P.R. conversion course was commenced at No. 3 School of General Reconnaissance at Squires Gate, after which pupils spent a further month training in the Flight at Detling before passing to the advanced training flight at Benson. With the formation of No. 8 O.T.U. both the conversion flight from Squires Gate and the training flight from Detling moved to Fraserburgh, where they became 'A' and 'B' Flights of No. 8 O.T.U.

The proposal to split the P.R.U. into squadrons did not receive such prompt agreement as the formation of an O.T.U. had done, largely owing to the fact that the whole P.R. organisation was under review at the time, and proposals for a Reconnaissance Group were being considered at a high level within the Air Ministry. In due course it was agreed that the first step in any such proposal was the reorganisation of the P.R.U., and in August 1942 Air Ministry approval was given to the formation of five P.R. Squadrons as under:-

No. 540 Squadron - 9 + 2 Mosquitoes (to be increased when the Mosquito supply position allowed)

Nos. 541, 542 and 543 Squadrons - each of 12 + 4 Spitfires IV and 4 + 0 Spitfires G (Mark VII)

No. 544 Squadron 2 + 1 Spitfires IV - the Gibraltar Detachment which was to replace the old Maryland Detachment and be situated permanently at Gibraltar.
 2 + 0 Wellingtons IV for night photography.

Together with Ansons and Tiger Moth for communication purposes representing in all a total of 64 operational P.R. aircraft.

Ibid 143A.

The actual reorganisation of No. 1 P.R.U. into squadrons took place on October 19th 1942. In September the promised addition to the Mosquito establishment was sanctioned by V.C.A.S. which was to be progressively increased each month until December 1942 when it reached the figure of 18 + 4 Mosquitoes. The additions were to be the Bomber Type Mark IV Mosquitoes with long range tanks, the fitting of these tanks and the camera installations being undertaken by the Initial Preparation and Installation Party. When the strength of the Mosquitoes reached the increased establishment figure early in 1943, Air Ministry felt that a corresponding reduction in the Spitfire establishments could well be effected, particularly as that time it was the intention of the Air Ministry to supersede all P.R. Spitfires with Mosquitoes as they became available. This suggestion was countered by a proposal from the A.O.C.-in-C. Coastal Command to form a Spitfire Ferry Training Flight in No. 543 Squadron. Overseas requirements demanded that P.R. pilots should be experienced in the P.R. role before proceeding overseas, and it was also necessary to give them ferry training before they were judged capable of delivering P.R. aircraft to the Middle East and India. In February a reduction of two G Type Spitfires (then Mark XIII) was made in each of the three Spitfire Squadrons, but the P.R.U. was allowed to retain its Spitfire IVs for advanced operational training. Although this arrangement did not receive official sanction for some months and training was given in a flight of No. 543 Squadron, in June 1943 a Ferry Training Unit was authorised at Benson, to be known as No. 309 Ferry Training and Aircraft Development Unit. From then until the end of the war all P.R. pilots destined for overseas passed through this Unit before proceeding to their appointed Commands.

From time to time during 1943 proposals were put forward to relieve Benson of the commitment of preparing P.R. aircraft for operations, work which was steadily mounting with the increase of overseas requirements. By this time P.R. aircraft were delivered as nearly as possible to the operational standard required, but with the first dozen or so aircraft of each new type complete camera installations were undertaken at Benson in order to secure the improved performance of the new aircraft as quickly as possible. It was not found practicable that the work being done at Benson in this connection should be transferred to a Maintenance Unit, and for the rest of the war the Aircraft Preparation Section at Benson handled all P.R. aircraft for operational units.

The Spitfire IV, which had become out-moded by the beginning of 1943, was being replaced by the Mark XI as quickly as possible. For the past year Army Co-operation Command's Reconnaissance Squadron, No. 140 Squadron, with armed Spitfires had been carrying out photographic reconnaissance over a large area of France for G.H.Q. Home Forces whose role had been extended to cover offensive operations

on the continent and had been lent some of the P.R.U's aircraft to assist them in this task. As they had now become purely a photographic reconnaissance unit, even using their Blenheims for night photography they became competitors for the newest types of P.R. aircraft. By February 1943 No. 140 Squadron's Spitfires were becoming old and worn, and the War Office asked that it should be re-equipped with Spitfires XI in order to undertake further photographic tasks in connection with the invasion. Already a clash of priorities had arisen between the United Kingdom and North Africa for Spitfires XI, where the progress of the battle made the latest type of P.R. aircraft an operational necessity. The net outcome of all these demands was the speeding up of the P.R. Spitfire XI production so that the revised United Kingdom target figure of 40 Spitfires and 40 Mosquitoes might be reached before the end of 1943.

The requirements of No. 140 Squadron were bound up with the needs of 2nd T.A.F. On the 1st June 1943 the Army Co-operation Command was disbanded and its units transferred to the Tactical Air Force. It was quite obvious that the requirements of the invasion forces could not be met by one squadron, and the P.R. needs for the new Command were assessed at 100 aircraft, to embrace two P.R. Squadrons directly under 2nd T.A.F. with two P.R. Squadrons for each Composite Group. The maximum number of aircraft which could be allocated to 2nd T.A.F. was estimated to be 60, (42 Mosquitoes and 18 Spitfires), but the interim establishments were subject to constant revision before the final P.R. organisation for the invasion was authorised. In July 1943 No. 34 Wing of the Army Co-operation Command was re-formed under 2nd T.A.F. as No. 34 Photographic Reconnaissance Wing, with the existing No. 140 Squadron as a foundation, soon to be joined by No. 16 Squadron, a Tactical Reconnaissance Squadron of Army Co-operation Command. From this point, photographic reconnaissance for the invasion forces became a separate story and will be dealt with under the heading of units for "North Western Europe".

No. 106 P.R. Wing was formed on the 26th June 1943 to control the operations of all the P.R. Units in the United Kingdom other than those of 2nd T.A.F., and by September 1943 the new establishments, based on the target of 40 Spitfires and 40 Mosquitoes, had come into force, Nos. 540 and 544 Squadrons with 16 + 4 Mosquitoes Mark IX and Nos. 541 and 542 with 16 + 4 Spitfires Mark XI. No. 543 Squadron was then disbanded, being surplus to requirements, and its aircraft, equipment and personnel were absorbed by the remaining four squadrons.

From thenceforward, these four Squadrons, together with the U.S. 7th Photo Group at Mount Farm, fulfilled the needs of Photographic Reconnaissance for strategic purposes in the European theatre of war other than those which were the direct concern of C.O.S.S.A.G. and later of Supreme Headquarters Allied Expeditionary Forces. Although at times, for reasons of expediency, they were drawn into work of a semi-tactical nature for S.H.A.E.F., their main function remained unchanged throughout the remaining period of hostilities.

As new and improved types of P.R. aircraft became available, the Squadrons were re-equipped - Nos. 540 and 544 Squadrons with the Mosquito Mark XVI, 32 and 34 in turn, Nos. 541 and 542 Squadrons with the Spitfire XIX, (1) the last-named being the aircraft equipment held at the end of the war in Europe in May 1945.

(1) See Section III for details of performance.

The provision of one more ancillary unit in 1943 to assist in the development of photographic reconnaissance, completes the list of United Kingdom formations. In September 1943, the A.O.C. of No. 106 Wing stressed the need for a small unit to undertake the tactical development of future and present photographic reconnaissance equipment. Urgent development was required of such items as night photography, oxygen equipment, and special tactics, whilst operational trials of new equipment which were necessary could not be undertaken by the normal P.R. Squadrons. This suggestion received the approval of the A.O.C.-in-C. Coastal Command and was forwarded to Air Ministry for consideration. It was submitted that the provision of such a unit would do much to bridge the gap between the P.R. Squadrons and the Photographic Division of the Royal Aeronautical Establishment at Farnborough. After consideration by the Air Ministry Directorates concerned, on the 14th November 1943 the proposal was agreed and the Photographic Reconnaissance Development Unit was established at Benson. As there were already technical personnel available on the Station to assist the unit when required, it was restricted to the small establishment of 2 aircraft, 3 officers and approximately 12 other ranks. This unit performed good work from its formation, in the development of camera installations and the methods of photographic reconnaissance at varying heights.

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(passim)

The provision of units to procure the photographs and produce the intelligence would have been of little value unless the information secured could be delivered immediately to the formations concerned. With the move of 2nd T.A.F.'s squadrons to the Continent a special Air Courier Service was set up under the control of No. 106 group, to deliver and collect photographs and intelligence from all the main Army and R.A.F. Hqrs. in Europe. This Air Courier Service linked with dispatch rider services operated by the P.R. organisations in the United Kingdom and on the Continent, formed the close link necessary for correlation of effort between No. 106 Group, 2nd T.A.F. H.Q.'s. and the Allied forces in the Mediterranean area.

B. North Western Europe

In the summer of 1943, the air force which was planned to take part in an invasion of the Continent ceased to be a force on paper and began to take shape. The extent to which all branches of the Army in the field had come to rely upon air reconnaissance had been emphasised by the campaign in the Western Desert and the invasion of North Africa, where it had been learned that a tactical air force, working in close conjunction with the Army, must form an integral part of an attacking force, and that important operations should only be undertaken after a full air reconnaissance of the terrain.

As far back as July 1941, Army Co-operation Command had established Wings at the Headquarters of every Army Command in England to ensure complete liaison with the Army and to make them "air minded". Army Co-operation Command Tactical Reconnaissance Squadrons took part in their first combined operation in the joint Army/Air landings at Dieppe, and one of the lessons learnt there was the value of oblique photographs for planning. The experience gained, both at Dieppe and from the Western Desert campaign, demanded for an invasion that a fully mobile Air Force should be set up to work alongside the Army, with Reconnaissance Squadrons to fulfil the requirements of air intelligence at Army Group and Army Headquarters levels.

In June 1943, when the Tactical Air Force was formed from the old Army Co-operation Command and units of Fighter Command, the units planned included a Strategical Photographic Reconnaissance Wing under the direct control of the Tactical Air Force working alongside 21st Army Group, and Reconnaissance Wings for the two Composite R.A.F. Groups which were to be associated with, and work on the level of the two Armies in the British Sector. The first step to this end was taken in July 1943 with the re-formation of No. 34 Wing as No. 34 Photographic Reconnaissance Wing under 2nd T.A.F. In the same month, the two Composite R.A.F. Groups were formed - No. 83 Group to work with the 2nd British Army, and No. 84 Group to work with the 1st Canadian Army. Under these Groups Nos. 35 and 36 Wings respectively became the Reconnaissance Wings for the 2nd British and 1st Canadian Armies, each of them planned to embrace Tactical Reconnaissance Squadrons as well as a Photographic Reconnaissance Squadron. The main task of these Squadrons was to produce large-scale cover of their respective Army fronts for day-to-day intelligence and immediate planning of operations. As an invading Army has to rely so largely upon air reconnaissance to obtain accurate information of enemy movements and troop dispositions, photographic reconnaissance also took its place in the three main classes of Tactical Reconnaissance viz:-

- (i) Fighter Reconnaissance, where low level photography was used mainly as a means to assist visual observations.
- (ii) Night Reconnaissance, where photographic reconnaissance was used to assist visual reconnaissance of night movements.
- (iii) High level Tactical Reconnaissance, where purely photographic reconnaissance was carried out by P.R. aircraft.

106G/TS.16/Air
1 B.

Many tentative estimates were made of the force which would be needed to fulfil all these requirements, but in October 1943 the A.O.C. commanding the Tactical Air force drew up a Memorandum setting out the forces to fulfil the tentative needs of A.E.A.F., 21st Army Group and 2nd T.A.F. At Army Group level in No. 34 Wing he asked for 1 Squadron of 18 Spitfires Mark XI, and 1 Squadron of 18 Mosquitoes Mark IX/XIV of which 1 Flight was to concentrate on night photography. At Army level in each Composite Group he proposed that there should be a Composite Squadron of 9 Spitfires and 9 Mosquitoes, in addition to 2 Tactical Reconnaissance Squadrons capable of taking photographs. It had been suggested within the Air Ministry that the aircraft used purely for photographic reconnaissance should all be organised within No. 34 Wing, working directly under Headquarters T.A.F., but in view of the fact that there were many main tasks where direct personal contact was essential between the Army Headquarters and the Composite Group, it was necessary that the Group should control the Units flying the sorties. The programme for Photographic Reconnaissance Squadrons under 2nd T.A.F. was finally agreed, in October, as 4 Squadrons, formed on the basis requested by their Air Officer Commanding, and it was estimated that the re-equipment of the Squadrons selected for this task would be completed by March 1944.

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Enc. 5A.

Nos. 16 and 140 Squadrons in No. 34 Wing were already in process of re-equipment to Spitfire XI and Mosquito XIV respectively. The squadrons selected for re-equipment to the P.R. role and subsequent duty in Nos. 83 and 84 Composite Groups, were Nos. 400 (R.C.A.F.) and 4 Squadrons.

The Tactical Reconnaissance Squadrons which were to be their companions in the Wing were as under:-

No. 35 Reconnaissance Wing, with No. 4 P.R. Squadron	Nos. 2 and 268 Squadrons
No. 39 Reconnaissance Wing, with No. 400 (R.C.A.F.) P.R. Squadron.	Nos. 414 (R.C.A.F.) and 430 (R.C.A.F.) Squadrons.

Thus, the Canadian 1st Army was served by an R.A.F. Reconnaissance Wing and the British 2nd Army by their R.C.A.F. counterpart.

Aircraft for the P.R. Squadrons were delivered to Benson for initial modification and camera installation during the winter of 1943/44. From there, they were to be issued "piecemeal" to the squadrons concerned, in order that the crews might have an opportunity to practise the technique of photography with the type of aircraft they would use in "Overlord". It was agreed that as soon as the P.R. Squadrons under 2nd T.A.F. were capable of full operation they should undertake all photographic reconnaissance tasks within the area of A.E.A.F. responsibility, and that they should only call upon the squadrons of No. 106 Wing when they were unable to complete the tasks without outside assistance.

The U.S.A.A.F. Reconnaissance Units of A.E.A.F. were organised in a similar manner to those of T.A.F., but within the 9th U.S. Air Force.

Owing to the mobile nature of the formations to which they all belonged, it was necessary to make them completely mobile and self-contained, and accordingly establishments were drawn up to supply them with complete photographic equipment in mobile prime movers or trailers, and teams of interpreters to be situated on the airfields from which the Units would operate, as well as at the various formation Headquarters concerned. At 21st Army Group, an Army Group Photographic Interpretation Unit (A.G.P.I.U.) was to be set up for 2nd and 3rd phase interpretation together with a Mobile Field Photographic Section and a Mobile Photographic Library, whilst at the Army level an Army Photographic Interpretation Section (A.P.I.S.) was to be formed with two Mobile Field Photographic Sections, one Type 'A' and one Type 'C' (1). Detachments of interpreters were to be provided from these Units to Corps and Divisional Headquarters as well as to the Reconnaissance Airfields for first phase interpretation. Both Army and R.A.F. interpreters were provided, the former using their specialist knowledge for dealing with interpretation of Army subjects, whilst the R.A.F. side was engaged upon interpretation of subjects such as marshalling yards, airfields, and bomb damage sorties. It should be mentioned, perhaps, that for Army requirements the P.R. pilots were to be briefed by Army liaison officers. When these ancillary units some of which had been formed in Army Co-operation Command as far back as 1942 were completed in the Spring of 1944, the status of the Mobile Photographic Library was altered to that of a static formation and re-named the Photographic Negative Library. It was placed under the control of A.E.A.F. and was designed to relieve the Mobile Photographic Units of large

(1) 'C' Type M.F.P.S. responsible for processing of film and production of initial set of prints.

'A' Type M.F.P.S. responsible for bulk printing - See Photographic Layout diagram Appendix E.

printing orders and to undertake the storing of negatives, which were passed back from the Mobile Field Photographic Sections. When formed in April 1944 it was then agreed that it should remain in the United Kingdom when the other Photographic Units moved to France, an air courier service being used for the transport of material to and from the Continent.

From February 1944 onwards the P.R. Squadrons were in full operation with their new aircraft equipment, working from airfields in Southern England, and they were kept busily engaged in photographic cover of invasion targets and V-1 sites. They participated in various exercises to improve their technique and tactics, and as a result of one of these exercises a third squadron was added to No. 34 P.R. Wing. At the beginning of May, Exercise 'Eagle' took place, which embraced the dropping of parachute troops and landing of gliders at night. It illustrated the need of adequate night reconnaissance, which up to this time was only provided for photographically, by a Flight of No. 140 Squadron Mosquitoes. Considerable discussion took place within the Air Ministry as to the type of aircraft most suitable for the task of both night reconnaissance and low-level photography. The Wellington was eventually selected as the aircraft, and No. 69 G.R. Squadron, newly returned from Malta, as the Unit. On the 5th May, No. 69 Squadron arrived at Northolt to take its place in No. 34 P.R. Wing and the task of re-equipping the squadron and converting the crews was begun. On the night of the 5th June No. 69 Squadron carried out its first night reconnaissance over the Rouen area, and when it is appreciated that in one month the squadron had been converted from day reconnaissance over the sea to night reconnaissance over the land⁽¹⁾, the speed with which the conversion was accomplished is a matter for congratulation.

The three Reconnaissance Wings in 2nd T.A.F. continued to operate from airfields in the South of England during the first few weeks of "Overlord", but at the end of July Nos. 35 and 39 Wings moved to the Continent to take up their location at airfields near their respective Army Headquarters. On the 9th September, No. 34 P.R. Wing followed suit, to work in close conjunction with the 21st Army Group, and as the Allied Armies moved eastwards across the Continent the Wings moved forward from airfield to airfield to continue their reconnaissance operations in the forefront of the Allied line. No. 34 P.R. Wing had its original location near Bayeux, in Normandy, but moved in rapid succession to Amiens and Brussels/Melsbroeck where it remained until April 1945.

Considerable tactical reconnaissance was carried out by the Fighter Squadrons of 2nd T.A.F., whose aircraft carried cameras to be used as a means of confirming observations of special interest, but their low-level tactical photography was restricted to oblique photographs for intelligence purposes. Prior to the invasion, the Fighter Reconnaissance aircraft of the Tactical Air Force had been equipped with Mustangs, whose high diving speed and stability had made them admirable for low-level photography. Unfortunately, the Typhoon, with which they were re-equipped for D-Day, had a poor range and indifferent camera installation, and every effort was made to secure further Mustangs for fighter reconnaissance on the Continent. As all Mustangs were needed for long-range bomber escort work the T.A.F. Squadrons had to be content with Spitfire XIVs when these replaced the Typhoons later in the year. However, the Spitfire camera installation was a great improvement on its

(1) Whilst No. 69 Squadron was responsible for P.R. in Malta before the formation of Malta's P.R. Unit, all the trained pilots had been transferred to No. 683 (P.R.) Squadron on its formation.

predecessor, although the aircraft had only a restricted range. The low-level oblique photographs taken by these squadrons throughout the campaign were used mainly for study of defences, briefing of assault troops, and study of local topography, assessment of activity in marshalling yards and on airfields, and for the study of rocket and flying-bomb sites. The information secured, together with the photographic cover obtained by the Tactical Reconnaissance and Photographic Reconnaissance Squadrons of Nos. 35 and 39 Wings, was used for the day-to-day intelligence required by the Army and R.A.F. Planning and Operational staffs.

When the high-level Tactical P.R. Squadrons of the two Wings were unable to operate owing to adverse weather conditions, the Tactical Reconnaissance Squadrons carried out vertical photography, but at a low level. The methods of obtaining these vertical photographs varied in the two Wings. No. 35 Wing fitted its Typhoons with 5" vertical cameras and carried out sorties at 2,500-3,300 feet, the Typhoons being found better suited than Spitfires to conditions of low-level flying. No. 39 Wing, on the other hand, used their normal oblique cameras with an 8" lens, their pilots developing a technique of banking their aircraft in such a way as to obtain a vertical photograph. Subjects covered in this manner were chiefly enemy Headquarters, vital defence points and bomb-damage assessment.

The Tactical Photographic Reconnaissance Squadrons of Nos. 35 and 39 Wings used Spitfires Mark XI with Merlin 70 engines throughout the campaign. They carried either 14", 20" or 36" F.52 split vertical cameras in the fuselage, and in some cases a 5" F.24 vertical camera in each wing. It will be seen, therefore, that with the Fighter Reconnaissance and Tactical Reconnaissance Squadrons, each composite Wing was provided with facilities for taking all types of day photographs, high and low level, vertical and oblique. Before leaving the subject of contributions to air intelligence by Reconnaissance Squadrons, mention should be made of the Army Air Observation Post Squadrons which contributed many useful oblique photographs of front line features and artillery defences.

The efforts of Nos. 35 and 39 Wings were co-ordinated by Headquarters 2nd T.A.F. with those of No. 34 P.R. Wing, but the operations of the former Units were not controlled directly by 2nd T.A.F. The two Reconnaissance Wings were so organised that control and executive action on demands by the two Armies and by Nos. 83 and 84 Groups and their lower formations, was decentralised down to the joint Headquarters Army/R.A.F. Group, if the tasks requested fell within their areas of responsibility. Generally speaking, the P.R. Squadrons of the Tactical Reconnaissance Wings operated within 150 miles of the front line, any photographic cover beyond this point being obtained by the P.R. Squadrons of No. 34 P.R. Wing.

No. 34 Wing was equipped for both day and night photographic reconnaissance and night visual reconnaissance by the provision of No. 140 Mosquito Squadron with one Flight of Mosquitoes each for day and night photography, No. 69 Squadron equipped with Wellingtons for night visual reconnaissance and low-level photography, and No. 16 Spitfire Squadron equipped for day photography. The requirements for day photographic reconnaissance on the Continent were reduced as the campaign progressed, and the opposition encountered in the shape of German jet propelled fighters was such that in the later months of the European war most of the day photographic reconnaissance was undertaken by the Mosquitoes and Spitfires of No. 106 Group. Night reconnaissance, however,

was undertaken entirely by the Mosquitoes, and to some small extent the Wellingtons, of No. 34 Wing. Whilst night reconnaissance was not under the control of the joint Army/R.A.F. Group Headquarters since the two squadrons responsible (Nos. 140 and 69 Squadrons) were primarily under Headquarters T.A.F., their resources were available to the lower formations and produced an important part of their air intelligence. The night photographic work of No. 140 Squadron, which has been described in the Section dealing with night photography, contributed a growing proportion of the information obtained by photographic reconnaissance, and at the end of 1944 the day Flight of the squadron was converted to night work, leaving No. 16 P.R. Spitfire Squadron for day photographic reconnaissance. The Spitfires of this squadron, however, were not equipped for mapping and survey work, and accordingly No. 140 Squadron retained responsibility for such tasks of this nature as were required from time to time. No. 69 Wellington Squadron, whose main task was visual night reconnaissance, also took photographs when necessary to confirm their visual observations. A perspex nose was fitted in their Wellington aircraft in place of the front turret, and split 7" night cameras were installed. The bomb-aimer, who was responsible for making the visual observations and dropping flares to illuminate the target, was also responsible for photography when needed. Technical limitations made it necessary to take photographs at 800-1,000 feet, and as at this height the Wellingtons were very vulnerable to flak they could only be used for photographic purposes in lightly defended areas. Their work was concerned almost entirely with visual reconnaissance therefore, and only a very small proportion of the tasks allotted to them were specifically for photographic cover.

During October and November 1944, night P.R. aircraft were busily engaged in watching enemy movements behind the front line, and in the last days of 1944 night photography contributed handsomely to the checking of the German offensive in the Ardennes. On January 1st, Melsbroeck, the airfield from which the squadrons of No. 34 Photographic Reconnaissance Wing operated, was attacked by 40 enemy aircraft. No defence could be put up against them as the aircraft were caught upon the ground and the Bofors guns on the airfield had been converted to anti-tank use for the Ardennes offensive. As a result, 6 Spitfires, 6 Mosquitoes and 11 Wellingtons of the Wing were completely destroyed, the only major loss to the Tactical Air Forces Photographic Reconnaissance during the whole of the campaign.

The poor flying conditions during the winter months interfered considerably with the air courier services and made it necessary to transfer the static Photographic Negative Library to the Continent. In January 1945 the machinery and personnel were moved to a location within twenty miles of 21st Army Group Headquarters. It is worthy of note that this unit was the only Photographic Unit on the Continent employing W.A.A.F. photographers, and it has been recorded that they worked as hard and as efficiently as their R.A.F. counterparts, as indeed they did wherever they were employed in the Photographic Reconnaissance Organisation.

Reconnaissance requests slackened in February, and in March, when the British and Canadian Armies crossed the Rhine, P.R. tasks became considerably fewer, both by day and by night. From then on, as more and more of the enemy territory was overrun, the normal work of photographic reconnaissance on the Continent ceased, but squadrons were used for such tasks as anti-submarine patrols and day

reconnaissance of shipping in the northern German ports. In May 1945, when war in Europe came to an end, a training programme was introduced into the P.R. Wing to prepare the squadrons for service in the Far East. With the end of the Japanese war there was no further need for tactical reconnaissance and the squadrons were returned to England for disbandment or conversion.

Note: With the exception of authorities quoted marginally,

- all information for this section was obtained from
- (i) Records of 35 Recce Wing, R.A.F., issued by 1st Canadian Army Headquarters.
 - (ii) Tactical Recce in End T.A.F. BAFO/30313/4/ops. Sept. '45.
 - (iii) Unofficial History of No. 34 Wing.

2. OVERSEAS COMMANDS

Before the commencement of the war, as in the operational Home Commands, a number of aircraft in the various Overseas Commands were fitted with cameras and a certain amount of aerial photography was carried out. This was not photographic reconnaissance in the true sense, however, and the primary function of these units was not photography. There were no trained photographic interpreters overseas in 1939 and 1940, and any aerial photographs secured were used only for the information that they might convey to the untrained eye.

Since this narrative deals with the development of photographic reconnaissance, the normal photographic routine of light bombers and general reconnaissance units is not enlarged upon here, and only such aircraft as were adapted and developed especially for photographic reconnaissance purposes are dealt with in the following paragraphs.

C. Middle East and Malta

The need for a photographic reconnaissance organisation in the Middle East theatre had been foreseen as early as 1940, and in September of that year approval was given to the formation of No. 2 P.R.U. (1) It was also appreciated that Malta would form a useful centre for photographic reconnaissance work in the Mediterranean, and although no special unit was approved for the Island it was agreed by Air Ministry to strengthen the G.R. Unit of Glen Martins already based there. Seven Marylands were to be allotted to the Middle East P.R.U. but, unfortunately, the first instalment of aircraft, despatched in January, 1941, had been lost at sea by enemy action and when the second instalment arrived in April they proved to be unsatisfactory for the work required of them and were transferred to a Survey Unit in process of formation from a South African Survey Flight brought from East Africa, (later to be No. 60 S.A.A.F. Squadron).

In view of the speed of developments in the Middle East in June, 1941, Air Ministry deemed it essential that a qualified officer from A.D.I. (Ph)'s department should make a tour of Middle East, briefed to investigate the requirements of photographic reconnaissance and intelligence in that theatre and then continue to India to undertake a similar investigation. The officer selected (2) found that failing the provision of special P.R. aircraft, Overseas Commands had adapted operational aircraft locally to fulfil their requirements for photographic cover as far as possible.

At Malta, two Hurricanes had been adapted in April, 1941 to carry twin 14" F24 cameras, and these, together with the Marylands on the Island, had been used for medium and short range sorties. Unfortunately, neither of these types was capable of photographing the major enemy ports considered so essential by the Admiralty, the Hurricane having only a radius of 350 miles which did not embrace Genoa, Trieste and other Northern Italian ports. Malta had no photographic interpretation officers to interpret the photographs taken, and the work was done by untrained intelligence officers.

(1) See Vol. I. page 245.

(2) S/Ldr, now G/Capt., P.J.A. Riddell.

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In Middle East also three Hurricanes had been modified locally to carry 14" F24 cameras, but they were unsuitable to carry out sorties of the North African coast as far as Tripoli, as was required by the Army. Only two trained photographic interpretation officers had been sent out from the Central Interpretation Unit, and they were assisted by a few locally trained officers. A small advanced Interpretation Section had been formed to work with the Army in the Western Desert, with one R.A.F. and one or more Army interpreters. A.D.I.(Ph)'s representative recommended, inter alia, that No.2 P.R.U. should be expanded to a total of twelve aircraft, in addition to the formation of a small P.R. Unit of six aircraft for Malta, and that both places should have an adequate establishment of photographic interpreters.

In July, 1941 the 1943 target force for photographic reconnaissance aircraft in the Middle East, including Malta, was agreed as twenty twin-engined fighters, and it was assumed that the aircraft supplied to meet this target would ultimately be the P.R. Mosquito, provided that its wooden construction was able to withstand tropical conditions. Owing to the overall shortage of P.R. aircraft, Air Ministry were willing to authorise the immediate establishment of twenty aircraft for No.2 P.R.U. (from which Malta was also to be supplied), but pointed out that until the general supply of Mosquitoes began, the Middle East would have to fill the establishment from their own resources. Nevertheless, it was agreed that the Middle East should have first priority of P.R. Mosquitoes, and in September two of these aircraft with two crews from No.1 P.R.U. were despatched to Egypt for trials to test their suitability for P.R. work in tropical conditions, and to meet the urgent demand for a few P.R. aircraft of adequate range. (1)

Up to the beginning of 1942 no further Mosquitoes had been allocated to No.2 P.R.U., but as an interim measure twelve "D" Spitfires were despatched to them in February, as by this time the Hurricanes were completely outmoded and of little use for work in the Desert. These Spitfires arrived in time to play an important part in the "Battle of Egypt" and the victory of El Alamein.

Meanwhile, photographic interpreters had been sent to Malta and to Middle East, and in November, 1941 it was decided to form a Middle East Central Interpretation Unit on the lines of the Central Interpretation Unit at Medmenham. This arrangement was designed to meet the needs of the Middle East Command as a whole, interpreters being detached to the various lower formations and for first phase interpretation as might be required by operational demands. The number of photographic interpreters established totalled sixty-three, with Headquarters at Heliopolis and detachments for the Levant, Iraq, Egypt, the Western Desert and Malta. Unfortunately, owing to the lack of suitable accommodation it was several months before the M.E.C.I.U. completed its formation.

By the spring of 1942 there were several units, in addition to No.2 P.R.U., undertaking air photography in the Middle East, such as No.60 S.A.A.F. Survey Flight, the Army Co-operation Squadrons in the Western Desert, and a Strategical Reconnaissance Unit operating from Air Headquarters in the Western Desert. No.2 P.R.U. also had a Flight operating in the Western Desert for long range strategical sorties. In addition, two separate organisations were carrying out photographic interpretation in the Middle East - the C.I.U. and an Army/Air Photographic

(1) The original two Mosquitoes were damaged by Enemy action at Malta and no replacements were sent until the end of 1942.

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L.M.717/D. of O
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M.E.Review
Nos. 1 & 2

Interpretation Unit. The existence of these units, all taking photographs for the same purposes, caused considerable confusion and duplication of effort. The increase in the scale of air operations during the opening phases of the "Battle of Egypt" in May and June, 1942, made it essential to co-ordinate all reconnaissance effort, both photographic and visual. Accordingly, in July, No.285 Reconnaissance Wing was formed to co-ordinate the reconnaissance requirements in the Western Desert, and the work of the Army/Air Photographic Interpretation Unit was organised to operate in close conjunction with the Middle East Interpretation Unit's detachment with the 8th Army, both being placed directly under No.285 Wing. This Wing incorporated a Spitfire detachment of No.2 P.R.U., the S.A.A.F. Survey Unit, a Strategical Reconnaissance Flight and two Tactical Reconnaissance Squadrons. Of the Tac/R Squadrons No.208 Sqdn. was equipped with Hurricanes, including four long range and four short range aircraft, fitted with oblique cameras. Although the task of the P.R. Spitfires was originally a strategic one, tactical objects were included in their sphere of operations.

Just prior to the El Alamein offensive a great deal of photographic work was undertaken covering the battlefront for the Army. The P.R. Flight photographed the whole battle-line from which a complete mosaic was made by the interpreters. Many obliques of the front were also taken by No.208 Squadron from a height of 5,000 feet in spite of intense flak, whilst No.60 S.A.A.F. Squadron, now equipped with Baltimores, surveyed and mapped territory behind the enemy lines. It may be said that the value of tactical photographic reconnaissance, as later practised so successfully in the European campaign, was first appreciated at the battle of El Alamein.

Malta/MS.
5013/Air
(passim)

During the latter half of 1942, Malta carried out the bulk of the photographic reconnaissance for the Navy, and also certain of the requirements for the invasion of North Africa, after the plans for operation 'Torch' first began to materialise in August, 1942. In these tasks they were aided by aircraft of No.1 P.R.U. which frequently used Malta as a refuelling and staging post, making photographic reconnaissance over Italy, Sicily and Southern France on both outward and return journeys. Malta had been allotted some of the 'D' type Spitfires from the general allocation to Middle East Command, and with these plus an odd Beaufighter a P.R. Flight was formed in No.69 G.R. Squadron. This P.R. Unit was badly handicapped by lack of pilots adequately trained in photographic reconnaissance, and by December with increasing calls for photographic cover which could only be obtained from Malta, they found it necessary to appeal to Air Ministry for further aircraft and pilots.

The invasion of North Africa in the previous November had increased the number of P.R. Units operating in the Mediterranean area, as Eastern Air Command had brought its own P.R. Unit, and the American Air Command was also equipped with P.R. Aircraft. With the advance of the Armies in the Western Desert the P.R. and P.I. Units operating with the 8th Army were approaching nearer each day to their counterparts in North Africa. On receipt of Malta's request for additional aircraft, coupled with demands from North Africa for more up-to-date types of P.R. aircraft, Air Ministry decided that the time had come to review the P.R. requirements for the Mediterranean theatre as a whole, and set up co-ordinating machinery for the allotment of tasks in each area.

D. The Mediterranean (including M.E. from January, 1943)

Before continuing with the photographic reconnaissance requirements in the Mediterranean as a whole, it is necessary to go back to August, 1942, when planning for Operation 'Torch' - the invasion of North Africa - was commenced in earnest. Attempts were made to propose one joint British and American Air Force for this operation, but the U.S. authorities would not agree to one Air Force Commander for the whole area, and therefore two separate Commands were formed, the Eastern Air Command for the R.A.F., the Western Air Command for the U.S.A.A.F.

The photographic intelligence required for the planning stages was carried out concurrently from the United Kingdom, Malta and West Africa, the home P.R. Units being responsible for the Toulon and Gibraltar areas, Malta for the Italian ports and the North African coast as far west as Oran, whilst West Africa concentrated on the Dakar area. Whilst existing Units disposed of the immediate strategical requirements for the planning stages, it was realised that as soon as our forces landed on the Continent of North Africa each Air Force Command would require its own P.R. Unit. No.4 P.R. Unit was therefore formed under Eastern Air Command, equipped with six P.R. Spitfire IVs and moved to Gibraltar in October, one month prior to the assault. At this stage, only seven photographic interpretation officers were considered necessary to meet the needs of No.4 P.R.U., but this number soon proved to be inadequate to fulfil the many demands for photographic interpretation. Western Air Command was also equipped with a Photographic Reconnaissance Group, the U.S. 3rd Photo Group commanded by Lt. Col. Elliot Roosevelt. This originally comprised twenty assorted aircraft, the majority of them Lightnings, but most of the pilots were inexperienced in P.R. work and the Group operated in complete independence of its R.A.F. counterpart.

In the 15th November, No.4 P.R.U. arrived at Algiers and commenced operations, thereby taking a load off the shoulders of Malta's P.R. Flight. Five days later, all their equipment and most of their aircraft were lost in the enemy bombing attack of the airfield at Maison-Blanche, and until they could be replaced, Malta once again took up the burden, although handicapped by unsuitable cameras and insufficient petrol. The American P.R. Group also operated from Algiers but the lack of liaison between the two Units led to much duplication. As the 8th and 1st Armies began to approach each other more closely every day, there was also duplication between the Middle East P.R. Flight with the 8th Army and its North African counterpart with the 1st Army. Demands for photographic cover of areas in the Central and Western Mediterranean, Southern Italy and Sardinia began to increase, and as the North African P.R. Unit was fully occupied with its Army tactical commitments the strategic tasks passed to Malta. Unfortunately, the Tactical Reconnaissance Squadrons sent out with 'Torch' had not profitted from the lessons of the Western Desert campaign and were unequipped for photography, so that tactical targets had to be undertaken completely by P.R. aircraft. Attempts at low-level photography were costly and had to be abandoned owing to the opposition of the ME.109Gs and FW.190s, which were more than a match for No.4 P.R.U.'s Spitfire IVs, and in December, 1942 Eastern Air Command made a desperate appeal to Air Ministry for the provision of Spitfire XIs. In the same month, as recorded in the previous section, the increasing calls for strategic photographic cover caused Malta to put forward a plea for more aircraft and pilots.

C.26023
A.M. Welsh's
Report on
'Torch'

L.M./DDOII/
602

2111

C.26023
'Torch'
Report

Signal
A.C.S.A.61
22.11.43

CS.11821/I
E.33A

Malta
MS.
5013/Air
E.26A

These applications culminated in the sending of an urgent personal signal from V.C.A.S. to the A.O.C.-in-C. Headquarters, Middle East, pointing out that the requests from Malta and Eastern Air Command for P.R. Spitfires were for aircraft in excess of the establishments laid down, and it was felt that there was considerable danger of overlapping tasks in the Central Mediterranean with consequent waste of effort and unwarranted demands for increased strength. V.C.A.S. suggested that either the A.O.C.-in-C., Middle East or the A.O.C., Malta should agree with General Eisenhower on the co-ordination of photographic commitments in the Mediterranean and the required number of aircraft estimated to be necessary to fulfil these, bearing in mind that cover for Spezia, Leghorn, Genoa and Toulon could now be undertaken from the United Kingdom, as the fuel position in Malta had improved sufficiently to permit landing there before returning to England. However, it was clear to Air Ministry both from the recent course of operations and the need to provide photographic cover in connection with the plans for the forthcoming invasion of Sicily, that the establishments of P.R. aircraft in the Mediterranean were insufficient both for existing and projected tasks. Whilst reminding Middle East and Eastern Air Command that P.R. aircraft were for long-range work and were not normally to be employed on routine tactical reconnaissance for the Army, it was agreed to provide establishments of 12 aircraft each for the P.R. Units of Eastern Air Command, Malta and Middle East.

Ibid
35A

L.M./3721/
D. of O.

On the 7th January, 1943, this announcement was followed by the decision to reorganise all overseas P.R. Units into P.R. Squadrons. No.2 P.R.U. Middle East and No.4 P.R.U. E.A.C. were to be disbanded, Nos.680 and 682 P.R. Squadrons respectively forming in their places, each with twelve Spitfires. In addition, Malta was to have its own P.R. Squadron, No.683 Squadron, formed from the P.R. Spitfires held in the P.R. Flight of No.69 Squadron. It was agreed that Malta and Eastern Air Command were to have Spitfire XIs included in their establishments as soon as they were available. As will be remembered, the opposition which the home P.R. Spitfire IVs had met from the ME.109Gs had led to the urgent speeding up of the production of Spitfire XIs, but there was none too spare for overseas commitments, resulting in Spitfire IXs being specially modified for P.R. work.

C.S.11821
E.19A

Up to this point, the Mediterranean P.R. Units had suffered from lack of fully trained P.R. pilots, the number of experienced pilots in No.1 P.R.U. being insufficient for many to be spared to overseas commands, who had to content themselves with fighter and G.R. pilots whom they trained in the squadrons. In February, 1943, however, No.8 O.T.U. was expanded to provide the increased number of pilots required for home and overseas, thus allowing more experienced pilots to be sent to Malta and North Africa.

Ibid
(passim)

By the Spring of 1943 no flow of Mosquitoes had commenced to overseas commands, and apart from the two sent to Middle East for reconditioning trials, which were being employed on a Middle East survey of the Mareth Line, M.A.C.'s P.R. squadrons still relied entirely on Spitfire IVs with a sprinkling of Spitfire IXs specially modified to P.R. requirements. The 3rd U.S. Photographic Group, however, was operating two Mosquitoes which they had borrowed, with Air Ministry permission, from No.540 Squadron's detachment at Gibraltar. These were originally lent in November, 1942 to carry out special long-distance photographic cover required in connection with Operation 'Brimstone' - the capture of Sardinia - but in spite of repeated appeals for their return they were retained in North Africa for the rest of the Winter.

In February, 1943, when General Spaatz requested that two P.R. Mosquitoes should be made available to Colonel Roosevelt, the two already on loan, both of which had now become unserviceable, were provided with spares and modified to be handed over to the 3rd Photographic Group, but unfortunately one crashed whilst under repair in the United Kingdom and owing to the shortage of P.R. Mosquitoes could not be replaced at that time. There appears to be no record that these Mosquitoes carried out any useful photographic reconnaissance whilst with the Americans, and most of the photographic cover of Sardinia was obtained by the P.R. Mosquitoes of the United Kingdom, on their flights to and from Malta.

C.S.17875
E.5A

Ibid
E.104A

In February, Air Chief Marshal Tedder made a further appeal for Spitfire XIs for photographic reconnaissance in the Western Mediterranean. He listed the four main requirements as - reconnaissance of Central Mediterranean ports for both naval and air purposes; reconnaissances of enemy aerodromes in Tunisia, Sicily, Sardinia and Southern Italy; photographs of enemy positions in Tunisia to modify and correct maps; and photographs of targets for future operations in Sicily and Italy. The whole Tunisian area and Sicily were well covered with strong enemy fighter defences and many P.R. pilots were being shot down by FW.190s and by anti-aircraft defences. A.C.A.S. (Ops) therefore agreed that four Mark XI Spitfires should be sent to Mediterranean Air Command as soon as possible, even if this had to be at the expense of home P.R. Units. It was also agreed that all future allocations of P.R. aircraft within Mediterranean Air Command should be allocated by Air Chief Marshal Tedder to North Africa, Malta and Middle East in whatever proportion he thought desirable. The first four Spitfire XIs did not arrive in North Africa until March, when they fulfilled the urgent appeal originally put forward in the previous December.

The Americans also were not satisfied with their photographic results, particularly the task of surveying for map correction, and there is no doubt that during the first half of the Tunisian campaign all the Services suffered from insufficient photographic intelligence. The U.S. P.R. Lightnings were inadequate owing to constant engine failures, and the American interpreters were not fully trained. As a first step towards an improvement Colonel Roosevelt secured four Fortresses which he formed into a P.R. Survey Unit and used them mainly to map the coastal areas of North Africa.

There was still little exchange of photographic intelligence between the various Units, however, and with the formation of Mediterranean Air Command in February, 1943, as a result of the Casablanca conference, it was obvious that all the P.R. and P.I. Units in North Africa should be brought under one central control, since the British and American Air Commands had now been amalgamated in the Northwest African Air Forces.

In order to avoid further duplication of effort, on the 23rd February, 1943, a North African Central Interpretation Unit was formed from the photographic interpreters of Eastern Air Command and the American interpreters of the 12th Air Force. This N.A.C.I.U., as it was called, was to become the Allied Force Headquarters Centre for all photographic intelligence, and every request for photographic reconnaissance was made direct to Allied Force Headquarters. In March, the efforts of the P.R. Units and the N.A.C.I.U. were all brought under one central control, when the 3rd Photographic Group and No.682 Squadron (previously No.4 P.R.U.) became the North African P.R. Wing embracing the North African Central Interpretation Unit. This Wing was commanded by Lt. Col. Elliot Roosevelt and under the direct control of the Commanding General, Northwest African Air Forces. Besides

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3/Air
passim

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DS 74661/1(72)

the P.R. Squadrons, the Wing included an Interpretation Intelligence section, a Photographic section, and 3 Mobile Interpretation Units. The responsibilities of North Africa for photographic reconnaissance were then defined and agreed with Malta and Middle East to prevent further duplication of effort.

The Northwest African Photographic Reconnaissance Wing was only an improvisation, built up from local resources, and the organisation suffered from this fact in that no planned requirements for a photographic organisation had been made at the time of the invasion of North Africa.⁽¹⁾

Therefore the commitments of Mediterranean Air Command were always ahead of their resources. In April, General Arnold appealed to the Chief of the Air Staff for the provision of Mosquitoes for North Africa for "special projects". C.A.S. replied that owing to the shortage of P.R. Mosquitoes there were insufficient to meet existing commitments at home, and it was thought that the Lightnings and Spitfires were proving satisfactory for photographic reconnaissance in the Mediterranean where the targets were mainly on the coast and the work was not hindered by weather as in the United Kingdom. It was then pointed out by Air Chief Marshal Tedder that these Mosquitoes had been requested for urgent mapping tasks in connection with the invasion of Sicily, which included constant cover of the Sicilian beaches, which could only be taken by Mosquitoes or Spitfire XIs modified to take 36" cameras. To meet this special commitment, C.A.S. agreed to allot two Mosquitoes to the Northwest African P.R. Wing to operate under the 3rd Photographic Group, whilst it was also agreed to speed up the flow of Spitfire XIs and commence a flow of Mosquitoes to No.682 Squadron as soon as they could be made available from the limited resources in the United Kingdom. The flow of Spitfire XIs would then enable Mediterranean Air Command to re-equip its two P.R. Squadrons and send on to Middle East the Spitfire IVs, where these could still be operated successfully owing to the lack of any strong enemy opposition.

C.S.11821/III
(passim)

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It must be borne in mind that until the 14th May, when the Northwest African campaign came to an end, the needs of the 8th Army for photographic reconnaissance in connection with current operations employed most of the effort of Middle East's No.680 Squadron and its Survey Unit, No.60 S.A.A.F. Squadron. Unfortunately, two of the first Mosquitoes to reach the Mediterranean were destroyed by enemy action, and there seemed little prospect of being able to complete the photographic cover for Operation "Husky", but in response to an appeal by General Eisenhower to the Combined Chiefs of Staff, four P.R. Mosquitoes were loaned to M.A.C. for six weeks to undertake this task. Moreover, No.60 Squadron became available to M.A.C. from the middle of June onwards, and, with its pilots experienced in survey work, was of great assistance in flying mapping sorties over Sicily. The few available Mosquitoes as they arrived from the U.K. were allocated to this squadron, which therefore became the first P.R. Mosquito Squadron overseas.

From June, 1943, all planning of future operations in the Mediterranean was carried out on the spot and not, as heretofore, in this country. As future strategy was outlined it was then possible for Mediterranean Air Command to estimate its requirements for photographic cover and allot its P.R. resources accordingly. The operational focus was now on Southern Europe and most of the resources were, therefore,

C.S.11821/III
(passim)

(1) Air Ministry profited by this example, when planning a photographic organisation for 'Overlord'.

concentrated in the North African P.R. Wing, leaving Middle East and its Central Interpretation Unit comparatively little work other than that in connection with day-to-day operations and long-range survey. In July, the North African P.R. Wing moved to La Marsa, Tunis, to be near the Mediterranean Air Command Post recently established there.

As soon as the invasion of Sicily had commenced on the 9th/10th July, the Mediterranean Air Command squadrons were busily engaged in obtaining photographic cover for the next large-scale operation, the invasion of Italy, and again an appeal was made for more P.R. aircraft. At the end of July, Mediterranean Air Command was advised that its commitments could only be met by existing resources but that the target force for the Mediterranean area for 1944 was to be two squadrons - 20 P.R. Mosquitoes Mark IX and 20 P.R. Spitfires Mark XI - to meet their total needs for survey and reconnaissance photography. To this end, it was further decided that there should be no separate Survey Unit but that one Flight of each Mosquito Squadron at home and overseas should be equipped to undertake survey photography in addition to normal photography. It was realised by Air Ministry that the widely separated areas in which Mediterranean Air Command's P.R. Squadrons operated made this target of two squadrons difficult of achievement, and in order that they might obtain flexibility and mobility, permission was given to maintain four squadrons provided that they did not exceed their total aircraft establishment. In September, Mediterranean Air Command therefore reorganised their Photographic Reconnaissance/Photographic Survey organisation as:-

No.680 Squadron, Middle East - 10 Spitfires⁽¹⁾
 No.682 Squadron, North Africa - 10 Spitfires
 No.683 Squadron, Malta - 6 Mosquitoes
 No.60 S.A.A.F. Squadron, - 2 Independent Flights,
 - each of 7 Mosquitoes.

Pending receipt of sufficient Mosquitoes IXs to fill these establishments, the three R.A.F. squadrons remained at 12 Spitfires each, and No.60 S.A.A.F. Squadron was equipped temporarily with 8 Mosquitoes.

To control all four squadrons a small P.R. Wing Headquarters was formed under the North African P.R. Wing in October - No.336 P.R. Wing - which became responsible for the provision of P.R. detachments to operate as required, either with the North African Tactical Air Force or under the full control of the A.O.C.-in-C., Middle East. This was followed in November by a similar reorganisation of the American side of the North African P.R. Wing. By this time, the 3rd Photographic Group had been joined by the 5th Photographic Group consisting of two U.S. and one Free French squadron designed to provide photographic reconnaissance for the 15th Air Force. The 90th Photographic Wing was formed to control all these P.R. Units for the 12th and 15th Air Forces, under the North African P.R. Wing.

Until December, the Wing continued to function from La Marsa, but as the Allied line moved above Naples the Wing transferred to Italy and was located at San Severo from the end of 1943 onwards. Mediterranean Air Command and the North African Allied Air Forces having been amalgamated into Mediterranean Allied Air Forces, the North African P.R. Wing was placed under the new Allied Air Headquarters and re-named Mediterranean Allied P.R. Command Colonel Elliot Roosevelt was recalled to England at this time to undertake control of American P.R. Units for the invasion of the Continent, but the

(1) In actual fact, when re-equipment of Squadrons took place in Jan., 1944 - No.680 became the Mosquito Squadron in place of No.683 Squadron.

O.S.18742
 Min.8

106G/43/1/
 Air
 (passim)

Command remained under the control of an American officer. The Middle East Central Interpretation Unit was also brought under the control of the Mediterranean Allied P.R. Command and became known as M.A.P.R.W. East,

The responsibility for conveying the requirements of the Mediterranean Allied Air Forces to the P.R. Command⁽¹⁾ and seeing that they were carried out, became the task of a new Photographic Intelligence Centre established in January, 1944 and called the Mediterranean Photographic Intelligence Centre, to act as a co-ordinating body for all photographic reconnaissance in the Mediterranean. The lines on which the M.P.I.C. functioned were similar to those of the Joint Photographic Reconnaissance Committee to be formed a few months later in the United Kingdom. Up to this time, demands for photographic cover had been unconsidered and often uncorrelated, and there was a lack of appreciation in the theatre generally of the basic principles of photographic intelligence. From the time of the formation of the M.P.I.C. these difficulties were overcome, and the co-ordination of all requirements for aerial photographs was put into effect, with excellent results.

There was still one more formation connected with the P.R. organisation in Italy, No.285 Reconnaissance Wing, originally formed to control reconnaissance requirements in the Western Desert. The Wing now operated with the Desert Air Force in Italy and a Flight of No.682 Squadron was loaned to them for the photographic requirements of the 8th Army, but all photographic interpretation for the Army was undertaken by the Mediterranean Army Interpretation Unit.

CS.11821/IV
(E.9A)

Photographic reconnaissance activities remained at high pressure throughout the Spring and Summer of 1944, from the Anzio beachhead to the fall of Rome and the invasion of Southern France. At the beginning of September, however, General Eaker ordered examination of a project to provide the 12th and 15th U.S. Air Forces with their own Photographic Wings so that either could be entirely self-contained in the event of a move to another theatre. It was suggested that the British photographic reconnaissance and intelligence organisation remaining would be adequate to meet the needs of the R.A.F. in Italy and the 8th Army. Although this ran contrary to the original conception of the Mediterranean Allied P.R. Wing, which was to combine all British and American P.R. forces to obtain the best possible results and to prevent overlapping, opposition failed to alter American policy and on the 1st October, 1944 the Mediterranean Allied P.R. Wing and the 90th Photographic Wing were disbanded. No.336 Wing continued to carry out the duties in respect of the R.A.F. previously performed by the Mediterranean Allied P.R. Wing, whilst Nos.3 and 5 Photographic Groups transferred to the 12th and 15th U.S. Air Forces respectively.

Ibid
E.11A

For the last six months of the war in Europe, the existing R.A.F. P.R. Squadrons and their Interpretation Unit continued to carry out the British requirements for photographic cover in the Italian theatre of war.

E. West Africa

In September, 1941 the R.A.F. West Africa Command was formed, comprising two Flying Boat Squadrons, one G.R. Squadron of Hudsons (No.200 Squadron) for anti-submarine patrols and a Squadron of Hurricanes (No.128 Squadron) for

(1) This rather high-sounding title was altered to "Mediterranean Allied P.R. Wing" in April, 1944.

MED/S.1518/ops.

the defence of Freetown, Takoradi and the West African Air Routes. Both the British and U.S. governments felt considerable anxiety about the possible action of the Vichy French in French West Africa, and from this anxiety there arose a demand by all three Services for adequate reconnaissance of Vichy territory. Very little information was available on the subject, presumably because the possibility of French West Africa becoming a hostile country had not been considered seriously and the possibilities of photographic reconnaissance were not yet realised by many people in the overseas commands, unaware of the progress and success being made in this direction in the United Kingdom.

Luckily the Senior Air Staff Officer of Air Headquarters, West Africa had been the first Commanding Officer of the Central Interpretation Unit at Medmenham⁽¹⁾ and it was undoubtedly due to his initiative that, at the end of 1941, steps were taken to provide some photographic reconnaissance and photographic interpretation facilities in West Africa, to supplement the work already undertaken in the northern section of West Africa by the P.R. Detachment at Gibraltar. No special P.R. aircraft could be spared at this time to form a Photographic Reconnaissance Unit, and it was considered that one of the types of aircraft already existing in the Command could be used for the task, as they would not have to fly over very heavily defended areas. The Hudson was chosen, and in December, 1941 it was agreed that two Hudson IIIs fitted for photographic reconnaissance should be despatched to No. 200 Squadron, West Africa. At the same time, a small photographic party was to be added to the Squadron, in addition to six photographic interpretation officers who were to be posted to Air Headquarters, West Africa.

ADIPH/4/4/Air
passimCS.11887
passimIbid
(E.40A)

Four photographic interpretation officers arrived in West Africa in January, 1942 but since the specially modified Hudsons had not then arrived the photographic reconnaissance organisation had to become an "ad hoc creation" formed within the resources of West Africa, with the aid of a Maryland from Gibraltar. On the 9th January, the first photographic reconnaissance sortie from West Africa was carried out by the Maryland over Dakar Harbour and Peninsula, previous sorties in the vicinity of Dakar having been made by the Maryland during its flight from Gibraltar to Gambia.

Ibid
E.34A
&
E.54A)

In the same month, the news reached West Africa that the United States War Department was preparing a Fortress (B.17) aircraft for a photographic reconnaissance of the Canary and Cape Verde Islands, Senegal and the Ivory Coast, and they wished to establish a small Photographic Reconnaissance Unit at Freetown. There was no objection to this on security grounds, as Fortresses were arriving daily at Freetown on the South Atlantic Ferry Route.

At the end of January, the A.O.C., West Africa requested that Glen Martins should be provided in lieu of the Hudsons which had not yet arrived, and that two long-range P.R. Spitfires should be sent to West Africa to carry out long-range reconnaissances, owing to the concentration of Vichy fighters in the Dakar area. Air Ministry was not anxious to introduce any further types of aircraft into West Africa at that time owing to the difficulties of providing spares and maintenance, and as no Spitfires or Mosquitoes were available West Africa were informed that they would have to be content with the Hudsons.

(1) Group Captain Carter D.S.O., O.B.E., D.F.C.

Early in March, the Maryland borrowed from Gibraltar crashed on landing after having taken a number of photographs in Senegal, but the disappearance of the only P.R. aircraft in West Africa was soon compensated by the arrival of the two Hudsons specially fitted for P.R. work with split 14" cameras and a long-range tank. This enabled the sphere of operations to be increased, one aircraft undertaking tasks in Gambia, the other in Sierra Leone and further south. Two Hurricane aircraft, provided from local resources and fitted with long-range tanks and an F24 8" camera, were also used for short-range photographic reconnaissance on occasions.

In April, the American Photographic Reconnaissance Mission arrived in West Africa engaged on a programme of photographic reconnaissance and survey in North Africa and Middle East. Their aircraft - a Flying Fortress - was accompanied by Major Elliot Roosevelt, later to become well known in the photographic reconnaissance spheres of North Africa and the United Kingdom. It seemed essential that photographic operations by the Americans and the R.A.F. in West Africa should be co-ordinated with those of the Photographic Reconnaissance Detachment at Gibraltar, and it was agreed that the dividing line below which the Gibraltar aircraft would not operate was to be latitude 30°N. Unfortunately, the American Unit were not made aware of the photographic work being done in West Africa and owing to the conditions of secrecy under which they operated they were never adequately briefed. In consequence, although they took a tremendous number of photographs and covered vast areas of Africa including those already covered by the Gibraltar and West African P.R. aircraft, they were of little value for intelligence. Eventually they damaged their aircraft beyond repair, and as no suitable equipment existed in Africa for development of their films they were obliged to return to the United States with the undeveloped rolls of film. Copies of the photographs taken were later despatched to West Africa, where, for the most part, they were found to be a waste of paper and photographic material.

CS.12658
E.6A

MED/S.1518/
ops

At the end of six months, the photographic reconnaissance work in West Africa had been welded into an efficient organisation, constant watch being kept over the Vichy areas and a comprehensive report compiled and issued on the defences of Dakar. Unfortunately, it was not possible to send sets of prints to Air Ministry by air, and as they had to be sent by fast sea mail the lapse of time incurred made the co-ordination of intelligence from both ends a difficult task.

CS.11887
E.171A

In order to secure more extensive photographic cover, in July the Air Headquarters, West Africa, made a further appeal to Air Ministry for a separate Photographic Reconnaissance Unit consisting of two Spitfires and two Hurricanes, in addition to their two special Hudsons. Whilst this request was still under consideration at Air Ministry, news of the plans for the invasion of North Africa became known and West Africa was given the special task of obtaining the necessary photographic cover in the Casablanca area. After further requests for more aircraft, in October two P.R. Spitfires were allotted from those in transit at Takoradi. These were flown to Freetown where split and single F24 20" cameras respectively were installed.

With the imminence of D-Day for the landings in North Africa, it was imperative that the P.R. organisation in West Africa should be ready for any calls that might be made upon it, and with this end in view, as their requests for a special P.R. Unit had not been answered, the few aircraft available were formed into a P.R. Unit based on Yundum, a newly completed airfield in Gambia. Besides the two

Ibid
(passim)

P.R. Spitfires there were two Hurricanes, one fitted with an 8" camera, the other with two 14" cameras, and one Hudson of No. 200 Squadron fitted with two 14" cameras and a 5" camera. This Unit was supplied with its own Photographic Interpretation Section under the main Photographic Interpretation Section at Air Headquarters. Sierra Leone, Takoradi and Nigeria also had their own detached aircraft for P.R. duties, accompanied by small interpretation detachments.

By dint of working frantically from the 25th October to the evening of the "Torch" landings, the Photographic Reconnaissance organisation was able to build up a good picture of the French Air Force and French defences in West Africa, including target maps for all principal areas, details of Vichy shipping, and cover of all aerodromes and landing grounds in Senegal.

On the 23rd November, the French in West Africa joined the Allied cause, and although at the request of the Navy further sorties were still flown over Dakar for some weeks, by the end of December the brief moment of glory of West Africa's Photographic Reconnaissance organisation was at an end. During the two years which embraced its history, it did excellent work with few resources and very inadequate equipment. The time factor robbed intelligence information sent to the United Kingdom of much of its value by the time it reached there, and the reverse applied to the supplementary intelligence sent from the United Kingdom to aid the interpreters in their work. Nevertheless had circumstances been different in this theatre, and had the French in West Africa resisted the Allies, the work done by the Photographic Reconnaissance Unit would have been of the greatest value to the three Services on the spot.

F. The Far East and India

Before 1941 little, if anything, was known of strategic photographic reconnaissance in India and the Far East. Routine photographic cover was obtained by Army Co-operation and Bomber Squadrons during operations on the frontier and during training, and special air survey was carried out for the Survey of India. The resulting photographs were interpreted locally by Air Intelligence Liaison Officers. Although the Japanese menace to India at that time was a far off threat, in the event of a major thrust developing towards India it was appreciated that some strategical reconnaissances of surrounding territories would be required, but unfortunately there were few modern aircraft in the Command capable of any long distance sorties.

In the Far East Command the threat of war was more imminent, and during the Summer of 1941 one Brewster Buffalo was adapted locally to carry an F24 vertical camera with 20" lens. Successful photographs were taken with this aircraft from 13,000 feet, but it had a range of only 300 miles, and a properly constituted Photographic Reconnaissance Unit was urgently required for P.R. work in the Malay States, Siam and Indo-China. With the move of the Japanese into Indo-China information of enemy movements in the Saigon area could only be obtained by photographic reconnaissance.

On the 1st July, 1941 a target force for photographic reconnaissance aircraft at home and overseas was drawn up by Air Ministry to include six twin-engined aircraft for the Far East, but it was estimated that these aircraft would not be available to the Far East for approximately a year and meanwhile they must rely upon local resources. In October, therefore, Far Eastern Command set about converting two Blenheim IVs for photographic reconnaissance duties, but little use could be made of these aircraft until long-range

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C.S. 10609

&
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(passim)

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ADI/EH/4/5/Air
5A

DS 74661/1(78)

L.M/O.8/432

tanks became available, and in the meantime it was found impossible to obtain accurate information of Japanese aircraft on aerodromes in Siam and Indo-China. For such photographs as they could obtain, however, they were in need of trained photographic interpreters, and in response to a request made in December 1941, Air Ministry agreement was given to the formation of the Far Eastern Interpretation Unit in January, 1942. The Headquarters of this Unit was to be located at Singapore with mobile detachments for other areas as operational requirements necessitated.

Meanwhile, India had made plans for forming a small P.R. Unit from its own resources, and applied to the Government of India for financial sanction for the establishment of a nucleus Interpretation Unit where officers could be trained in intelligence and interpretation duties. In due course, this sanction was given when two R.A.F. interpreters and an Army interpreter were despatched to India from the United Kingdom to commence the formation of a Central Interpretation Unit for Air Headquarters, India. They arrived in March, 1942 to set up a School of Photographic Interpretation, a Central Interpretation Section, and a Photographic Library. The few photographic interpreters who had already embarked for Singapore in February happily did not reach their destination before it fell into Japanese hands and they were diverted to India to assist in building up the photographic interpretation work there.

C.S.11821/I
E.81AADIPH/4/6
(passim)L.M./446/
D.D.O.IIC.S.10610
Es. 29A & 32A

In March also, India tested the B25 (Mitchell) aircraft, four of which, taken over from the Dutch, were at that time available in the Command. As this type was considered suitable for photographic reconnaissance work, the four aircraft were accordingly formed into a Photographic Reconnaissance Flight, to which Air Headquarters, India, gave the title of No.5 Photographic Reconnaissance Unit. By this time P.R. Spitfires were arriving in the Middle East to replace the Hurricanes now completely outmoded there. The A.O.C.-in-C., Middle East was therefore requested to send on to India the photographic Hurricanes as soon as they could be replaced by Spitfires, and in April the first two Hurricanes arrived in India. At the same time, Air Headquarters, India, was advised that a Photographic Reconnaissance Unit for India had been approved by Air Ministry and was to be established with twelve aircraft. Owing to the general shortage of photographic reconnaissance aircraft, however, the number required to bring the strength up to the newly established figure had to be supplied from within India Command. As India had modified five B25s and three Hurricanes to the P.R. role, in May, 1942 the official establishment was issued as two Mobile Flights, one of six B25s, the other of six Hurricanes, but the number of the Unit was amended to No.3 Photographic Reconnaissance Unit to follow consecutively upon those already in operation in the United Kingdom (No.1), and Middle East (No.2). At the same time, the Far Eastern Interpretation Unit, which had never had any actual existence, was officially disbanded and an India Interpretation Unit was formed with an establishment of twenty-eight photographic interpretation officers.

By July, the lack of intelligence in India regarding Japanese movements had become acute and there were no long-range general reconnaissance aircraft in the Command, other than flying boats, able to assist with visual reconnaissance. Although Burma was not heavily defended by Japanese fighters, no evasive routing was possible for aircraft engaged upon reconnaissance over that territory, and by the end of July all the B25s had been put out of action by Japanese fighter interception. This left only the Hurricanes, which meant that India Command were limited to information of enemy movements

ADIPH/4/6
(passim)

DS 74661/1(79)

within 200 miles of Chittagong, their operational centre. By September, the situation had deteriorated still further, and it was then felt that enemy operations against Ceylon or North Eastern India could be commenced without any adequate warning, owing to the lack of photographic intelligence. The A.O.C.-in-C. India therefore made a personal appeal to the Vice-Chief of the Air Staff for "even two P.R. aircraft with an adequate supply of spares, which would be worth their weight in gold".

As Middle East had a reasonable supply of P.R. Spitfires by this time, appeal was made to them to assist India whose "Hurricanes were insufficient for the operations planned after the end of the Monsoon period". The A.O.C.-in-C., Middle East was asked to send four Spitfires to India in September, followed by two more in October, in order that a P.R. Spitfire Flight could be formed to take the place of the B25 Flight. The establishment of No.3 P.R.U. was accordingly amended in October to twelve Spitfires/Hurricanes. In the following January, to bring India in line with the other Overseas Commands where increased P.R. facilities were now to be provided, No.3 P.R.U. was disbanded and replaced by No.681 P.R. Squadron, planned to be re-equipped with P.R. Spitfire IVs at a wastage rate of two aircraft per month sent from the United Kingdom.

Routine P.R. sorties were then organised over Burma, and a watch was kept on all main enemy aerodromes, thus making it possible to forecast with a reasonable degree of accuracy the imminence of enemy attacks. For a time the Squadron undertook from Bengal the P.R. tasks for the R.A.F. as well as certain photographic cover for the U.S.A.A.F., but during the Spring of 1943 a U.S. P.R. Squadron of Lightnings - the 9th Photo Squadron - arrived to undertake photographic work for the 10th Air Force. One Flight of this P.R. Unit was located in China, the other in India, and all photographs taken were sent to the U.S.A.A.F. quarters in Delhi for interpretation, but the American P.R. organisation worked quite independently of the R.A.F. although an effective liaison was set up between the two organisations.

The photographic reconnaissance organisation in India had a "lone furrow to plough" - they were not fighting a common enemy like the P.R. Units in the United Kingdom and the Mediterranean and so could not benefit from any exchange of intelligence between the various theatres of war. They had to start almost from scratch in compiling details of Japanese military objectives, naval units, and aircraft, but by the Spring of 1943 they had succeeded in issuing over a hundred reports and intelligence summaries on Japanese activities, and in May, 1943 issued their first edition of "Evidence in Camera (India Command)", a booklet giving examples of outstanding photographic work, based on lines similar to those of the Home edition.

During the next six months, the organisation became an important factor in the planning and carrying out of operations against the Japanese. The A.O.C.-in-C., India, described the development of the photographic reconnaissance organisation as "a notable feature of the period", and stated that No.681 Squadron "operated magnificently during the whole of the 1943 Monsoon period". The 1943 P.R. Expansion Programme for India was for two squadrons of twenty aircraft, including a P.R. Mosquito Squadron which it was intended would be equipped by April, 1944. Nevertheless, in August, 1943 authority was given to increase the establishment of No.681 Squadron to twenty Spitfires and to form a new squadron - No.684 - with a temporary establishment of ten Spitfires and

C.S.11821/I
E.108A

Ibid/Pt.II
E.78A

ADIPH/4/6
E.6A

Ibid
E.31A

A/C/M
Peirse
dispatch
June/Nov.43

LM/1616/
D.D.O.2
9/8/43

LM/1640/
D.D.O.2
16/8/43

DS 74661/1(80)

ten Mosquitoes, although the policy was to re-equip the latter squadron wholly with P.R. Mosquitoes by April, 1944.

ADI (PH)
4/6
(passim)
& E.53A

Until August, 1942 all the work of the P.R. aircraft was carried out from Bengal, but when the need arose for intelligence regarding areas outside Burma, some of the G.R. Liberators of No.160 Squadron in Ceylon were modified for P.R. work. Other photographic cover was also obtained by aircraft of No.225 Group, Bangalore. Three Photographic Interpretation Sections were formed to undertake first and second phase interpretation for these Units by detaching interpreters from the main Interpretation Unit in Delhi, whilst tactical photographic reconnaissance, carried out for the Army mainly by Hurricanes, was handled and interpreted by Army Photographic Interpretation Sections.

Folder
305/O.8
E.27A

A review of P.R. requirements was made in August by Air Ministry so that they might arrange the distribution of the latest marks of Mosquitoes and Spitfires in accordance with future strategy, and it was agreed that India should have high priority both for Mosquito IXs and Spitfire XI's, the flow of the latest mark of Spitfire being planned to commence in September, 1943.

C.A.S. folder
2091
(passim)

Before the end of August, however, it became important for India to obtain early photographic cover of Sumatra and Malaya to assist in making plans for the defeat of Japan. These areas were outside the range of any P.R. Spitfires based on India or Ceylon. Five of the Liberators in Ceylon being used for P.R. work were modified to give them an extended range, but they were not suitable for reconnaissance work in the face of any enemy air opposition. It was even suggested at this stage that an aircraft-carrier should be transferred from the Mediterranean to act as a mobile base for photographic reconnaissance aircraft, but the Admiralty would not even consider such a suggestion until the invasion of Italy was well launched. The first P.R. Mosquitoes arrived in India during the Autumn and were of great assistance in undertaking long-range reconnaissance of such areas as the Andaman Islands. To begin with, they were attached to No.681 Squadron but they were so few in number that they had to be assisted in their task by the Liberators of No.160 Squadron. Unfortunately, the enemy's warning system in the Andamans was very effective, resulting in the loss of several of our aircraft and necessitating a new form of tactics for securing photographic cover. This was achieved by using three aircraft flying in formation in order that each might protect the other from surprise attacks, but it placed a heavy burden on the few available aircraft.

A/C/M
Peirse's
dispatch
June/Nov.
1943

Signal
77130/C.O.S.
11/10/43

Meanwhile, in October, General Auchinleck pointed out to the Chiefs of Staff the difficulties encountered in his advance planning for 1944 and 1945, owing to the lack of intelligence and maps of the enemy-held territories in South East Asia. Whilst existing photographic reconnaissance squadrons when up to full strength, with the aid of the Liberators and the American P.R. Unit, were considered sufficient to deal with photographic requirements in Burma, the Andaman Islands and Malaya, air survey requirements both for these areas and Sumatra, would need considerable additional photographic reconnaissance sources. In fact, General Auchinleck estimated his needs at the staggering figure of 100 additional aircraft, until such time as a forward base for operations, could be obtained in the Andaman Islands. Needless to relate to anyone who has read this narrative so far, there was not the remotest possibility of providing additional photographic reconnaissance reinforcements in such numbers, and the Commander-in-Chief was advised that he must make do with the resources already allotted.

A.C.M. Peirse's
dispatch
May/Nov. 1943

As soon as sufficient Mosquitoes were available, it was intended that India's second P.R. Squadron should be formed, and in November, 1943 when nine Mosquitoes had been dispatched from the United Kingdom, No. 684 Squadron formed in Bengal. Temporary use was also made of four B25s (Mitchells) modified for photographic work.

SEACOS 26
16/11/43

The Supreme Commander of the newly-formed South East Asia Command then took up the fight for further photographic reconnaissance assistance. He pointed out to the Chiefs of Staff that since the previous request made in October by the Commander-in-Chief, there had been further losses of P.R. Liberators over the Andaman Islands, and in any event the South Andamans could only be covered by Mosquitoes Mark IX, four of which were at that time operational in the Command. Full pressure was placed accordingly upon the provision of Mosquito IXs for India as being the only suitable aircraft both for long-range and survey photography. At the same time the establishment of No. 684 Squadron was altered to twenty Mosquitoes Mark IX. Air Ministry could not hold out any hopes of being able to complete this establishment before February, 1944, however, as unfortunately at that time there were heavy calls upon this type of aircraft for all theatres. It was the agreed strategy of the Chiefs of Staff that the war with Germany took precedence over the war with Japan, and in November, 1943 a photographic reconnaissance organisation for 2nd T.A.F. was about to be formed in readiness for "Overlord". The only other assistance that could be given to South East Asia at this stage was to investigate the methods used to collect intelligence from sources other than photographic, in an endeavour to improve and increase the material available.

C.A.S. folder
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(passim)

A/C/M
Peirse's
dispatch
Nov., 43/May, 44

On the 16th November, 1943 Air Command South East Asia was formed from the R.A.F. forces in India and the 10th United States Air Force. As this new Command was a joint Anglo-American Command whose aim was to integrate the efforts of the English and American Units in India, it was intended to amalgamate the work of the British and American photographic reconnaissance and interpretation organisations. The duties of the R.A.F. and the 10th Air Force in Bengal and Assam were co-ordinated by the newly-formed Eastern Air Command, under its American Commander. The administrative and operational control of Nos. 681 and 684 P.R. Squadrons was then given to a P.R. Wing established under Eastern Air Command - No. 171 Wing - formerly engaged on tactical reconnaissance duties. For several months the 9th U.S. P.R. Squadron remained directly under the 10th Air Force, but the final step in amalgamation was taken in February, 1944 when the Photographic Reconnaissance Force was formed, incorporating No. 171 Wing and its Units and the 9th P.R. Squadron, with its co-ordinating Headquarters, 8th Photo Group. Co-ordination of photographic interpretation activities had already been effected by this time, a joint R.A.F. and American Photographic Interpretation Unit having taken the place of the Central Photographic Interpretation Unit at Delhi.

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74B

Such importance was attached to the survey of Burma and Malaya that when the new Mark 34 P.R. Mosquito commenced delivery in March, 1944 the first four were allocated to Air Command South East Asia. The long distances and great areas involved required the employment of every available P.R. Mosquito, but as A.C.S.E.A. became more familiar with the potentialities and performance of the aircraft under tropical conditions during the Spring of 1944, tremendous strides were made in the photographic survey work.

A/C/M
Peirse's
dispatch
Nov., 43/May, 44

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The Spitfire XIs and the Mosquito IXs in Air Command South East Asia were sufficient by this time to do all the photographic reconnaissance required which lay within their range, but the Command were still handicapped by lack of very long-range aircraft for photographing areas 1500 miles away, and there was still no operational base nearer than Ceylon from which photographic reconnaissance aircraft could operate over the Dutch East Indies and Indo-China. Again the suggestion was put forward by the A.O.C.-in-C., A.C.S.E.A., that a mobile base might be used for this purpose in the form of an aircraft-carrier. None of the British Fleet Air Arm aircraft were suitable for such a task, and it was therefore suggested that Washington might be asked to provide Corsairs suitably modified for photographic reconnaissance. At the beginning of May the United States Navy offered Hellcats in lieu of Corsairs, and the Admiralty announced their intention of forming a Unit of 6 P.R. Hellcats as soon as the aircraft became available, to ensure a fully equipped long-range P.R. Unit being provided for South East Asia at an early date.

C.O.S. (44)
395 (0)

By the end of May, not only had all the battle areas been photographed by the normal P.R. Squadrons, but 57 per cent of the total area of Burma had been mapped, an area equivalent to three times the size of England. It was found, however, that these maps had only limited value unless fixed ground or air positions could be obtained when the photographic survey was in process. The only solution to this was the use of radar, but there were no existing radar aids suitable for air survey work. New types of radar sets were evolved by radar experts in this country, and by January, 1945 a technique had been developed to enable small-scale tactical maps (1/50,000 and 1/100,000) to be prepared with a radius of 250 miles from a ground Radar Station. Although experimental work still continued, it was considered that the experiments were sufficiently far advanced for four P.R. aircraft to be specially fitted with radar and sent to India in April, 1945. Unhappily, further delays took place in testing and fitting the apparatus and it was necessary to inform Air Command South East Asia that no more of these aircraft would be arriving until after the Monsoon period.

SEACOS.
132
14/4/44

COSSEA
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C.A.S. folder
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With the capitulation of Japan in August 1945, the need for further intelligence of the theatre ceased to be an urgent one, and the survey and photographic cover then required could be obtained from forward bases, as the British took over the enemy-occupied zones. No use was therefore made, either of the radar air survey Mosquitoes or the Fleet Air Arm Photographic Reconnaissance Unit of Hellcats.

6. CO-OPERATION WITH THE PHOTOGRAPHIC RECONNAISSANCE ORGANISATION OF THE UNITED STATES ARMY AIR FORCES IN EUROPE

Before the entry of America into the war, American observers of their three Fighting Services took a great interest in the development of photographic reconnaissance and photographic interpretation in this country. Many requests for photographic reports and cover were made by the American Embassy on behalf of their Army, Navy and Air Corps, and wherever possible these requests were met. In August, 1941, application was made to the Air Ministry for permission for American officers to be trained in this country in photographic interpretation, and by October 1941 eleven American officers of the three Services had passed through the interpretation course at Medmenham and been attached to the Central Interpretation Unit for practical experience. They then returned to the United States to act as instructors in photographic schools.

S.73440
(passim)

On American entry into the war the R.A.F. gave them unstinted advice and assistance on the formation of the Photographic Reconnaissance Units and Photographic Reconnaissance Organisation, and they were able to learn valuable lessons from our experience in developing this branch of the Service. The first suggestion that American Photographic Reconnaissance Units should operate from the United Kingdom appeared in January 1942 when the preliminary arrangements for the arrival of VIIIth Bomber Command were being studied in Washington. It was then proposed that two P.R. Squadrons of Lightnings should accompany the first American Bombardment Squadrons due to arrive in this country during the summer of 1942. These plans were modified later.

J.O.M/U.S.
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22.1.42

In the Spring of 1942, when General Eaker and his staff were making finalised plans for the arrival in England of the first Units of the United States Army Air Forces, it was agreed that the 8th Air Force should have its own Strategic Reconnaissance Units in order that their Commanding General might plan and carry out his own reconnaissance at the same time as his bomber sorties. In this manner, when targets came under consideration for the next day's bombing, photographic cover taken after the last operation would be available and the latest prints of the targets could be distributed to the bombardiers.

A.D.I.PH/7/
Air
(passim)

American authorities agreed, however, that for efficient operation there could only be one Interpretation Unit in the United Kingdom, which should be an inter-service and inter-Allied concern, American officers being assigned there to assist in the work and to provide the necessary co-ordination. It was realised that to set up a separate American Interpretation Unit would entail vast copying of Medmenham's intelligence records and would lead to duplication and conflicting reports. It is interesting to note this early decision in view of later efforts made by the Americans to break away from the Central Interpretation Unit and set up a separate one of their own.

C.S. 15160
E.5A

Among General Eaker's proposals for his Photographic Reconnaissance Unit was the suggestion that the American 8th Air Force should prepare lists of photographic cover required, and forward these to A.D.I.(Ph) at Air Ministry, to which Directorate an American officer would be appointed. As far as possible, United States requirements should be covered by American P.R. Units, but the R.A.F. could be called upon for assistance when necessary. Conversely, the American Units should also be made available to the R.A.F. in emergency, but all photographs taken, whether by R.A.F. or American P.R. Units

A.D.I.PH/7/
Air
(passim)

should be made available to the 8th Bomber Command and 8th Air Force for distribution,

The tentative plan for the American Units was that six P.R. Units should be made available to operate from this country (later this figure was reduced to four), of which the first was scheduled to arrive in the United Kingdom by September 1942. Each unit was to be composed of eighteen P.38s (Lightnings), of which twelve were operational, and they were fitted with K17 American cameras with lens up to 24" focal length.

When the VIIIth Bomber Command commenced operations from the United Kingdom in August 1942, no U.S. Photographic Reconnaissance Unit had become available, and the 8th Air Force relied entirely on the British organisation. At the first meeting of the Anglo-American Committee for Co-ordination of Current Air Operations, General Spaatz expressed his thanks for the service offered by the R.A.F. P.R. organisation, but stated that he had already taken up with the American authorities the provision of special squadrons to undertake his photographic requirements. Whilst the Air Staff was glad to hear that the P.R. resources in the United Kingdom would be augmented in the near future, they hastened to point out that it would be necessary to co-ordinate the activities of all P.R. Units, owing to the danger of overlap in some areas and gaps in others. Furthermore, there was the possibility of one P.R. Unit warning the German defences in an area about to be entered by a P.R. aircraft from another Unit. It was agreed by the Committee that plans for co-ordination should be worked out in detail before any American P.R. Units commenced operations from this country.

American photographic interpreters began to arrive at the Central Interpretation Unit in the Autumn of 1942. Although trained in American photographic schools they were completely inexperienced in any interpretation of operational photographs, but gradually acquired the necessary knowledge after a short period at Medmenham, and worked in complete co-ordination with their R.A.F. colleagues. The first American P.R. Squadron, the 13th Photographic Squadron, arrived in this country in October 1942, but it was several months before the organisation built-up to one comparable with the R.A.F.'s. By March 1943, the 7th Photo Group, comprising four Lightning Squadrons (including the 13th Photographic Squadron) was operating from Mount Farm, the previously owned R.A.F. Station situated in close proximity to Benson. All the photographic reconnaissance work carried out by the 7th Photo Group was handled by A.D.I.(Ph) in exactly the same manner as that carried out by the P.R. aircraft from Benson. All tasks received were vetted, and priority assessed, after which the appropriate operational order was issued via Coastal Command to Benson, repeated to Mount Farm, in order that both R.A.F. and U.S. P.R. Units should be aware of all obligations. At the same time, the Central Interpretation Unit was given full instructions on the action to be taken by them on the result of sorties, whether flown by British or American aircraft. The Commanding Officers of Benson and Mount Farm worked in close collaboration and the 7th Photo Group maintained an operational staff in the Operations Room at Benson. All requests received from American Departments and Commands were suitably marked as being of American origin and where range and capacity permitted, these tasks were given to 7th Photographic Group for execution. When not possible, they were undertaken by an R.A.F. P.R. Unit. Films of all sorties, both R.A.F. and U.S., were sent to Medmenham for second and third phase interpretation, but although American interpreters worked upon American photographs whenever practicable,

A.C.C.
A.O.
Minutes
21.8.42

106G/1
E.1A

this arrangement was not always possible as the Americans still had insufficient trained interpreters. In June 1943, the American Liaison Officer with A.D.I.(Ph) was withdrawn, as both General Eaker and the Commanding Officer of the American P.R. Unit were satisfied that American requests would be handled efficiently and with complete co-operation by A.D.I.(Ph) alone.

In operation, the P.R. Lightnings were not found to be very effective aircraft for long-range reconnaissance and they had a very high rate of unserviceability. The P.R. Mosquito was a very better aircraft from every point of view, and the Americans made no secret of the fact that they would like to be allotted some Mosquitoes in lieu of their Lightnings. As early as March 1943, when the American P.R. Unit had only just begun to function operationally, the Chief of the Air Staff considered offering some Mosquitoes to the Americans for use in their P.R. Squadrons provided that there was no risk of the R.A.F. Units running short. However, the urgent need of Mosquitoes for photographic reconnaissance work in India and the general supply position, made it necessary to consider the matter afresh, and the offer was not made. General Eaker was not satisfied with the mark of Lightning aircraft in the 7th Photographic Group however which he did not consider was up to the standard necessary for the type of operation the Unit was called upon to perform. Accordingly, in October 1943, he approached D.C.A.S. for the loan of some Spitfire XIs. He asked if his Unit might be loaned twelve P.R. Spitfires to tide over the period until a new mark of Lightning was available. The loan was agreed, although it entailed retarding the build-up of T.A.F. P.R. Squadron for about a month. Twelve Spitfires were modified at Benson and passed to the American Units at Mount Farm, and although it was anticipated that they would need to operate them only until the end of 1943, they were still in full use until long after 'D' day. During the latter half of 1944, when the American Spitfires had been reduced to six, they were replaced by a new Mark of Lightning, but the P.R. Spitfire remained a popular aircraft with its American users.

A.C.A.S.(P)
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D.C.A.S.
folder
V.11

The first large-scale American bombing mission had taken place in October 1942, and for the next eight months the American day bomber offensive gradually built up to a scale comparative in number of sorties to that of Bomber Command's night attacks. It naturally followed that by the Summer of 1943 the demands on the Central Interpretation Unit from U.S. sources, particularly for bomb damage assessment, had increased in proportion and more photographic interpretation officers were brought over to assist in the work. By September 1943 there were three American Units at Medmenham, all under their own Commanding Officers and responsible to the 8th Air Force, but working in conjunction with and alongside the R.A.F. Section of Medmenham. These American Units included the First Air Force Photographic Intelligence Detachment, consisting of 61 officers and 15 enlisted men, a small administrative body known as the 1st Photographic Procurement Detachment, whose sole task was the collection and distribution of orders from American customers, and an Engineer Model Making Detachment working with the Model Making Section of the Central Photographic Unit. Unfortunately, no minimum basic establishment had been laid down for the American side of the Central Interpretation Unit and the trained interpreters were frequently detached to Headquarters, VIIIth Bomber Command and elsewhere, whilst their places were taken by untrained officers. The 8th Air Force therefore agreed that a minimum of 63 experienced photographic interpreters should be maintained at the Central Interpretation

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E.4A

Unit, but they planned to augment this figure, by the inclusion of those under training, to a total of 163, including 30 W.A.Cs by the 1st January 1944.

By the beginning of 1944, the Americans were building up their organisation to prepare for the invasion, and formed a new Reconnaissance Wing - the 8th Reconnaissance Unit (later re-named the 325th Recce Wing) - to co-ordinate all reconnaissance requirements of the United States Strategic Air Forces. Although belonging nominally to the 8th Air Force it was intended that this Wing should have entire and general control of all American photographic reconnaissance from the United Kingdom. This threatened break-away of the American P.R. Units was followed by its natural corollary, a proposed split in the ranks of the Central Interpretation Unit. It was obvious that the new Commanding Officer of the 8th Reconnaissance Wing - Colonel Elliot Roosevelt - wished to control not only the P.R. Units but the photographic intelligence which was acquired from their photographic effort. The centralisation of photographic interpretation in the United Kingdom up to this point had guaranteed that there should only be one source of photographic intelligence and one statement on each subject. Should the Americans break away, two conflicting statements would appear on many subjects, particularly on bomb damage assessment, and it is easy to imagine the confusion that might have occurred where U.S. forces attacked a target in daylight, Bomber Command the same target at night, two lots of photographic cover were obtained over the target, and two damage reports issued.

The full story of the struggle to retain a centrally controlled Photographic Reconnaissance Organisation has been related elsewhere, but to quote just one aspect of the case, had the Americans set up their own Central Interpretation Unit it would have been necessary for Medmenham to reproduce 400 sorties, 10,000 prints, 1,200 mosaics, 100 maps and 2,000 cards to supply the necessary reference material.

Since September 1943, the Army Air Corps had been training a number of Reconnaissance Groups and Squadrons in the United States for field operations in their Third Reconnaissance Command when the invasion of the Continent took place. They wished to bring their reconnaissance organisation as far as practicable in line with that planned for 2nd T.A.F., and one of the arguments put forward by General Spaatz in favour of a separate Photographic Reconnaissance Organisation was that it would facilitate the provision of the necessary skilled personnel to complete the field organisation for photographic reconnaissance in the 9th Air Force.

When agreement was finally reached on the formation of 106 Group and the Joint Photographic Reconnaissance Committee, the Air Ministry gave instructions that every assistance was to be given in the way of releasing personnel and equipment from Medmenham to help in building up the requisite Photographic Reconnaissance Organisation for the 9th Air Force. At the same time, General Spaatz ordered the 8th Reconnaissance Wing to bring its Units to a degree of efficiency whereby not only all requirements for day and night photographic reconnaissance and requisite photographic interpretation could be completely and adequately met, but also the needs of the Combat Units of the 9th Air Force in photographic interpreters and in training of squadrons might also be achieved, until both 8th and 9th Air Forces Reconnaissance organisations should be complete and capable of carrying out all tasks required, both from the United Kingdom and, ultimately, from the Continent.

Ibid.,
23A

Ibid.
E.41A

The Joint Photographic Reconnaissance Committee undertook the unified control of R.A.F. and U.S. photographic reconnaissance and photographic intelligence resources in the United Kingdom in May 1944, and from thenceforward until the end of the war in Europe the smooth working and harmonious collaboration of the British and American organisations furnished an outstanding example of Allied co-operation.

To meet the P.R. requirements of the Western Front the R.A.F. and American Air Forces scheduled to operate on the Continent were each allotted their own photographic reconnaissance organisation. The 9th Air Force which was responsible for providing reconnaissance for its own Units and the 12th United States Army Group, was provided with a P.R. organisation which operated like the T.A.F. photographic Reconnaissance Units. As the American organisations worked in complete independence of the R.A.F., details of their build-up need not figure in this narrative. It is sufficient to say that there was little co-ordination between the various P.R. forces on the Continent, which led to duplication of work and consequent loss of effort and resulted in calls for assistance being made upon the services of 106 Group and 325th U.S. Wing. Had it been possible to provide an Allied centralised control for all P.R./P.I. forces on the Continent with the happy results achieved in the United Kingdom, Anglo-American co-ordination of P.R. resources would have been complete in every sense and in every theatre of war.

Report on
PR/P. I
Mission
to SHAEF.
1944

7. COMPARISON OF THE GERMAN PHOTOGRAPHIC RECONNAISSANCE AND PHOTOGRAPHIC INTELLIGENCE ORGANISATION

It is not the purpose of this narrative to give a detailed description of the organisation of enemy photographic reconnaissance in all its facets, but a brief account of the control, the system, and the equipment used may serve as a comparison with the British Photographic Reconnaissance Organisation. In 1938, General von Fritsch is reputed to have said - "The military organisation that has the best photographic intelligence, will win the next war", and there is little doubt that before and during the early years of the late war the German High Command was fully aware of the value of air reconnaissance and air photography.

Control at Air Ministry Level

Prior to 1935, a small band of enthusiasts who realised the importance of air photography was responsible for the running of a photographic reconnaissance and photographic interpretation unit known as the Main Photo Unit of the Reichswehr (the Habi). Working as civilians, and unequipped with aircraft, they co-operated with the Army in air reconnaissance, each Army Division having an "air representative" and a small Photographic Section. With the establishment of the German Air Force in 1935, the Main Photo Unit became a part of the Luftwaffe, the staff of the Unit forming a Department under the Director of Training in the German Air Ministry, whilst the technical personnel were controlled by the Intelligence Section of the German staff which dealt with long-term intelligence generally, having a separate sub-section dealing with photographic intelligence. The Training Section was used to form the nucleus of the new Photographic and Photographic Interpretation School.

In 1942, a reorganisation took place in the high levels of the German Air Ministry and the Luftwaffe, whereby the control of photographic reconnaissance became the responsibility of a Department known as Air Photos in the Air Inspectorate for Reconnaissance. Photographic reconnaissance was here regarded as one of the branches of general reconnaissance, and as photographic technique and research have nothing whatever to do with general reconnaissance, the results to the German organisation were little short of disastrous. From that date onwards no new equipment was developed nor were major experiments in technical photography carried out, mainly owing to the lack of specialist knowledge amongst the responsible officers in the Department concerned. Not one of them was capable of supervising the whole province of air photography, the original experts having been dispersed and employed on other duties, and the Department was gradually robbed of its powers and responsibility until it became little more than a sorting office for requests and demands.

Control at Operational Level

When the Luftwaffe was created in 1935, it was appreciated that air photography and reconnaissance would play an important part in war time, and by the beginning of the last war some 80 Reconnaissance Units had been formed, including Meteorological Units. These were classified as close-range units intended primarily for Army support; long-range units for Air Force and Naval requirements and for strategic Army requirements, and sea reconnaissance units for anti-shipping work.

Each Luftflotte Headquarters, (the Area Command Headquarters of the German Air Force), was responsible for all photographic reconnaissance and photographic intelligence

services for the Navy and Air Force within its own area, with the power to control all operational sorties. In addition to the long-range units under each Luftflotte, the Headquarters had a night reconnaissance unit at its disposal, used for visual night reconnaissance as well as to accompany night bombers and photograph markers and fires. A Staff Photographic Officer was established on each of these Headquarters, whose task it was to co-ordinate the photographic work of the various reconnaissance units in his area and to arrange for exchange of information between them. He was responsible to the Senior Intelligence officer for all technical matters, as well as for the correct interpretation of air photos.

The control of the close support reconnaissance units was retained by the Army until 1942, when a reorganisation took place and the Air Force Headquarters, formed to work with the various Army Commands, took over responsibility for these units. Air photography was rarely used under battle conditions, the work of the close range units attached to Corps Headquarters and Armoured Divisions being mainly visual. One long-range reconnaissance unit had been working for each Army Command until the reorganisation, when these too became the responsibility of the associated Air Force Headquarters.

Long-range reconnaissance was more strategic in intent, and owing to the greater depth of penetration into enemy territory by these units and the height at which such sorties were flown it was almost always obtained by means of air photography. Several long-range reconnaissance units were normally grouped together on one airfield under the control of a "Group", nominally equivalent to a Bomber Command clutch. A Photographic Officer at the Group was responsible for advising the Group Commander on all photographic reconnaissance questions, and for co-ordinating demands and information between units and higher formations.

Photographic Intelligence Resources

The main photographic unit under the control of the German Air Ministry (re-named Habia in 1942) although the Central Photographic Unit of the Luftwaffe, cannot be regarded as the equivalent of the Allied Central Interpretation Unit because photographic intelligence was decentralised to lower formations and no long-term detailed specialist interpretation was undertaken, either at the highest or at any other level, the Habia being mainly responsible for reference and training material. Another Central Photographic Unit was known as the Sobia, formed at the outbreak of war by the militarising of a civilian firm specialising in aerial photography. This firm, the Hansa Luftbild, continued to operate as it stood and undertook all mapping and survey work, producing mosaics of all the principal operational areas.

Each reconnaissance unit had its own Photographic and Photographic Interpretation Section with an officer, usually a Lieutenant, in charge, who was directly responsible to his Commanding Officer for all technical matters concerning photographic reconnaissance. The Photographic/P.I. Section consisted entirely of other ranks and for the most part the interpreters on the unit only carried out a rough interpretation direct from the negative. The films were then sent to the Area Command Headquarters for further interpretation as might be necessary. In some cases the Photographic Officer at the Group also had a Photographic/P.I. Section under his command, and if so this section undertook most of the interpretation for its units, the latter then being reduced in strength.

The Air Force Headquarters at the various Army Commands

had fully mobile Photographic/P.I. Sections corresponding somewhat to those of the 2nd T.A.F. Reconnaissance Wings, on a smaller scale. These Sections were responsible for the detailed interpretation of all long-range sorties flown by the long-range reconnaissance unit under their command. At each Area Command Headquarters a Staff Photographic/P.I. Section was provided (the Stabia). The Staff of interpreters here was a larger one and permitted of some specialist interpretation.

Although the importance of the interpreters' work was appreciated they rarely became more than senior N.C.Os, whilst the majority of German interpreters were only corporals. Photographic interpretation remained entirely a Luftwaffe responsibility: not even in the Army reconnaissance units were any of the interpreters drawn from the military services. They were selected on the grounds that interpretation was more or less a mechanical process and whilst it required a background of education it did not need a fund of specialist knowledge. Unfortunately for the German Photographic Interpretation Service, the process was looked at more from a photographic than from an intelligence viewpoint and its ranks were not regarded as those of intelligence personnel. Generally speaking, interpreters were not supplied with ground information and other forms of intelligence in any detail which might have had a bearing on their work, and they were only allowed to record what was seen upon the photographs. Any evaluation of intelligence gained thereby was a matter for the Photographic Officer in charge, and many opportunities for obtaining valuable information were missed by this method. Although it was the responsibility of the Photographic Officer on the Staff of the Area Command Headquarters to disseminate and co-ordinate information to and from all the reconnaissance units in his area, the fact that photographic reconnaissance and interpretation was looked upon as a tactical weapon rather than a strategic weapon precluded the obtaining of any valuable strategic information which a full investigation of photographs and comparison with other sources of intelligence might have yielded. Even at the Habia, no attempt was made to study photographic cover in the way in which it was undertaken at the Allied Central Interpretation Unit; the interpreters were only looking for what they had been asked to find and not for any additional information which a photograph might reveal.

Types of German Aircraft used for P.R. Work

In 1939 short-range units were provided with the Henschel 126, similar in type to a Lysander. This aircraft had little speed or range, and it was soon realised that it was not adequate for reconnaissance in war time. Units were therefore re-equipped with the twin-engined Focke Wulf 189, which remained in use until 1943, but this type had the drawback of only being able to carry one fixed vertical camera. A P.R. Spitfire captured fairly intact in 1941 revealed to the Germans the possibilities of single-engined aircraft for photographic reconnaissance, and the single-seater ME.109 was introduced for short-range work as a result. Although it carried two automatic cameras, the retention of its armament restricted its height and range, and the Germans never took the step of sacrificing armament to higher performance. From 1943 onwards close-range units were all re-equipped from FW.189s to ME.109Gs.

The long-range units were equipped with multi-engined aircraft, initially with DO.17s, later with HE.111s and JU.88s. As none of these aircraft was a match for our fighters, after early 1942 they were unable to operate over Great Britain other than the South Coast or, indeed, anywhere where British or American opposition might be met. One added

difficulty to reconnaissance over the United Kingdom was the efficiency of the Allied radar service, which located the enemy aircraft at an early stage of its sortie so that it had invariably to meet fighter attack.

German reconnaissance aircraft gained initial success in the early stages of the war when they met with little opposition. Before the campaign in France they carried out unlimited and unopposed air intelligence for the High Command, and the greater part of the planning for the invasion of England was done with the aid of information and intelligence secured from air photographs. The invasion of Greece was largely put into operation with these aids, but later, Allied opposition in the Mediterranean interfered considerably with enemy reconnaissance operations, and photographic reconnaissance from Crete over Egypt could only be carried out by high altitude JU.86Ps.

Up to 1941, German photographic reconnaissance provided a clear picture of the disposition of the main units of the British Home Fleet, and the information obtained was sent direct to Supreme Naval Headquarters. With the decline in superiority of the German P.R. aircraft and increased R.A.F. fighter opposition, photographic reconnaissance of the main British ports became impossible, but the German Navy's needs for photographic assistance were not considered to be as pressing as those of the Army. By the end of 1941, photographic reconnaissance over Britain had become dangerous in the types of long-range aircraft available, and in 1942 had almost ceased, other than along the Channel coast. Certain night photography was carried out with indifferent success, mainly to provide strike photographs of bomb damage assessment for German Air Force raids. From 1943 onwards, the shortage of P.R. aircraft became more and more acute and the High Staff had no enthusiasm for re-equipping P.R. units at the expense of fighters. During the pre-invasion period the complete Allied air superiority made it very difficult for German reconnaissance aircraft to carry out any operations at all, and by June, 1944 air reconnaissance on the Western Front was reduced to negligible proportions. On the Eastern Front the German reconnaissance aircraft were not technically inferior, but here the lack of aircraft was the reason for the failure to obtain air intelligence. In the Russian campaign, during the counter-offensive at Stalingrad in 1942, and the Russian summer offensive of 1944, the German reconnaissance service failed to provide adequate information on which the strength of the expected attacks could be based. In March, 1945 an attempt was made to re-equip two units with jet propelled ME.262s, but only a few such aircraft had been made available for reconnaissance work by the end of the war in May, 1945.

One of the few successes obtained by the enemy during the North Western European campaign was the photographing of Allied airfields in preparation for the attack of the 1st January, 1945.

Camera Installations

German air cameras were well constructed and capable of high quality photographs and were fitted with Zeiss lens of 20, 50 and 75 cm. They were designed primarily for survey work, however, and their weight and bulk made them difficult to fit in most of the types of aircraft used for reconnaissance, particularly the single-seater types. As no attempt was made by the Luftwaffe to develop a special aircraft for photographic reconnaissance, it follows that few experiments were made to develop a suitable camera.

Weaknesses of the German Photographic Reconnaissance Organisation

The fundamental weakness of the German photographic reconnaissance service lay in the failure to develop a fast high altitude aircraft specifically for photographic reconnaissance purposes. From 1941 onwards the aircraft used were never the equals in performance of either their R.A.F. counterparts or of our fighters, and by 1944 had become hopelessly outmatched. No preparations were made for providing an efficient P.R. force to assist in repelling the invasion, with the result that at a time when the German force urgently required accurate intelligence it lacked both the aircraft strength and technical superiority to obtain photographs.

That without successful photography no P.R. organisation can achieve success is a self-evident fact, and therefore to the aircraft situation alone the German failure can be attributed, although many other weaknesses would have become contributory factors had adequate photographic cover been obtained at all times. The greatest of these was the failure to centralise the organisation. The story of British photographic reconnaissance shows the constant endeavour made to bring the organisation under one central control, with the result that when the highly centralised organisation of No.106 Group and the Joint Photographic Reconnaissance Committee was achieved, it was able to produce quickly for all who needed it a vast amount of accurate information bearing on enemy activity of any kind wherever it took place.

Extreme decentralisation achieved its object in providing photographic results for the Army with minimum delay as long as Germany was fighting a rapid war of movement, as she was doing in the campaigns in Poland, Norway and France, but the organisation broke down in the defensive period when she was forced to play a part she had not foreseen. The Germans never realised to the full the strategic as opposed to the tactical possibilities of photographic reconnaissance and were, therefore, unable to appreciate the defensive part which it could have played in the later stages of the war. Their organisation can be likened to the tactical P.R. organisation in 2nd T.A.F., shorn of any assistance given by No.106 Group.

What central control there was at Air Ministry level did not interest itself in purely P.R. matters, and the Senior Officers concerned at high levels lacked all technical knowledge. The whole air photo service, such as it was, needed independence to obtain any results, but as it was always necessary to co-operate with one Department or another before the slightest improvement or adjustment could be made, the P.R. organisation became a mere "hanger on" of the Supreme German Air Force Command.

The failure to exploit the possibilities of photographic intelligence, albeit hampered by lack of adequate photographs, was another nail in the coffin of German photographic reconnaissance. The decentralisation of interpreters, carried out with the object of having information available at the front line, resulted in numbers of small interpretation units incapable of research or development and very wasteful of manpower.

In spite of General von Fritsch's pronouncement, and the realisation by the High Command that photographic reconnaissance was one of the essentials of modern warfare, the German P.R. organisation remained inflexible to the end, and from every point of view proved impossible of adaptation to the needs of the changing war situation.

Note: A full description of the German P.R./P.I. service is contained in a report issued under that heading by Air Ministry (A.I.(2)). The information given in the above Section has been taken from this report and from other similar reports in the possession of H. Qtrs. No.106 Group.

8. THE ORGANISATION OF PHOTOGRAPHIC RECONNAISSANCE

The requirements of a Photographic Reconnaissance Organisation fall broadly under three main headings:-

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- (i) Adequate control of the organisation - the assessment and co-ordination of all demands for photographic cover in order to obtain the best results with the facilities available, and the allocation of those facilities to accord with the operational requirements of the moment.
- (ii) Sufficient operational units - and all those ancillary units which contribute directly to the successful flying of the sortie - to bring back the photographs required.
- (iii) An efficient air intelligence organisation - the interpretation of the photographs obtained, the co-ordination of information derived therefrom with intelligence from other sources and, finally, its delivery to the authorities who desire it.

How these requirements were developed has been the subject of the preceding sections. This part of the narrative would not be complete without a brief description of the way in which the whole organisation was welded together from the moment when the photographic reconnaissance aircraft was received from the factory to the final delivery of the intelligence to the "customer". The system in force up to the end of the war in Europe is the basis of this description.

New photographic reconnaissance type aircraft were delivered to the R.A.F. Station, Benson where cameras were installed and the aircraft prepared for operations. In the earlier years of the war before standardised types of P.R. aircraft were completed at the factory, considerable modifications had been undertaken on arrival at Benson, but from 1943 onwards the work entailed was, for the most part, concerned only with the camera installation. Aircraft were prepared according to the requirements of the unit or formation to whom they were to be delivered and according to whether they were to be used for day or night photography. These details were issued by Air Ministry, and the Initial Preparation and Inspection Party at Benson was responsible for carrying out the work under the directions of Headquarters No.106 Group.

In addition, this unit carried out a considerable amount of experimental work, including the preparation of new types of camera installations for special requirements and the adaptation of operational non-photographic reconnaissance type aircraft to P.R. use. When the installations were complete and cameras had been both ground and air tested, those aircraft intended for overseas commands were handed to No.309 Ferry Training and Aircraft Despatch Unit, also at Benson. Aircrews who had completed their training in No.8 P.R. O.T.U. and were annotated for overseas service, were then posted to the Ferry Training Unit where they received a period of ferry training before delivery of the aircraft to their overseas destination. Other P.R. aircraft intended for home use were fed into the P.R. squadrons of No.106 Group or 2nd T.A.F. as required, matched up when necessary with crews from No.8 O.T.U.

The Initial Preparation and Inspection Party however was not the only unit at Benson which carried out experimental work for the P.R. organisation. Experimental flying on new types of P.R. aircraft and with new types of equipment was carried out by the Photographic Reconnaissance Development Unit. This Unit was responsible for the development of P.R.

tactics and operational technique and gives advice from the user's point of view on the development of photographic equipment.

When aircraft and crews reached their operational Unit they were ready for action, but before they could be employed on operations the controllers of the Photographic Reconnaissance Organisation had to carry out their functions. A body which was previously the Air Ministry Branch known as A.D.I. (Ph), and from May, 1944 to the end of the war, the Joint Photographic Reconnaissance Committee, had been entrusted with the task of receiving applications for photographic reconnaissance or photographic intelligence. The Joint Photographic Reconnaissance Committee, which was a Sub-Committee of the Joint Intelligence Sub-Committee through which it was responsible to the British Chiefs of Staff, consisted of Naval, Army and R.A.F. officers, together with two American officers. This Committee was kept very fully informed of the higher strategy of the Government and obtained all the most recent information of impending operations. Against this background of knowledge its members were able to assess the importance of requests for photographic cover and arrange a priority list accordingly. Their duties also included the clarification of ambiguous requests and the ascertaining of what cover already existed and they pointed out to formations the difficulties and dangers of carrying out certain sorties. They were thus able to reduce the enquiries to exact terms and accurate map co-ordinates, and to decide the scale type of photograph which must then be obtained to satisfy each particular requirement.

With this information, Headquarters No.106 Group was able to decide the best type of aircraft for the purpose, the type and setting of the camera to be used, and the height to be flown. It was quite normal for one aircraft to undertake up to a dozen different tasks in the same area and for the Mosquito in the course of one flight to take both oblique and vertical photographs of different types of targets. With care and forethought the Operations Staff of the Group could despatch aircraft with suitable camera installations to photograph many different targets in the course of one sortie. The sortie was not complete, however, when the aircraft reached its target and secured the photographs, but it was essential to return to base with the photographs before success could be registered. It reflects great credit upon the Photographic Reconnaissance Organisation, therefore, that the technique and tactics developed during the war assisted aircraft to operate with little fear of molestation by enemy fighters, with the exception of the latter half of 1944.

Following the completion of a successful sortie the film was processed and the requisite number of prints made for interpretation. Details of the organisation for the handling of films and prints for interpretation have already been given, but it should be mentioned here that to achieve good quality negatives and prints it has been necessary to maintain continual search into the methods of processing and printing, and to effect constant improvement in photographic materials. Many sources of intelligence contributed information to the particular section handling the interpretation which, when collated with the photographic interpretation, gave a concrete foundation for military, economic or political action either in the immediate future or for long term planning.

This information was passed to the various formations and commands, who might be interested in varying degrees from either the operational or intelligence point of view. In most cases the ability to produce the photographs and the

intelligence would have been wasted unless prompt delivery could be ensured, and for this reason communications facilities to all main customers in the United Kingdom and on the Continent were operated by the Photographic Reconnaissance Organisation itself to avoid delay or confusion.

This system of organisation of the photographic reconnaissance structure was evolved during four years of experiment and hard work and was found suitable to the war situation during the years 1944-45. Although the organisation of No.106 Group has here been taken as the example of how a photographic reconnaissance organisation functions, the principle has been emulated in a lesser degree on the Continent of Europe and in overseas commands, and these formations have benefited considerably by the experience and research of their "parent" organisation.

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PART IIPHOTOGRAPHIC RECONNAISSANCE - OPERATIONS AT HOME
AND OVERSEAS, MAY, 1941 TO AUGUST 19451. - MAY, 1941 - FEBRUARY, 1942

In the six months following the Battle of Britain, photographic reconnaissance had been directed in support of the measures undertaken against enemy anti-shipping activities, and these have already been recorded in the previous volume. In the nine months which followed, the attention of our photographic reconnaissance organisation remained focused principally upon the same objectives, but in addition to photographic reconnaissances for defensive purposes a considerable amount of work was done in support of the slowly mounting bomber offensive.

A. German Naval Units

✓ In 1940/41 Germany possessed a formidable number of large naval units. High on the list came the battleships Bismarck and Tirpitz, intended to constitute the major part of German naval might, and designed to be the most powerful warships in the world. Bismarck was completed in November, 1940 Tirpitz in the following year. In addition, the Germans possessed three heavy cruisers, including the Lutzow, the battle cruisers Scharnhorst and Gneisenau, and three Hipper class cruisers, including the Admiral Hipper and Prinz Eugen. So powerful a battle fleet was sufficient seriously to threaten our merchant shipping operating in the Atlantic and to occupy the attention of a considerable British naval force. Regular reconnaissance of enemy-held shipping bases was of the utmost importance if the individual units of this large force were to be neutralised, and from the end of 1940 onwards the P.R. Unit had combined with naval intelligence sources to provide regular information about enemy shipping movements.

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Despatch
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✓ In the early days of 1941 these efforts had met with some success. In January, 1941 the P.R.U. had located a Hipper class cruiser in dry dock at Brest, resulting in a series of attacks being made upon it, and in March, 1941 the presence of the Bismarck in Kiel dockyard, and the Scharnhorst and Gneisenau in Brest, had been established by the aid of photographic reconnaissance. The Tirpitz, now fitted out, was also known to be in Kiel at this time.

✓ On the 20th May a report was received that two heavy ships, accompanied by destroyers and escort vessels, had passed through the Kattegat on a north-westerly course. Two Spitfires of No. 1 P.R.U. were sent to search all Norwegian ports and anchorages within range of Wick, and one aircraft⁽¹⁾ found and photographed a battleship and one 8" cruiser at anchor in the fjords near Bergen. Interpretation of photographs taken revealed that the vessels were the Bismarck and Prinz Eugen, and showed that there was a possibility of launching a torpedo or aerial torpedo attack upon them. On receipt of this information the Admiralty disposed all its major units within range, with the object of engaging the enemy vessels. The Bismarck was subsequently engaged and sunk on the 27th May, but the Prinz Eugen was not sighted and her whereabouts remained unknown until a P.R. aircraft located her at Brest on the 4th June.

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✓ On the 3rd June, good photographs of Kiel, Brunsbuttel, Cuxhaven and Heligoland were obtained by a Spitfire pilot of

(1) (Pilot - P/O. Suckling)

No.1 P.R.U. They revealed that although the Admiral Hipper and the Admiral Scheer were still at Kiel, the Tirpitz had left.

On June 11th, information was received that a German naval force might break out of the Skagerrak, and No.1 P.R.U. was instructed to be ready to locate the force should the threat materialise. Although no sighting was made, a force of torpedo bombers set off in the hope of effecting an interception. They made contact with, and attacked, a heavy cruiser - the Lutzow - and four destroyers. The Lutzow was believed damaged and her speed reduced, and a little later, when ten miles south of Christiansand, a P.R. Spitfire obtained a photograph of her, confirming that she was damaged. Further photographs of Kiel, obtained on the 17th June, showed the Lutzow in dry dock there.

Meanwhile, the German battleships Scharnhorst and Gneisenau in Brest continued to be the objective of a very high proportion of the sorties flown by No.1 P.R.U. (1) Not only was continuous photographic cover required to keep watch on the movements of these vessels but also to ascertain the damage done during the numerous attacks made upon them by Bomber Command during April to July, 1941 and again at the end of the year. As soon as the Gneisenau was placed in dry dock at Brest, photographs revealed the efforts to camouflage the vessel. This was even more evident in the case of the Scharnhorst, which was moved to La Pallice for a week during July. Attempts were made to conceal its movement by the use of a camouflaged tanker, but photographs showed the substitution in progress and subsequent result when the move to La Pallice took place on July 21st/22nd. Photographs were taken of her whilst in her new quarters, and when she returned to Brest on July 27th, photographic reconnaissance showed the attempt made to camouflage the battleship to look like the tanker. On the 27th July, photographs revealed the presence of a balloon barrage of 26 balloons within a 1½ mile radius of the port.

As for damage assessment, the most successful sorties were those of May 20th, which showed a floating crane alongside the Scharnhorst and repair work in progress, which confirmed that damage had been done by Bomber Command during their raid on the night of May 3rd/4th. On July 24th, photographic reconnaissance of the Gneisenau tended to confirm the report that the attacks during April and May had been successful in causing damage to the engines or propeller shaft. Photographs showing that the super-structure on the after part of the vessel had been removed. After the arrival of the Prinz Eugen in Brest on June 4th, one successful attack was made upon her on the 1st July, in which she received three direct hits. A photograph showed her remaining in dry dock until December 1941, which confirmed that some serious damage had been caused. Photographs continued to be taken of all three vessels until February 11th/12th. They revealed that the Gneisenau remained in dry dock until December 23rd, and returned there after the attack of the 9th January, which caused a rent near her propeller shaft. She remained in dock until January 25th, 1942.

On January 29th, and 31st photographic reconnaissance revealed the arrival at Brest of two destroyers, five torpedo boats and eight minesweepers. This, coupled with Admiralty information, seemed to indicate that the ships might break out of Brest. On the 8th February, further photographic reconnaissance showed the Scharnhorst and Prinz Eugen in harbour, whilst two more destroyers had arrived. These

(1) See Volume I, page 262.

Monograph
on Scharnhorst
and Gneisenau
in A.M. Library

photographs caused the Air Officer Commanding-in-Chief, Coastal Command, to issue a warning to Fighter and Bomber Commands that there were indications that a break out might be attempted any time after the 10th February. Photographic reconnaissance was continued, and on the afternoon of the 11th February the presence of all three battleships was established; the Scharnhorst was undocked as well as the other heavy units but the torpedo booms were in place, which was interpreted to mean that a break out was not imminent.

On the morning of February 12th, 1942, a Fighter Command Spitfire on reconnaissance observed all three vessels proceeding up the Channel, whence they escaped into the North Sea. Although a photographic reconnaissance had been ordered for first light on this day, in February the earliest photographic light was sufficiently late for all traces of the warships to have disappeared from the vicinity of Brest. Two more P.R. sorties were flown over Brest on that day to confirm the vessels' departure, completing a total of 729 P.R. sorties flown over Brest since March 28th, 1941, on four occasions as many as 7 sorties having been flown in one day. In achieving these results, 9 P.R. Spitfires were lost, representing 1.2 of the sorties flown, five of these losses occurring during the first five months of their task. After the location of the Gneisenau and the Scharnhorst in Kiel, and the Prinz Eugen in Norway in March, 1942, routine photographs of them were taken from time to time, but these vessels were considered to be sufficiently damaged for them to cease temporarily to be a serious menace to the safety of British shipping, and other photographic reconnaissance activities became of greater importance in the Spring of 1942.

TIRPITZ ✓
The remaining German major naval units gave the P.R.U. work for some time to come. The Tirpitz, ready for sea in the Summer of 1941 and known to have left Kiel in June, now remained the biggest single menace to our shipping. The same Spitfire pilot⁽¹⁾ who had discovered her absence from the German port in a 5½ hour sortie on the 29th September, 1941, photographed Gdynia and Danzig ports that had recently come within the range of the P.R. Spitfire. He brought back news of the presence of Tirpitz in the Gulf of Danzig. In January, 1942 she moved to the Trondheim area of Norway, and although she never again left Norwegian waters, for the next 2½ years she became the subject of an almost uninterrupted flow of photographs in the face of many difficulties. On the 23rd January she was photographed on the north side of the inlet at the head of the Aasfjord. She was photographed in Narvik Sund, off Trondheim, on the 5th February, and again on the 15th February, at Aasfjord, this time at the low level of 1,500 feet. From thenceforward, continuous watch was kept upon her by the P.R. Spitfires from Wick, soon to be assisted by the new Mosquito detachment at Leuchars.

B. Enemy Decoys

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The other highlights of 1941 were not so much the outcome of special P.R. missions as the result of activity on the part of the Central Interpretation Unit in searching routine photographic cover for special objects, such as dummy decoys and enemy radio and radar installations, although sometimes, as a result of their investigation, special sorties were flown to obtain further information.

In August, 1941, the first report on enemy decoys was issued by the Central Interpretation Unit. Bomber crews returning from raids had reported that dummy factories, dummy fires, and artificial explosions were being increasingly used by the Germans. Owing to the fact that photographic reconnaissance only covered the targets themselves as a rule,

(1) (F/Lieut. SALWEY).

P.R.U.
Records

C.I.U.
Report
Z.3

12.8.41.

the countryside surrounding the main industrial targets was not often photographed, but on some photographs received during the Summer of 1941 a number of curious structures were found, varying in type but all with uniformity of design. These structures were situated at the distance from the targets which might be expected if they were decoys. The growth in the number of such decoys was noted and compared with pilots' reports, from which it was possible to build up a picture of the decoys, categorised into their various types. The plotted positions were then made available to Bomber Command, and were of great assistance in briefing crews for bomber raids.

C. Enemy Radio and Radar

On the 23rd February, 1941, the first photographic proof had been obtained that the Germans were making use of radar, and from that time onwards the value of photographic reconnaissance and photographic interpretation began to be widely recognised in investigating the various forms of radio and radar installations employed by the enemy. This information became of first rate strategic importance throughout the war years and a special section (Section G) was formed at the Central Interpretation Unit in November, 1941. Development was rapid and revealing. Before December, 1941 the only type of enemy radar installation known to us was the long-range type "Freya". On 5th December, two brilliant and daring photographs obtained by an expert P.R. pilot (S/Ldr Hill) revealed the first of the short-range series of radar installations, a parabaloid type of radar known as the Wurzburg. This new short-range installation, known colloquially as the "bowl fire", was first photographed near Le Havre and became the objective of the Bruneval raid. In order that we should have full information of this new type of German radar equipment which was playing an important part in the control of German flak, a combined operation to capture a radar set was put in motion as a result of the photograph of the "bowl fire". The C.I.U. was called upon to supply intelligence for the planning of the operation. A large scale mosaic of the whole area was prepared and annotated, a trace showing gradients, and a model of Bruneval and district, on a scale of 1/2,000, showing every feature of the terrain was provided for the operation with which all concerned were briefed. The attack took place on the 27th February, 1942 and was entirely successful. The Commander of the Airborne Division (Major-General F.A.M. Browning D.S.O.), in his official report, paid tribute to the "really excellent photographs and models" which contributed to the success of the operation. By the end of February, five further "bowl fires" had been located by P.R.U., most of them being installed at previously known Freya locations, the combination of the two types forming a very powerful installation.

Besides these new discoveries, considerable interpretation work was done on enemy navigational beam systems and direction finding stations.

D. Enemy Aircraft and Aircraft Factories

Watch was constantly kept by photographic interpreters for proof of new types of enemy aircraft shown on photographs of factories and airfields. At first, the photographic cover obtained was of a chance character, mainly of factory airfields close to ports or of factories in principal target areas, as in 1941 most of our P.R. aircraft were too occupied with priority tasks to allow cover of enemy centres of aircraft development to be obtained other than at irregular intervals. An early success of photographic interpretation in this connection, however, was the discovery of Heinkel 177s on Rostock airfield during the Summer of 1941.

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Another success during the period under review was the discovery during September of a number of large German gliders on German aerodromes. This was one of the last invasion scares, and some alarm was caused in Air Ministry when the presence of gliders with a wing span of up to 180 feet was reported at Merseburg. This aerodrome was first photographed on the 13th July, 1941 when three very large gliders were visible. The same aerodrome covered again on two occasions during September confirmed the presence of the gliders. Smaller gliders in some numbers were also reported at Gottingen, Hagenow and Halberstadt airfields, and certain aerodromes in Belgium. The photographic evidence was later collated with other intelligence sources and a full report on German troop and freight carrying gliders was issued by Air Ministry (A.I.2(g)).

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Home. During this period No.1 P.R.U. was mainly engaged with the Scharnhorst, Gneisenau and other German naval units, but already a good beginning had been made in the task of building up a complete picture of Germany's war potential; her aircraft factories, her war industries and her defences including decoys and wireless and radar installations. Although so short a time had elapsed since Germany had completely overrun the Continent already photographic cover of the coasts of occupied countries was being obtained, knowing that one day in the future the Allies would invade the Continent.

During the latter half of the period under review there were several outstanding events in the history of photographic reconnaissance. On the 20th September, the first successful operation in a P.R. Mosquito was made over Bordeaux and the Bay of Biscay. In the same month the longest flight in distance was made by a P.R. Spitfire, when an aircraft (Pilot-F/Lt. Salwey) photographed Gdynia and Danzig, reporting the presence of the Tirpitz and photographing three of the four 6" German cruisers in port - the Nurnburg, Koln and Emden. The aircraft was airborne for 5 hours 30 minutes.

On the 12th December, a sortie was made by one of the most experienced P.R. pilots (S/Ldr. Hill) over France, during which he took remarkable low oblique photographs from a height of 300 feet of a tank factory at Gien near Orleans. Information already received that great activity was taking place here was definitely established by the photographs he obtained. The fortifications of Saarbrucken were covered in February, 1942, the first time since 1939.

The development in the P.R. organisation can best be illustrated by comparing the sorties attempted during 1940 with those flown in 1941:-

	Total Sorties	Successful	Unsuccessful
1940	1,198	835	363
1941	2,676	1,855	821

Already the successful sorties had been more than doubled, and this progress was to be maintained throughout the war.

This period was also a successful one for technical development, the first 36" lens being used on operations in November, 1941 and the first F52 camera in the following January.

P.R.U.
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Overseas. The only photographic reconnaissance of any consequence overseas during this period was carried out in the Mediterranean, by No.2 P.R.U. in Middle East, No.69 Squadron in Malta and by the Gibraltar Detachment of No.1 P.R.U. The first operational P.R. sortie from Gibraltar was made on the 25th June, 1941 by a Maryland, when good photographs of the Spanish & Moroccan Coasts were obtained. The main work of the Detachment at this time was the photographic cover of certain portions of Spain and shipping in the waters of the area.

Air photography from Malta and Middle East during the period was concerned principally with information for the local Naval and Air Commands. The predominance of seaborne over railborne transport in the Mediterranean generally meant that few sorties were flown over inland targets at this time. Movements of merchant shipping were followed with great interest from Italian and Greek ports to the Axis supply ports in Africa, as the Germans were fighting in a country where there were none of the materials of war and where everything their Air Force and Army needed had to be brought from Europe.

Photographic reconnaissance from Malta may be said to have commenced with the photographing of Taranto by Marylands on the 10th November, 1940, the day before the attack by the Fleet Air Arm⁽¹⁾. In spite of the handicap of inefficient aircraft, regular sorties were flown over Sicily and Tripoli during the Summer of 1941, and elementary interpretation of shipping and airfields was made for the information of the Naval and Air Staffs on the Island. For the rest of 1941 the Hurricanes and Marylands of No.69 Squadron continued to carry out reconnaissance of enemy convoys between Sicily and Tripoli and enemy airfields in Tripolitania. In September, 1941 a Spitfire from No.1 P.R.U. was based on Malta to secure large scale cover of ports in the Central Mediterranean, and in January, 1942 some Middle East Beaufighters were sent to Malta to secure photographic cover of the Sicilian coastline, which at that time was the next object of our strategic planning, in view of Rommel's retreat to El Agheila.

One item worthy of note during the period under review was a short burst of photographic activity in Iraq and Persia between June and September, 1941. In May the Arabs in Iraq had revolted. Iraq was of great importance to Britain, as an unfriendly government there might foreclude British forces from protecting the important Persian oilfields, should these be threatened. At that time there was no photographic interpreter in the country, although the squadrons based in Iraq were capable of taking photographs. In June a photographic interpreter was sent to Habbaniya to interpret photographs of enemy troop movements and aircraft on landing grounds. In August, a small detachment of aircraft from No.2 P.R.U., Middle East, was sent to Shaibah, Southern Iraq, to undertake a photographic reconnaissance of Persia, in view of the projected invasion of that country. During the short period of the campaign, which only lasted a few days, many photographic sorties were flown over Persia to report on any troop concentrations which might be found, aircraft on enemy aerodromes and shipping off the coast.

(1) This has not been mentioned in the previous volume dealing with the period. The Commander in Chief, Med. Fleet, paid a tribute to the work of the R.A.F. Marylands from Malta, whose "photography played an important part in the success of the Fleet Air Arm at Taranto".

2 March, 1942 - November, 1942

This period is noteworthy in the records of the photographic reconnaissance organisation for the contributions made to the various combined operations which took place in 1942. A start had already been made with Bruneval, then came St. Nazaire and Dieppe, and the period culminated with the first large-scale allied assault operation - the landings in North Africa - to which photography contributed in no small measure. Meanwhile, the task of watching the German battle-ships was still of high importance, and in an effort to protect our Russia-bound convoys from their attacks a P.R. detachment was sent to Russia for the first time. Bomb damage assessment and the location of enemy radar also contributed their share to the tasks of the P.R. organisation during the nine months under review.

See P102

A. Combined Operations at St. Nazaire and Dieppe

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When a combined assault operation on St. Nazaire was being planned at the end of 1941, the only map of the port available was an out of date and inadequate Admiralty chart. As the object of the operation was the destruction of the lock gates, accurate charts were an essential part of the planning. Happily, photographs of the port taken over a period of eight or nine months were available and from these a model was constructed on a scale which made it possible to show changes in ground level and surface detail 3 - 4 feet and above. This model was made available to the Combined Operation planners in October, 1941, and with its help the careful planning and briefing was carried out, which led to the success of the operation. Photographic reconnaissance of St. Nazaire was continued at intervals right up to the time of the attack in March, 1942, in order that the development of new buildings such as U-Boat shelters and camouflage could be followed in detail. Moreover, the model, corrected by these details, was photographed from every angle and in day and night lighting effects, so that the participating forces were able to gain an impression of the port under the conditions in which they might be carrying out the attack. On March 28th, 1942, the Campbeltown, with her escorting force, entered the port of St. Nazaire and blew up the lock gates. How successfully this had been accomplished was shown by the damage assessment photographs taken not only just after the raid but at intervals during the next few months. The huge caisson was buckled and off its sill, which meant that the only dock on the Atlantic seaboard capable of taking the Tirpitz was unserviceable for some considerable time to come.

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Similar arrangements on a larger scale were made for the raid on Dieppe, one of the French ports which held large numbers of invasion barges and was strongly defended by the enemy. In April, 1942, when the question of the attack was first suggested, examination of all the available photographic cover of the coastline was undertaken to decide the best methods of assault and the most suitable beaches for landing the attacking forces. Details of the enemy defences and the shipping available to the Germans in the vicinity was obtained by photographic reconnaissance. Likewise, the information regarding the assault beaches was very complete, and most of it was obtained from vertical and oblique air photographs. Full topographical reports, illustrated by photographs, were issued by C.I.U., as well as information on approaches to Dieppe, the tides and tidal streams off the coast. During the planning stage amendments and additions were made to the detailed enemy defence Schedules from information obtained by photographic reconnaissance - this was very comprehensive and provided a complete picture of the area. Special models of Dieppe were built on which were marked all batteries, beach

defences, pill boxes, machine gun posts, anti-tank blocks and R.D.F. Stations. These models were then photographed from the seaward side at a very low angle to represent their appearance at nautical twilight. 750 copies of this silhouette were issued to Flotilla leaders and officers Commanding all ships.

No. 140 (A.Co.) Squadron, which in conjunction with the P.R.U. flew sorties over Dieppe during the whole planning period, flew a very low sortie over the harbour entrance only 36 hours before the attack. This revealed a tank in a concrete emplacement used as a strong point, a fact which was added to the latest details of the defences. In the afternoon of the day before the attack, a photographic reconnaissance sortie was made of all the Channel ports but revealed no change in the position of the shipping they contained. On the 18th/19th August, when the raid took place, all the forces in the landing craft were supplied with photographs and plans of the beaches from which they were to operate. Photographic reconnaissance sorties made during and after the raid showed that a good deal of damage had been done to buildings.

These two examples give an idea of the indispensable part played by photographic reconnaissance and aerial photography in the planning and preparation for special operations, and it was as a result of these and other experiences that photographic reconnaissance and intelligence work was brought to its highest level in undertaking the tasks for the invasion of the Continent.

B. The Landings at Madagascar

When planning for the capture of Madagascar began to take place in December 1941, the only maps and charts available were very out-of-date. The Planners required fuller information than was available to them, and photographs of beach areas, in order to select the best landing places. A request for photographic reconnaissance of Madagascar was made to the Chiefs of Staff, and on the 24th December 1941 A.C.A.S.(I) was asked to obtain photographs, particularly in the area of Diego Suarez, the initial objective of the operation. The difficulty was to provide an aircraft suitable to undertake the task, as at that time there was no operational P.R. Unit available in the Middle East. After a series of delays, eventually a Maryland of No. 60 S.A.A.F. Survey Flight undertook the work with the permission of General Smuts, and operating from East Africa, on the 1st March 1942 the pilot flew seven sorties at 18,000 feet taking photographs with 8", 14" and 20" lens cameras.

The delay in obtaining these photographs had been such that it was touch and go whether they would be available when the expedition sailed. On the 18th March, embarkation of the expeditionary troops took place; on the 19th March, the successful films were flown to Medmenham for interpretation and the reports were made available to the Planning Staff on board the "Winchester Castle" just before the vessel sailed on the 23rd March. The small scale and inadequate cover limited the scope of the intelligence obtained, but it was at least found possible to correct a large number of inaccuracies on the maps and charts available, the details of which were of great value to the operation. Unfortunately, the photographs stopped a few miles short of Antsirane, the point which was the first objective, and thus missed a prepared defence line which was only discovered during the operation, when it took place in May 1942.

The Officer commanding the Assault Force included in his report a recommendation that air photography could have been

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used over the enemy's prepared positions with great advantage and saving of time. (1) It is interesting to note that this step was taken in most of the later operations and assault landings, by using the tactical reconnaissance Squadrons fitted with cameras for photography.

C. German Naval Units

The watch on the Northern ports was continued unabated for those German naval vessels capable of offensive action, and progress of the work on the damaged Scharnhorst and Gneisenau was anxiously watched from time to time. On March 2nd, a reconnaissance of Kiel, Brunsbuttel, Hamburg, Cuxhaven, Flensburg and Sylt was carried out at a height of 21-24,000 feet. The photographs taken revealed the Gneisenau at Kiel in dry dock with the Scharnhorst lying alongside in the centre dockyard basin, as well as the Nurnburg. On April 12th Kiel was photographed again, when Travenmunde Port, seaplane base and aerodrome and Lubeck were also covered. The Scharnhorst and the Nurnburg were still in Kiel, but the Gneisenau had gone. On the 14th April the German ports of Bremen, Bremerhaven and Wilhelmshaven were covered, the Sedlitz being the only major unit in Bremen, with the Koln in Wilhelmshaven. The German and Baltic ports continued to be photographed regularly without revealing any outstanding movements, but the Gneisenau was subsequently located at Gdynia, and on the 1st August excellent photographs of her showed that she was still under repair.

Meanwhile, the Tirpitz accounted for most of the sorties from Wick and Leuchars. On the 14th April she was again photographed in Aasfjord, with Prinz Eugen, Admiral Hipper and Admiral Scheer nearby. On the 16th, when photographed, she was issuing smoke but rafts surrounded her stern. On the 21st, 24th and 27th, further reconnaissances were made, but apart from the fact that much of the camouflage had been removed, there was no significant change in the situation. On the 15th May the first sortie of a P.R. Mosquito⁽²⁾ was made to the Narvik area where the Tirpitz was soon to be transferred, and it was fortunate that the Mosquito had now come into regular service with the P.R.U. since Narvik was beyond the range of the Spitfires. On May 16th, a photographic reconnaissance of Trondheim showed the Prinz Eugen steering southwest at high speed accompanied by two destroyers, obviously making for Kiel. This knowledge resulted in attacks by Beaufighters of Coastal Command, and the next day the ship was seen proceeding at 10 knots in a south-easterly direction. She was subsequently located in Kiel. Photographic reconnaissance of the Trondheim area on the 22nd and 23rd May showed the Tirpitz, the Lutzow and Admiral Hipper still in the fjords. Between the 19th January and the 23rd May, 74 successful sorties from Wick and Leuchars were made over this area; 39 sorties were unsuccessful and 4 aircraft failed to return, resulting in the loss of three Spitfires and one Mosquito.

All went well until July 6th, when a photographic reconnaissance of the Trondheim fjords showed that none of the major naval units was present. The next day was a red letter day in the annals of P.R.U., when the first P.R. sortie to Alten Fjord was made via Russia. The enemy force - the Tirpitz, the Lutzow and the Admiral Hipper - was photographed moving within the Arctic circle by a P.R. Mosquito pilot⁽³⁾ who left

(1) No R.A.F. aircraft took part in the landings, only shipborne aircraft of the Fleet Air Arm.

(2) Pilot - F/O. Higson.

(3) F/O. Bayley.

his Scottish base at 0706 hours, landed at Vaenga airfield near Murmansk to refuel, and returned to base with his photographs at 2250 hours after operating at the extreme limit of his range. Clearly there was now a risk that the Tirpitz might retire still further north beyond the range even of Mosquitoes, so that she might be able to escape without notice and attack Allied shipping in the North Atlantic. In view of this danger, and to provide protection for Russian-bound convoys, it was agreed to move two Hampden Squadrons to Russia. To provide the reconnaissance needed to enable the forces to strike in time, a P.R. Detachment of Spitfires was sent to Russia to watch the Norwegian fjords within their range, whilst those out of range were covered by Mosquitoes from Leuchars.

On the 17th August the first evidence was seen that the Germans were making systematic attempts to hinder aerial reconnaissance, when a smoke screen was put into operation at Kiel, and photographs taken later in the month of the same port showed that this was so effective that the Prinz Eugen was completely obscured. Meanwhile, the watch on the German and Baltic ports brought some reward when in August 1942 the first photographic sortie of the Baltic port of Elburg revealed an entirely new class of small German destroyer, which in fact took its class name from this port.

D. The First P.R. Detachment in North Russia (August to October 1942)

On the 1st September three P.R. Spitfires left Scotland for Vaenga aerodrome. The enemy was aware of their presence and the aerodrome was attacked immediately prior to and after their arrival. The first P.R. sortie from North Russia was made over the Alten Fjord on the 11th September and revealed that the Köln and the Scheer, with four destroyers, had moved up to the fjord, but the Tirpitz was not present. A second sortie, made to search the anchorages for her, was fruitless. One or two sorties were made on each day when the weather was suitable, but in most cases the pilots had to descend through cloud to 3,000 - 4,000 feet to secure any photographs. With the arrival of a fourth Spitfire from Wick to replace the damaged aircraft, watch on the German naval units was continued until the 22nd October. Between the 1st September and the 23rd October, 19 successful sorties of the fjords were made, but weather was unsatisfactory for good results in photography, and the Tirpitz was not located by the Detachment. It was, however, photographed by a P.R. Mosquito⁽¹⁾ from Leuchars on the 28th September, when she was seen at Narvik steaming down Ofot Fjord, but as she was without escort it did not seem likely that she would put to sea. From thenceforward she remained in Kaa Fjord, except for one sortie, until her ignominious end in October 1944.

During the stay of the P.R. Detachment in Russia, photographs and general reconnaissance information of interest to the Russians was made available to them for their bombing attacks, and in return they allowed all their photographs of the area to be examined. On the 23rd October, when it was considered that weather conditions would make further operations of little value, the P.R. Detachment returned to the United Kingdom leaving the P.R. Spitfires, cameras and equipment at the disposal of the Russian Air Force. Although the Detachment did not take any outstanding photographs during its stay, it served to develop the cause of Anglo-Russian friendship and demonstrate the value of Russian operational bases for attacks against enemy held targets in Norway.

(1) Pilot - F/Lt. Merifield.

*There were three Spitfires
Vaenga Detachment*

E. Enemy Radio and Radar

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Parts of the apparatus brought back from the Bruneval raid showed that the new German radar installation had come into mass production. Several more "bowl fires" were discovered in April 1942, and it was evident that they would now appear in ever increasing numbers. In July, extensive search by the Central Interpretation Unit showed that they were being used for gun laying in enemy anti-aircraft batteries, at first in Germany then later all over the enemy-occupied Continent and as far afield as Greece, Crete and North Africa. In March, a larger development of the "bowl fire", known as the "basket", was first photographed. This object had been noticed in a photograph of a radar site near St. Trond and soon afterwards a pair of small objects was found on an ordinary routine sortie of Walcheren Island. It was clear that these were paraboloid reflectors of a type similar to the "bowl fire" but with a reflector constructed of wire mesh stretched over a framework like a basket. S/Ldr. Hill was called upon to take special low oblique photographs of the site, in order that further details might be seen, and he came back with some of the finest photographs ever taken of such a subject. Subsequent investigation proved the installation to be part of the radio control of night fighter operations against our bombers attacking Germany.

Reports received at C.I.U. spoke of an unusual tower on the dunes of the Hook of Holland. Again S/Ldr. Hill made a sortie, on the 24th May, and from 150 feet took excellent low level photographs to bring back the proof of another new type of radar which existed. This time it was a Coast Watching Station, specially designed to check all surface craft that ventured within range. Further photographs of the enemy-held North Sea and Channel coasts revealed a chain of such stations, and by November 1942 eighteen had been located by photographic reconnaissance. In August, a new and puzzling construction was photographed at The Hague, looking like a girder or bar raised well above the ground in the shape of a hoarding. As far as could be ascertained, its function was to operate against aircraft, and by the end of October three more "hoardings" were located by photographic reconnaissance, one in Holland and two in France.

By the end of 1942, sorties went further afield in their search for radar installations, and the comprehensive information that the interpreters obtained from their photographs was of the greatest operational importance. The work of this period was outstanding in bringing to light the extraordinary range and complexity of the enemy radar system. At the beginning of 1942 only 9 enemy radar stations had been located; by the end of the year the total was over 70 in addition to over 700 radio stations of various kinds located and listed.

F. Damage Assessment

Work on bomb damage assessment began to increase rapidly during this period in phase with the mounting bomber offensive. Before the autumn of 1942 the U.S.A.A.F. day bomber attacks were started, and continued on an increasing scale, target photography and damage assessment work being carried out by the P.R.U. and the C.I.U.

One early example of good bomb damage photography was in connection with the successful Bomber Command raid on the Renault Works. On the night of the 3rd/4th March 1942 the Renault factory, situated in a suburb of Paris, was attacked. It was a matter of urgency to photograph the results

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immediately to supplement the public announcement of the raid and to forestall enemy attempts to camouflage the damage or deny its existence. A P.R. Mosquito⁽¹⁾ took off from Benson at 1145 hours on March 4th in heavy rain and poor visibility. At 1230 it was over the target taking photographs at 600 feet. After being in the target area for 34 minutes, course was set for England and the aircraft arrived back at base at 1415 hours after a trip in very bad visibility. A brief report from visual reconnaissance was given immediately to the Intelligence Officer, the negatives were developed, printed by hand, and despatched to Bomber Command by 2010 hours. In spite of the appalling weather conditions, some fine oblique photographs were obtained which clearly showed the damage done. The destruction was widespread, and later photographs confirmed that 31 out of the 35 buildings had been hit by high explosives or burnt out by incendiaries.

Other successes in bomb damage photography included cover of Lubeck, obtained on the 12th April after many setbacks due to unfavourable weather. This revealed extensive damage to warehouses, the railway station and residential areas, two thousand houses and a dozen factories being destroyed. On this evidence, Lubeck was considered the most heavily damaged German town to date. The big raid on Augsburg during April was covered a few days afterwards, on 25th April, when the main Diesel Assembly Shops were seen to be severely damaged. Four raids on Rostock during the same month were all covered by photographic reconnaissance the next day, although the task was hindered by smoke from many fires. On 30th/31st May the first thousand bomber raid took place. The target was Cologne, and on the 1st and 2nd June bomb damage assessment sorties were successful in bringing back photographs showing the immense amount of damage done. In August, the first daylight American bomber raids took place, and photographic reconnaissance of their targets, particularly the marshalling yards at Rouen and Abbeville aerodrome, showed that the bombing was very accurate. On 10th/11th September the big raid on Dusseldorf was followed by bomb damage sorties which confirmed the heavy damage done, 380 acres being devastated and widespread destruction covering the whole town. Similar successful sorties were made over Karlsruhe and Bremen following the attacks made on these towns in September. In October, Italy became a target for Bomber Command, Genoa being raided on the 23rd and again on the 24th, whilst Milan was the objective on the 25th. Highly successful photographs of the damage were secured on the 2nd November by a Mosquito of the newly formed No. 540 Squadron.

An ambitious daylight raid was carried out by Bomber Command on the 17th October, when 94 Lancasters attacked the Schneider Works at Le Creusot. The following day, a photographic reconnaissance was made over the target, a round trip of 1,719 miles, but owing to a technical fault in the camera no photographs were obtained, and on the second attempt by the same pilot the aircraft failed to return⁽²⁾. Later in the month, large scale cover was secured showing the severe damage done to the various workshops.

A special task for which No. 1 P.R.U. provided both the intelligence and the bomb damage assessment was the Mosquito low level raid on the Gestapo Headquarters at Oslo on the

(1) (Pilot - F/O. Ricketts)

(2) The pilot was the expert low level exponent, S/Ldr. A. E. Hill, D.S.O., D.F.C., Commanding Officer of the newly formed No. 543 Squadron, flying a Spitfire of No. 542 Squadron.

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25th September. Photographs from sorties flown on the 26th and 28th September⁽¹⁾ by P.R. Mosquitoes, clearly showed the damaged building and the absence of any other serious damage in the vicinity. It must not be assumed, however, from these records that Bomb Damage Assessment photographs were easily obtained. Often the target had to be covered several times before photographs were secured, or sorties postponed on account of weather and between January and June 1942 only 45 successful sorties were flown, as compared with 62 unsuccessful sorties for Bomb Damage Assessment purposes⁽²⁾.

G. The Battle of Malta

During the greater part of 1942, and particularly during the successful German campaign in the Western Desert, Malta was on the defensive. Whilst her P.R. aircraft still followed the passage of supplies to Tripolitania, they became more and more occupied with the strength and location of the German Air Force in Sicily. Photographs of the Sicilian airfields showed that the G.A.F. had returned in strength to the bases which they had used for the 1941 attacks on Malta, and which were now to be used again in the intensified air bombardment of Malta which continued throughout the Summer of 1942.

In March, a few of the P.R. Spitfires allocated to Middle East Command were given to Malta to replace their out-moded Hurricanes, and these were employed both for photographic reconnaissance of Sicilian airfields and for the long-range shipping reconnaissances. During the whole of this period, described as "the heaviest and most sustained bombardment in the history of aerial warfare", photographic reconnaissance from Malta was the work of the two or three trained P.R. pilots⁽³⁾ who for eight months averaged one sortie each every two days, operating from an airfield subjected to almost continuous enemy air attack. Reconnaissance of all the Sicilian airfields was carried out twice each week by two aircraft in turn, and from the photographs obtained it was possible to maintain an accurate list of the number, types and disposition of the enemy Air Forces being employed against the Island.

On April 21st 1942, when the offensive was at its height, a rectangular area some 1,500 yards x 400 yards was observed on photographs to have been marked out by a plough close to Gerbini airfield, one of the main German bomber bases. This place was closely watched on photographs, and by the 24th it was in the process of being levelled, and it was soon apparent that some kind of satellite was in preparation. This was alarming as it seemed to imply an even greater intensification of aerial bombardment, but when soon afterwards two more satellites were discovered, a still more disturbing explanation of the air strips could be given; that they might be intended not merely to provide additional dispersal for bomber aircraft, but to accommodate the gliders which might play a major role in an airborne invasion of Malta. The plain, south-west of Catania, where the strips were found, was a flat tract of open land only 100 miles from Malta and would have made an ideal area for such a purpose. Each strip was also within a short distance of a railway station on the direct line from

(1) Pilot - F/Lt. Sinclair (26th Sept.) & F/Lt. Van Damm. (28th Sept).

(2) In October 1942 A.O.C. in C. Bomber Command stated that he was "not satisfied with results over a prolonged period." (See Section I). The chief difficulty in this respect was the weather.

(3) Perhaps the best known of these P.R. trained pilots, later to become first Commanding Officer of Malta's own P.R. Squadron (No. 683) was S/Ldr. (later W/Cdr.) Adrian Warburton, D.S.O., D.F.C.

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Catania and the Messina train ferry, over which the glider components and the airborne troops could pass. Complete photographic cover of the whole plain and other suitable areas in Southern Sicily was obtained immediately, and regular reconnaissance of the existing strips was carried out every other day. Huts were erected, underground cables were laid, and by the 10th May the strips appeared to be complete. But no aircraft appeared on them, and it seemed that Rommel was staking his all on the advance to Alamein. Nevertheless, close watch was kept on the strips throughout the Summer, but once the Germans began to retreat in the Western Desert they were in no position to invade Malta, and as the Allied air attacks on Sicily mounted it was noticed that the strips were used as dispersals for Catania and Gerbini airfields.

Between February and September, four attempts were made to run convoys to Malta from both east and west. Each of these operations was preceded and accompanied by a period of intensive photographic reconnaissance, during which constant watch was maintained, both over the enemy Naval Bases from Navarino in Greece to Cagliari in Sardinia, and over the airfields from which German dive-bombers and Italian torpedo aircraft could attack our ships. In February, had it not been for the previous destruction of convoy M.W.9 by German bombers from Crete it would almost certainly have met disaster at the hands of a cruiser force from Messina, and this and other examples proved the importance of continuous reconnaissance. In March, the convoy commanded by Admiral Vian encountered a superior Italian force, luckily engaged in escorting an enemy convoy to Tripoli, and in June failure to locate the Italian Battle Fleet in the Eastern Mediterranean after it had left Taranto, obliged the convoy to return to Alexandria. Whilst the historic convoy of August 1942 was passing through the Western Mediterranean, an exceptionally large number of P.R. sorties was flown over ports such as Taranto and Palermo, both of which were covered nine times during a period of only four days. A formidable force of three 8" and three 6" cruisers assembled in the Tyrrhenian Sea was photographed steaming westwards to intercept the largest and most vital of all the Malta convoys. But off the north-west coast of Italy, almost within striking distance of the merchant ships, the enemy cruisers were induced to turn back by intercepting an order deliberately broadcast in plain language from Malta, which made it appear that an attack was due to develop. This simple stratagem, made possible by previous photographic reconnaissance, saved the convoy from what might otherwise have been complete destruction. As the convoy came within range of Sicily, a raid against Catania airfield was carried out by Commandos landed from a submarine. This was intended to act as a diversion and to cripple as many dive-bombers as possible. The photographic interpreters in Malta assisted the Army Commander to prepare an annotated mosaic of the airfield and its defences, from information obtained by photographic reconnaissance. This was taken on board the submarine, as well as being used in planning the details of the operation. Unfortunately, the raid failed owing to the elaborate system of guards maintained by the Germans and no opportunity was given of checking the accuracy of the photographic intelligence.

By the end of September, air superiority had been regained in Malta and daylight attacks on shipping were resumed. A Beaufort Torpedo Squadron was used as a striking force, and the P.R. Maryland was reintroduced for long-range shipping reconnaissance, thus relieving the P.R. Spitfire pilots of much of the navigational strain of flying aircraft out over the sea in search of convoys. By this time, very few ships attempted the dangerous route from Naples down to and along

the Tunisian coast or through the Straits of Messina, but ran across the Central Mediterranean to Tobruk and Benghazi from Taranto and Brindisi. The loading of merchant ships in the Italian ports and their berthing and unloading alongside the hulks of sunken vessels which served as improvised quays in Benghazi harbour was closely followed by photographic reconnaissance. The results of the Beaufort strikes themselves were assessed from oblique photographs taken by a Baltimore specially detailed to photograph the attack, a method which was found to produce better results than the erratic photographs taken by the attacking aircraft. Photographs of beached merchant ships being unloaded in isolated bays along the Greek coast and of burning tankers in the Gulf of Taranto provided further evidence of the success of these attacks. Until the 8th Army's advance brought Benghazi once more within range of photographic reconnaissance from the Middle East, daily sorties were flown from Malta to provide the American bomber force with the necessary pin-points of merchant shipping in the port, and afterwards further sorties were flown to photograph the result of the attacks.

In October, the enemy made a last attempt to keep the R.A.F. squadrons grounded and deny access to Malta. Photographic reconnaissance had already shown an increase in the number of German aircraft in Sicily, and in the early part of the month the total number of enemy aircraft arrayed against Malta was approximately 600 on photographic evidence. The October attacks were the last sustained attempt to neutralise Malta as a sea and air base, and their defeat, together with the opening up of the Eastern Mediterranean to Allied shipping, brought about by the advance of the 8th Army, terminated the island's ordeal and enabled its P.R. aircraft to play an increasingly offensive role in the campaign for Tunisia and the invasion of Sicily which followed.

H. Operation "Torch"

When planning for the landings in North Africa first took concrete shape in August 1942, a considerable amount of photographic intelligence was made available to the planners from routine photographic sorties of the North African coast taken during the previous months. The Army Section of the Photographic Interpretation Unit was also able to supply many of the details required of enemy defences in the areas scheduled for landings. The cover required to fill the gaps in this information and to keep it up to the moment was secured by the P.R. Units from the United Kingdom, Gibraltar, Malta and West Africa. Mosquitoes from England were based on Gibraltar to carry out special tasks in the Casablanca area, whilst photographic reconnaissance over the Southern French ports was maintained by the Mosquito Detachment at Benson. West Africa kept a watch on the movements of the Vichy French at Dakar, whilst the bulk of the task was undertaken by the Spitfires of No. 69 Squadron, Malta, who were responsible for most of the work over the South Italian ports, Sicily and the coast of North Africa as far west as Oran. A photographic reconnaissance P.R. Mosquito from Benson carried out the first return trip to Malta on the 2nd October⁽¹⁾, whilst photographing some of the objectives for the North African landings. It left Benson, and flying via Venice, photographed Trieste, Pola and Fiume on the way, the first time these places had been photographed during the war. Cover was also obtained of shipbuilding yards at Monte Falcone, the port of Venice, Rome, and the aerodrome at Littorio. The aircraft left Malta the next day for targets on the North African coast, but

(1) Pilot - P/O McKay.

persistent clouds made it necessary to return to Malta, Palermo being photographed on the way. On the 4th October it covered Tunis, Bizerta, Bone and Philipville, and returned to Benson via Gibraltar, having covered 4,000 miles and taken nearly 1,000 photographs. Besides the North African photographs, very useful information for later use was provided by the Italian and Yugoslav photography. From all these sorties 46 different models of the landing beaches were made for the planners, the first one of Oran being delivered to the Planning staff on 15th September 1942. The lack of floor space for the Modelling Section at C.I.U. hindered the progress of the work, but all the models requested both by British and American authorities were completed in time for study before the landings.

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For the actual landings in North Africa, photographic reconnaissance resources on the 8th November included eight Spitfires in Malta, Mosquitoes from No.540 Squadron at Gibraltar, as well as the six Spitfires of the newly formed No.4 P.R.U. of Eastern Air Command, who operated from that base from the 6th November to the 13th November, during which time they made several sorties over Oran and Algiers. The Gibraltar aircraft were used to cover the operational areas of Algiers, Oran and Casablanca, whilst the Malta Spitfires kept watch on enemy shipping in Taranto, Naples, Palermo, Bizerta and off Cape Lena. In case the French Fleet should set sail from Toulon to join the enemy, Mosquitoes from Benson kept careful watch on the port, whilst shipping in Algiers, Oran and Casablanca was carefully watched on the two days prior to the landings. Practically all the tactical reconnaissance involved fell upon Malta, whose task it was to inform the Navy of any movement of the Italian Fleet which might threaten the assault convoys as they passed through the Straits of Gibraltar and along the North African coast. Happily, the Italian Navy remained at anchor, but on November 11th Spitfires from Malta photographed large numbers of transports and gliders on Tripoli, the most westerly airfield in Sicily. A close watch was also kept on Tunisia between the 8th and the 30th November, and large scale photographs of El Aouina aerodrome taken on the 12th November showed it crowded with JU.52s, JU.87s and ME.109s, some of which were later to be used in attacks against No.4 P.R.U.'s aircraft at Algiers. Besides the North African and Sicilian aerodromes, airfields in Southern France were closely watched for any threats from the German Air Force there. Marseilles was also closely watched during the landings, six photographic sorties being flown during the assault period, as it was thought that military stores might be shipped from the port to German-held ports in North Africa.

On the 13th November, No.4 P.R.U. was transferred to North Africa, from which time it was intended that this unit should provide the bulk of the photographic reconnaissance required in that area, although it was some time before it had sufficient aircraft to do so. The main criticism of 'Torch' from the P.R. angle was that too little attention was given by the planners to the provision of P.R. aircraft, photographic equipment, and Photographic Interpreters especially for the actual operation, with the result that like Oliver Twist, they were always asking for more.

J. Scuttling of the French Fleet

As soon as the initial landings in North Africa had been successfully accomplished, much speculation took place as to the movements of the French Fleet, which the Germans announced had sailed from Toulon. The port was photographed eleven times between the 7th and the 26th November by P.R. Mosquitoes from Benson, and during this period all the units known to have been there immediately before Operation "Torch" was

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launched, were still visible. On 27th November, rumours abounded that most of the major units had been scuttled. The question was finally settled by a photographic reconnaissance over the harbour on the 28th November, which put an abrupt end to speculation. The photographs taken revealed that nearly all the vessels which had been present on the 26th November were lying partly or wholly submerged at their berths, whilst the vessels in dry dock were also submerged to some extent. Further sorties, flown on the 30th November, showed four cruisers still on fire, whilst two 6" cruisers and several merchant vessels were afloat and undamaged.

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The period under review embraces nine months of rapid progress and development in photographic reconnaissance and interpretation. It marked the end of No. 1 Photographic Reconnaissance Unit and its reorganisation in October 1942 as five P.R. Squadrons, one of Mosquitoes, the rest of Spitfires. The period also saw the formation of two new P.R. Units, one for North Africa and one for India, so that by November 1942 every overseas Command was established with its own P.R. organisation.

During 1942 the Mosquito had proved its worth as a photographic reconnaissance aircraft, and by May the number of these aircraft available made it possible to increase the radius of reconnaissance in all directions from the United Kingdom, higher into Scandinavia and deeper into Central Europe, from Tromsø to Prague and Pilsen.

The period began to see the build-up of photographic intelligence, both for the non-stop Bomber Command offensive of 1943/1944, and for the return of the Allies to the Continent. The extent of German development of the defences of Europe was carefully checked throughout 1942. In March, photographic cover of Guernsey, Jersey and Alderney, obtained on the 8th, the 16th, and the 20th, showed the Channel Islands to be heavily fortified and their ports very active. In May and June, increased defence works and camouflage in France were photographed many times and much evidence was obtained of the German anxiety to increase their defences in every field against invasion and attack. In March, too, two of the longest photographic reconnaissance flights were made by Mosquitoes, to Bodo on the 11th(1) and Königsberg on the 27th(2).

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During the Spring and Summer, many industrial targets in Germany were photographed, some for the first time. In March, the hydrogenation plant at Rodleben was covered and the synthetic petrol plants at Bohlen/Rotha. In May, Germany's largest synthetic oil plant at Brux, Sudetenland, was photographed for the first time, and the photographs showed that, though incomplete, the installation was already far greater than ground intelligence sources had been led to believe. In May, too, the Skoda Works at Pilsen were photographed for the first time. In July, many chemical industries were covered, such as the I.G. Farben Chemical Works near Ludwigshaven and the Leuna Ammonia and Fertiliser Works. On the 19th August, the first cover for two years was obtained

(1) Pilot - Flight Lieutenant Merifield.

(2) Pilot - Flight Lieutenant Ricketts.

by a P.R. Spitfire of Schweinfurt, the centre of the German ball-bearing industry⁽¹⁾, whilst on the 6th October, Upper Silesia was the target of photographic reconnaissance aircraft, when important oil plants were photographed, including two at Blechhammer and one at Deschowitz, the existence of which was previously unknown⁽²⁾. The intelligence obtained from these photographs and many others was carefully classified and checked to compile the dossiers in readiness for future Bomber Command attacks.

Peenemunde aerodrome was photographed in May 1942, when it was noted that construction work was heavy. This was the first photographic record of the German experimental station which, over a year later, was to provide the initial photographic clue to the existence of the enemy's V-weapons.

Research on the German shipbuilding and U-boat building industries was carried out actively during 1942. Watch on the Baltic ports showed many U-boats under construction, and in June it was estimated that in the previous nine months four destroyers and 152 U-boats had been completed, whilst at that date five destroyers and 204 U-boats were under construction. In September, a review of the previous year's progress revealed that five U-boats were then being produced every week, including small units only 200 feet long at Hamburg. Construction of U-boat pens along the coast of France was also carefully watched, and by September the completed pens included six at Boulogne and twelve at Dunkirk, whilst work was in progress at Le Havre, Lorient and Bordeaux, all to be targets of the Anglo-American Bomber offensive. On 16th June⁽³⁾, Spezia, Genoa and Leghorn were covered for the first time since the previous Autumn, when it was noted that four Italian cruisers were at Spezia. In October, photographic reconnaissance aircraft reached North Finland for the first time, and in this month excellent photographs of Swinemunde⁽⁴⁾, obtained on the 4th, showed an interesting assembly of German vessels there, including the cruisers Leipzig and Nurnburg and three Narvik class destroyers.

The main technical highlights of the period were the first use of the 500 exposure magazines in F52 cameras on the 3rd May 1942, and the first operation of a Mark IX P.R. Spitfire on the 30th November 1942. In this latter operation an aircraft of the new Spitfire type, belonging to No. 541 Squadron, carried out a successful sortie over the Boulogne area.

The proportion of successful sorties during 1942 steadily improved, as illustrated by the comparison given below:-

<u>Year</u>	<u>Total</u>	<u>Successful</u>	<u>Unsuccessful</u>	<u>Percentage Successful</u>
1941	2,676	1,855	821	68%
1942	2,777	2,203	574	78%

Overseas

No. 3 P.R.U. was formed in India in April 1942, but photographic reconnaissance work in that Command was practically non-existent and was limited almost entirely to

- (1) Pilot - F/O Barraclough.
- (2) Pilot - P/O McKay.
- (3) Pilot - Flight Lieutenant Ricketts.
- (4) Pilot - Flight Lieutenant Van Damm.

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tactical reconnaissance for the Army. The reason for this was the lack of suitable aircraft and the vulnerability of the modified Mitchells used for the purpose. However, by November, India Command had received its first P.R. Spitfires and the organisation began to take proper shape.

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In West Africa, the bulk of the reconnaissance work was done during this period. A good deal of it was flown in connection with intelligence for Operation "Torch", although during the Spring and early Summer excellent cover of Casablanca and Dakar was obtained. In March 1942, when Dakar was photographed several times, there were signs of great activity and large dumps and stores were visible. In April, a report was issued on the defences of the port, which was of great value to the Admiralty. In the same month, an interesting sortie was flown to the island of Fernando Po in an effort to ascertain whether aid was being given by the Spanish authorities to Axis submarines and shipping. From Bathurst a number of Hurricane sorties were flown over Dakar in September, when operations against Madagascar were resumed, and during September and October every opportunity was taken to complete the tasks for the North African landings, in particular a series of vertical and oblique photographs covering areas of coastline in the vicinity of the Dakar Peninsula, and cover of all French Air Force aerodromes in West Africa. These tasks were the "swan song" of the West African Unit, which, during its short period of life - December 1941 to November 1942 - completed 184 P.R. sorties.

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The onerous tasks undertaken by Malta's P.R. organisation have been related elsewhere, and No.4 P.R.U. in North Africa had only just become operational within the period under review.

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The remaining Reconnaissance Unit - No.2 P.R.U. - in Middle East was hard at work throughout the Egyptian Campaign, supplying photographic intelligence for the Air Force and the Army. During June, a constant watch was made by Middle East P.R. Spitfires for German landing grounds used during Rommel's advance on Egypt, and these were made immediate targets for the R.A.F. attacks. During the static period of the campaign from July to October, P.R. Spitfires covered Tobruk daily to gauge the amount of war material piling up for the Axis. Benghazi, however, was out of range and was, therefore, covered in similar fashion by the P.R. aircraft from Malta. Photographs of Tobruk, taken on the 25th July, were examined at the Central Interpretation Unit on the 30th July, a record for the receipt of Middle East material. In the months before El Alamein, every portion of the enemy's lines was photographed by "A" Flight, the advance flight of the P.R.U. operating with No.285 Reconnaissance Wing, and a mosaic of the whole of the battle area was completed as a result. The enemy's retreat after El Alamein was followed up by the P.R. Spitfires and Tactical Reconnaissance Squadrons of No.285 Reconnaissance Wing, but during the whole period of the Egyptian campaign the strategic side of photographic reconnaissance was subordinated to the tactical side.

3. DECEMBER 1942 TO DECEMBER 1943

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With the first invasion of enemy-held territory successfully accomplished, 1942 amply demonstrated the necessity for photographic reconnaissance and air intelligence as an integral part of every combined operation. All three Services had come to rely upon air intelligence as a vital adjunct to successful planning, and in January 1943, in the words of the Vice-Chief of the Air Staff, it was "time to state that no Commander will now undertake an operation unless he has been completely equipped with air intelligence, not only with photographs and mosaics but also with models of the beaches he is to land on". During 1943, this statement was to be substantiated again and again in the account of the work undertaken by the Photographic Reconnaissance organisation in the Mediterranean for the invasion of Europe from the south.

Besides major operations and preparation for the great assault upon "Fortress Europe" from the north, during 1943 the Photographic Reconnaissance organisation continued to carry out a great deal of useful work in connection with the ever increasing bomber offensive upon the economic targets of Germany, with the watch on the German naval and merchant shipping, and with such special operations as the attack on the Ruhr Dams. In addition, 1943 was to see the commencement of the successful story which tells of the biggest feather in Photographic Reconnaissance's cap - the battle of the flying bomb.

A. German Major Naval Units

1943 proved to be a year of hide-and-seek with the major naval units of the German Fleet, which ended in the crippling of the Tirpitz and the sinking of the Scharnhorst, all aided by photographic reconnaissance.

In December 1942 and January 1943 the Tirpitz was photographed four times by Mosquitos of No.540 Squadron, each time in her berth at Lofjord, although by the end of January no other major vessels were present there. The Scharnhorst, which had been seen on trials near Gdynia in December, was photographed by aircraft of No.540 Squadron on the 25th January moving in company with the Prinz Eugen on a westerly course in the Skaggerack. However, she returned to Gdynia and was photographed there on 9th February and again on 21st February. Meanwhile, the Köln arrived from the north and was photographed at Kiel on the 19th February.

The Admiral Scheer, which had been photographed at Wilhelmshaven on the 25th January, was joined by the Admiral Hipper on the 20th February, thus bringing several important units of the German Navy within convenient striking range of Bomber Command for the first time since the Scharnhorst and Gneisenau left Brest in February 1942. As a result, four night raids by Bomber Command and one day raid by VIIIth Bomber Command were made upon Wilhelmshaven with the object of damaging or destroying the ships. On the 26th February, a U.S. Bomber aircraft noticed that the Scheer had been placed in dry dock. On the 27th, a photographic reconnaissance of the port was made to assess the bomb damage. The Hipper and the Scheer were still there, although the Scheer showed no signs of serious damage. On the 18th March the Scheer was still in dry dock and the Hipper was lying off the South Wall of Hipperhaven with camouflage on her decks. By 29th March Scheer had left Wilhelmshaven, whilst the Hipper was not visible on photographs taken on that date.

During these first months of 1943 a close watch was kept along the thousand miles of coastline from the Skaggerack to

Narvik by the Mosquitoes of No.540 Squadron, who also covered Gdynia from time to time. When Gdynia was photographed on the 8th March the Scharnhorst was no longer there, although on the 9th March the Tirpitz was still in Lofjord. On the 13th March, when No.540 Squadron paid its usual visit, the Tirpitz too had disappeared and her berth was empty. Thus in February eleven of Germany's naval units had been accounted for, whilst by the end of March most of them had disappeared into the blue.

Another enemy ship, which up to this time had not contributed a threat to Allied shipping, also came into the picture for a short while - the Graf Zeppelin, Germany's only aircraft-carrier. Throughout 1942 she was being built and little progress seemed to be made with her. However, by January 1943 she had been photographed in Gdynia several times, and it was apparent that work on her had been speeded up and was nearing completion. She therefore became another target for the watchful eyes of the Photographic Reconnaissance Organisation.

The disappearance of the Tirpitz did not prove to be quite the "headache" it might otherwise have been, as the sailing of Russian-bound convoys from the United Kingdom to the White Sea was to be suspended during the summer months of 1943. Nevertheless, she still constituted a menace to Allied shipping from America should she escape into the North Atlantic, particularly as it was clear that she had retired still further north than Lofjord. After several attempts, Narvik was reached by F.R. Mosquitoes on the 27th March but there were no signs of any major units. The Russian F.R. units also did their best to photograph Alten Fjord on several occasions during March, and when they succeeded on the 27th, and again on the 6th April, only the Nürnberg was present. Nevertheless, it was pretty certain that the Tirpitz would make for an anchorage in Alten Fjord, and as this was beyond the range of F.R. Mosquitoes from Scotland at that time, the Russians undertook the task of keeping the area under observation. After several attempts, at the end of April they succeeded in photographing a battleship and three cruisers in Kaa Fjord. Photographed again on the 6th May the larger unit was identified as the Scharnhorst, whilst one of the cruisers was the Lutzow. This good news was followed, on the 9th May, when a second large ship was seen to be present, presumably the Tirpitz, and on the 1st June the Russians were able to give definite confirmation, as a result of their photographic reconnaissance on that day, that the Tirpitz and the Lutzow were in Kaa Fjord and the Scharnhorst in Lang Fjord. Throughout June and July they were carefully watched, but remained within Alten Fjord the whole time.

At the same time, the R.A.F. F.R. aircraft were searching for the other German naval units. The Scheer was found at Swinemünde on the 22nd April with the Graf Zeppelin, but on the 5th May, when the port was photographed again, she had gone. On the 3rd May, the Nürnberg was found moving south from Norway and was traced to Kiel, while the Emden and the Prinz Eugen remained in Gdynia. On the 2nd May, photographs of Wilhelmshaven showed no signs of the Hipper, and this was confirmed on the 4th May when complete cover of the port was secured. On the 21st June, the Nürnberg, the Prinz Eugen, and the Emden were all found at Swinemünde, but as if to balance this find, there was now no sign of the Graf Zeppelin. As it was felt that she was becoming dangerous, an immediate photographic reconnaissance of Danzig and Gdynia was ordered to find her, and on the 26th June she was seen alongside the western bank of the Oder, near Stettin. Here she remained until August, but although she was photographed refuelling on one occasion, there was no other activity around her, and it was assumed that the Allies' successful war against the U-boats had

changed German naval policy and the aircraft-carrier was not to be commissioned after all. By the end of August, the Scheer had arrived in Swinemünde but the Nürnberg and the Emden had left.

All these movements, and particularly the threat offered by the Tirpitz, had caused the Admiralty to study afresh the problem of how to attack the enemy's main units when out of range of long-range bombers. During the spring and summer of 1943 they evolved and perfected midget submarines, designed to attack the enemy shipping in the Norwegian fjords. The operation, planned for the end of September, required the fullest knowledge of many details of the ships and their defences, which could only be supplied through the medium of photographic intelligence. Arrangements were therefore made for preliminary reconnaissances by P.R. Mosquitoes operating between Scotland and North Russia on a shuttle service whilst the final details were to be obtained by a P.R. Spitfire detachment based at Vaenga. Owing to adverse weather, the Mosquitoes were unable to carry out their part of the operation, but the detachment of three P.R. Spitfires of No. 543 Squadron arrived at Vaenga on the 3rd September and began to fly a series of sorties over the Kaa and Lang fjords to obtain details of the boom defences, conditions in the fjords and other defences surrounding the vessels.

Second Detachment

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On the 7th September the Tirpitz and Scharnhorst were seen to have left Kaa Fjord, together with five destroyers, and on the next day the Admiralty received a report that they had formed part of a large German naval force being used in an attack on Spitzbergen. Their objective was the British meteorological Station and base upon the island. The Germans then broadcast a report that "Spitzbergen had been annihilated" and the naval force withdrawn. On the 10th September, a sortie over Kaa Fjord revealed that the Tirpitz and the Scharnhorst had returned there, whilst the Lutzow had moved to Lang Fjord. A Coastal Command flying boat took low obliques of Spitzbergen on the 10th September, 1943, and when interpreted by C.I.U., the photographs revealed the extent of the damage. The three main settlements on the island showed extensive damage, and all the coal-handling gear had been wrecked. A number of R.A.F. and naval ratings managed to escape, and were later taken off by the Navy, but many of the Scientists and Meteorologists were killed.

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Eight successful sorties were flown by the P.R. Spitfires to secure last minute details before the midget submarine attack in the early hours of the 22nd September. With the details of the defences supplied by photographic interpretation on the 14th September and described by the Naval Commander of the operation as "invaluable", six midget submarines were launched against the three major units. Three of them were able to penetrate the submarine nets and attack the Tirpitz, but owing to various difficulties the Scharnhorst and Lutzow were not reached. Subsequently it was ascertained that the Scharnhorst had left her anchorage during the late hours of the 21st to carry out gunnery exercises, and before her return on the morning of the 22nd she received a signal that the Tirpitz had been torpedoed. She put about, therefore, and proceeded to Lang Fjord, where P.R. Spitfires found her on the 23rd September, on which day several sorties were flown to ascertain the damage done. Further sorties were made until the 23rd October, when the detachment was withdrawn, the three Spitfires, as before, being handed over to the Russians on departure. Although the photographs taken did not reveal the full extent of the damage to the Tirpitz, it was possible to assess it as serious, and coupled with information from other sources it was evident that it was sufficiently severe to put the ship out of action for three or four months. When the

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last photograph of the Tirpitz was taken on the 23rd October, she was the only major unit left in Kaa Fjord. A total of 31 sorties had been flown to Alten Fjord between the 3rd September and the 23rd October, of which 25 were successful. After this date, the photographic light was considered insufficient to continue operations from North Russia.

After the 28th September, the Lutzow was not seen in Alten Fjord, and a report was received that she was proceeding into the Baltic. On the 7th October, a brilliant P.R. sortie over Gdynia by a Mosquito pilot of No.540 Squadron⁽¹⁾ lasting 5 hours 35 minutes discovered the whole pack of German ships which still remained effective - Lutzow, Scheer, Prinz Eugen, Nürnberg, Leipzig, Emden, Gneisenau, and Schlesien. This made a tempting target for the U.S.A.A.F. who attacked Gdynia in strength on the 9th October. A P.R. Mosquito followed almost directly behind the bombers, photographed the port and returned with good photographs of the damage, as well as some of the returning Fortresses. Further excellent photographs were obtained by No.540 Squadron on the 10th, whilst a photographic reconnaissance of Swinemünde on the evening of the 9th showed that the Scheer had moved there.

The Baltic ports were closely watched for further movements until the end of the year, but nothing of major importance took place. The Russians continued their vigil over Alten Fjord, reporting the Scheer in Lang and the Tirpitz in Kaa fjords up until the 24th December. The Russian-bound convoys recommenced in November, and it was felt that the enemy ships and submarines based on Northern Norway might come out to the attack. Two convoys were due to sail in December, and with the safe arrival of the first one in Russian ports the Commander-in-Chief, Home Fleet, felt certain that the enemy would use their only remaining effective capital ship - the Scharnhorst - in an endeavour to attack the second convoy. This proved to be correct, and shortly after the last Russian sight of her in Lang Fjord on the 24th she left with three destroyers to make her attack. Radar contact was made by the British naval force in the early hours of the 26th December, and the Scharnhorst was engaged and sunk before the evening of the same day. This made a triumphant end to the successful war against the German naval units in 1943, towards which the Photographic Reconnaissance Organisation had contributed so much of its operational effort.

B. The Attack on the Ruhr Dams

The importance of the Ruhr Dams - the Möehne, the Sorpe and the Eder Dams - is that they are a source of the power for the Ruhr industries, and during the war these industries were all connected with war production. It followed, therefore, that they should be looked upon as a special target, and it was realised that an accurate bombing attack upon them would do much harm to German war industries in the Ruhr area.

At the beginning of 1943, it was decided to plan the details of the attacks as soon as the necessary photographic intelligence could be secured to assist in the breaching of the dams at vital points. A first request was therefore made on the 25th January for a photographic reconnaissance of the Möehne Dam and Reservoir. The task was entrusted to No.541 Squadron, whose Spitfires commenced a series of sorties on the 7th February. The weather was very unsatisfactory and so it was not until the seventh sortie on the 19th February that partially successful photographs were obtained. A further sortie on the same day⁽²⁾ was wholly successful. On the

- (1) Squadron Leader Lenton.
(2) Pilot - Flight Lieutenant Cussons.

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13th February, a further request was received by No. 541 Squadron for large scale cover of the Mœhne Dam for detailed interpretation of the layout. This was satisfactorily obtained after five attempts, and was secured on the 19th February during the successful sortie made for the initial cover. From the photographs of these sorties models were constructed by the Central Interpretation Unit for use in the planning of the attack and to brief the bomber crews who were to make it. A third request for further photographs of the Mœhne Dam was made on the 19th March, the special requirements in this instance being the level of the water and the details of defences in the area. This request was completed on the 5th April, and the details deduced from the photographs obtained were later found to be very accurate; for example, the depth of water at one point was estimated as 13 feet, which was within one foot of the actual depth. Nos. 541 and 542 Squadrons both undertook the task of photographing the Mœhne Dam periodically to keep check upon the details of defences and water levels, and to supply additional information required in planning the raid, the level of the reservoir being constantly watched to assist in choosing the right moment for the assault. Targets in the Ruhr and Holland were covered on all these sorties, not only to mislead the enemy but also to make the maximum use of the photographic effort involved. For example, on the 4th April a Spitfire pilot of No. 541 Squadron took photographs of Liege, the Soest area including the Mœhne Dam, flew from Neheim to Arnsburg and back, then north of Borkum, then over Essen, Duisburg and Rotterdam. When over Duisburg he encountered very accurate flak, and on two occasions his engine cut when at 28,000 feet. Nevertheless, he returned safely, not only with photographs of the dam but also of shipping targets and bomb damage information.

On the 5th April, a request was made for a photographic reconnaissance of the Sorpe and Eder Dams, as well as further photographs of the Mœhne Dam. All three dams had been successfully photographed by the 15th May. The same pilots flew most of these sorties and became so familiar with the landscape that when they flew over the area after the attack they were able to appreciate the size of the floods and the changes in the appearance of the countryside.

The attack was made by Bomber Command on the night of 16th/17th May. No. 542 Squadron had been warned of the hour of the attack and that an immediate photographic reconnaissance would be required of the result. Eight hours after the attack the first photographs were being taken and, in all, three separate sorties were made on that day. A wide stream of muddy water was seen flowing east from the Eder Dam by one pilot⁽¹⁾, and excellent quality large scale photographs were taken of the damage done to the Mœhne and Sorpe dams. The second sortie⁽²⁾ secured good photographs of the Mœhne Storage Lake and flooded areas 16 miles downstream from the Eder Dam. The third secured photographs of the Eder Valley showing much mud deposit for many miles east of the Eder Dam. From all these photographs it was possible to assess the great extent of the damage done. The Mœhne Dam had been breached at a width estimated as 180 - 200 feet, and over a million tons of water had been released. The Mœhne Reservoir was practically dry and 25 miles from the Ruhr the whole valley was inundated. On the 18th and 19th May, sorties were flown by No. 542 Squadron to record the passage of the flood waters as they passed down the valley. On the 18th, the first photographs of the Eder Dam were obtained showing the burst dam walls. Water flooded

- (1) Flying Officer Fray.
 (2) Pilot - Flying Officer Searle.

of Kassel and reached as far as Kerdecke in the Ruhr. On the 19th May, photographs of the Sorpe Dam were obtained, which showed that it had not been breached but it had been damaged. Further sorties over flooded areas were flown frequently during the last week of May, and on the 2nd June a request was received for a photographic reconnaissance of the River Weser between Munden and Minden, and north of Minden in the direction of Bremen to examine the flooding. Nos. 541 and 542 Squadrons continued to watch the floods, the efforts to repair the dams, and the activity on the Dortmund-Ems Canal until July.

Many of the photographs, obtained both before and after the raid, were of the highest quality, and Bomber Command undoubtedly owed a considerable amount of its success to the co-operation and assistance rendered by the Photographic Reconnaissance Organisation.

C. The Blockade Runners

One of the highlights of 1943 was the success obtained by the Photographic Reconnaissance Organisation in watching the movements of enemy shipping, estimating their cargoes and destinations, and providing almost complete records of the whereabouts of the majority of enemy merchant vessels. The watch that was kept over the blockade runners in the Bay of Biscay was an outstanding example of the success achieved in this direction.

During the winter of 1941/42 the enemy had become boastful about the good results of his blockade-running to the Far East, and during 1942, as cameras and interpretation technique improved, it had been possible to trace the movements of his ships between the various ports on the French west coast. F.R. Spitfires from St. Eval made frequent sorties over these ports and, from the evidence they produced, the tangled movements of the enemy shipping were gradually unravelled by the Central Interpretation Unit. In September 1942, the solution to the problem became complete. A vessel of the Emland type, seen on the 19th August in an evident attempt to run the blockade, was next photographed in Bordeaux on the 28th. Between the reconnaissances of the 7th and 8th September she had left the port and disappeared. A careful examination of her movements was then made on all the photographs taken of the Biscay area since April 1942. Her progress was followed from dockyard to dry dock for overhaul, then back to the dockyard, then to a loading berth, and finally to the Customhouse Quay before departure. Movements of ten other vessels were then analysed and each of them conformed to all or part of the sequence. It was obvious that these vessels were undergoing a fixed routine, moving from port to port to make best use of the limited facilities. Fortunately, we were dealing with a methodical enemy who could be relied upon to stick to his schedule, and the Central Interpretation Unit was thus provided with a means of recognising potential blockade runners and making forecasts of their dates of departure. This information was then used for wireless propaganda directed against the crew, and by the Navy and Coastal Command for interception purposes.

During 1943, twenty vessels were identified by name and closely watched in Bordeaux, which was their European base. At times, when a vessel was known to be ready to run the blockade, the task of watching her became one of high priority. Not one of the twenty escaped destruction in one form or another, except the Emland which was attacked outward bound, returned to Bordeaux, and abandoned on account of her damage.

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The last serious effort on the part of the enemy to send a blockade runner to the East took place in April 1943. The Italian motor vessel Himalaya was watched during the various stages of her preparation until, on the 29th March, a Coastal Command aircraft photographed her moving in the Bay escorted by a considerable force of destroyers and torpedo boats. She was next photographed by a P.R. Spitfire lying off La Pallice on the 2nd April. She set out again later, when she was found by Coastal Command on the 10th April and once again she put back to the safety of the Gironde. She did not attempt to run the blockade again, and was eventually scuttled after the Allied invasion. Five other vessels remained in Bordeaux for the rest of the summer, and though their movements were closely watched it was evident by September 1943 that they had given up all hope of escaping notice and slipping out on the Far East route. They remained in the port until they were scuttled in 1944. The loss of further blockade runners on the High Seas no doubt led to a revision of the enemy's plans, and in October one of the blockade runners - the Munsterland - was photographed moving up the coast towards German waters. She was attacked by Fighter Command aircraft and returned for repairs to various Channel ports in turn. She ultimately met her end when trying to force the Straits of Dover in 1944, when she was sunk by Coastal artillery.

D. Bomb Damage Assessment

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The task of obtaining bomb damage assessment photographs increased tremendously during 1943, with Bomber Command putting forth a mounting effort against enemy targets, assisted more frequently and in growing strength by the U.S. VIIIth Bomber Command. By the Spring, British and American bombers were causing unprecedented havoc in enemy-held territories, and P.R. aircraft frequently flew almost in the wake of the bombers. Every raid had to be followed up by photographic reconnaissance, the weather made many difficulties, and frequently otherwise good photography would be obscured by the smoke and haze from the many fires caused by the raid.

No. 541 Squadron (1) made an outstanding sortie to photograph Berlin raid damage on the 19th March when probably the finest damage assessment photographs to date were taken, the pilot photographing the whole of the city and remaining over the target for 45 minutes. Within a few hours of the raid on Berlin on the night of the 23rd/24th August, a successful P.R. sortie was made and excellent photographs taken, in spite of the targets being obscured by heavy fires and smoke clouds. Berlin presented difficulties, however, after the first large scale attack in November when 37 sorties (31 Spitfire and 6 Mosquito) had to be made over the target in adverse weather, mostly by No. 542 Squadron, before clear photographs could be obtained, and one P.R. aircraft encountered enemy aircraft over Berlin at a height of 42,000 feet. The weather and enemy fighter interception combined to handicap photographic reconnaissance over Berlin during December, when further attacks were made by Bomber Command. No. 541 Squadron made 24 sorties during the month to Berlin and only managed to secure photographs on two occasions, making 18 attempts before being successful. The two lots of photographs obtained were together sufficient for damage assessment, but tremendous effort went to the securing of them, one of the two successful pilots (2) being airborne for three hours fifty-five minutes and returning to base with only 20 gallons of petrol left.

(1) Pilot - F/Lt. Brew.

(2) F/O Glover and F/Lt. Brew.

Other outstanding damage assessment sorties during 1943 were those to Friedrichshaven and Regensburg on June 21st and August 24th respectively. After bomber attacks on these places the aircraft flew on to North Africa to land and refuel. P.R. aircraft followed to the target a few hours afterwards to take photographs of the damage, which they did successfully and returned to base before the bombers were known to have landed in North Africa.

July was an outstanding month for bomb damage photography, every request by Bomber Command having been completed by the end of the month. On the 28th July, the VIIIth Bomber Command bombed Kassel and asked that P.R. aircraft should be over the target within half-an-hour of the raid. This was accomplished⁽¹⁾ and successful photographs were obtained.

On August 15th, good cover of Milan was made by No.540 Squadron Mosquitoes, in spite of considerable smoke and widespread fires. Photographs were obtained a few hours after the Bomber Command attack on Munich on the night of the 6th/7th September, and similarly of Hanover after the attack of the 22nd/23rd September.

A sortie flown by No.540 Squadron on the 24th August⁽²⁾ provided the target material for a raid on the Antheor Viaduct. This Viaduct near Cannes carries the Marseilles/Genoa railway. The object of the attack was to obstruct or damage the Viaduct and block the railway lines as there is no alternative route for military supplies to reach Italy. The attack was made on September 16th/17th by Bomber Command, and on September 18th high level vertical photographs of the viaduct were obtained, again by Mosquitoes of No.540 Squadron, but it was impossible to see from them if damage had been done. The attack was re-planned in case the first raid had not been successful and the Central Interpretation Unit supplied detailed measurements of the viaduct and the heights at either side. Two further attacks were then made, by Bomber Command on the 11/12th November, and by U.S. bombers from North Africa on the 24th. Mosquitoes of No.544 Squadron then undertook the task of obtaining low oblique photographs to see if the structure was damaged, and on the 29th November they were successful in achieving their object.

Many heavy attacks were made upon U-boat bases and pens during the year. In March, the brunt of the attacks fell upon St. Nazaire, where subsequent photographic reconnaissance showed much devastation and widespread damage. Two attacks were also made during March on the submarine yard at Bremen when fifteen 500 ton U-boats were on the slips. Damage assessment photographs showed that 11 of these were damaged, as well as damage done to cranes and ships. Between the 24th July and 3rd August, 9 raids were made upon the U-boat yards at Hamburg. Damage assessment sorties showed the damage which the Central Interpretation Unit estimated to mean the loss of 7 to 8 weeks work on German submarine production. A careful watch was kept upon the U-boat yards and every time a sufficient number of nearly completed U-boats was photographed further attacks were made.

All these are but a few examples of the many calls made upon the P.R. Squadrons for Bomb Damage sorties, and in spite of the hazards of weather and increased enemy opposition 1943 was the most successful year to date for these tasks.

(1) Pilot - F/Sgt. Dearden.
(2) Pilot - F/O. Richards.

E. Operation "Husky" - The Invasion of Sicily

No sooner had the Allies landed successfully on the shores of North Africa than planning began for the invasion of Europe from the south, for which Sicily and the nearby Mediterranean islands were to be used as stepping stones. Selected prints covering ports and other areas in Sicily, Italy and Sardinia, taken by P.R. aircraft based on Malta, were sent home to England to the planners as early as November 1942, but in January 1943 photographic cover began in earnest. Sardinia was originally chosen for early assault (Operation "Brimstone") and for this two P.R. Mosquitoes of No. 544 Squadron Detachment at Gibraltar were lent to the American P.R. Unit at Algiers in December 1942. No success was obtained with them, however, and in January a Mosquito was sent out from Benson to operate from Malta over the same area. A series of sorties was designed to cover the entire Sardinian coastline, and a complete set of prints from each sortie was supplied both to the planners in the United Kingdom and to the P.R. Unit in North Africa, (soon to become the North African P.R. Wing). The operation was eventually abandoned, and the photographic cover of Sardinia still required was undertaken by aircraft from North Africa and by others in transit from the United Kingdom to Malta. In February, photography of Sicily and the surrounding islands began in earnest. The special task of the Benson Mosquito was that of covering the whole coastline of Sicily on 36" scale photographs,⁽¹⁾ but when further extensive areas in the south-east corner of the islands were also required on large scale cover, Malta-owned P.R. Spitfires of No. 683 Squadron were modified and called in to assist. During February and March, No. 683 Squadron flew 50 sorties over Sicily alone. Air mapping of the island was considered to be very inadequate, and a request was made to Headquarters, Middle East for the use of Mosquitoes from No. 60 S.A.A.F. Squadron, a unit well experienced in survey work. The 8th Army were unable to release the two Mosquitoes from the Squadron, as they were engaged in a survey of the Mareth Line and other work in Tunisia, and consequently in March a detachment of three Lightnings from the 3rd U.S. Photo Group arrived in Malta to fly a series of mapping sorties.

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The task of obtaining all the photographic intelligence required for "Husky" was not made easier by the number of planners and the various forces interested in the operation, all of whom made requests for photographic cover. To begin with, planning was taking place in the United Kingdom, in Middle East and in North Africa, the 15th Army Group, the U.S. VIIth Army and the British 8th Army, all having a part in the operation. Eventually it became necessary to appoint an authority in Malta to effect co-ordination between the various planners' requirements, and the situation was further eased in June when all planning took place in North Africa under the auspices of the Allied Force Headquarters at Algiers. A proper courier service was then arranged between Malta and the P.R. Wing in order that first and second phase reports of sorties flown from Malta should be in the hands of the planners in North Africa at the earliest possible moment.

As early as February, a definite division of responsibility was agreed between the three P.R. Units in the Mediterranean. North Africa took all the area west of 12° including Tunisia, Sardinia and Corsica, Malta took east of the

(1) A report on Catania, produced by C.I.U. in March 1943, based on these photos, revealed the presence of such formidable coastal defences that the area was rejected as suitable for first landings.

same line with a dividing line drawn through Tripoli and Corfu and including Pantellaria, Sicily and Italy, and Middle East took responsibility for the eastern Mediterranean, the whole of Greece with the exception of Corfu. (1)

One of the preliminaries to the success of landings in Sicily was the capture of the various Mediterranean islands in the vicinity, of which the most important were Pantellaria and Lampedusa. In the case of Pantellaria, the most formidable obstacle, a major air effort was required to reduce the island, and a detail based largely on photographic intelligence had to be followed. Although No. 682 Squadron (North Africa) was still badly handicapped by lack of suitable aircraft - their Spitfire IVs being no match for F.W. 190s - and much of its effort being needed by the army in North Africa, it undertook the bulk of the sorties required to secure the necessary air intelligence of Pantellaria, during the attack upon the island. The fixed coastal batteries were the primary targets, and since neutralisation of the defences by area bombing would have been a lengthy and costly affair, the position of all defensive installations was carefully studied in order that each one's importance to the entire system could be assessed and the air effort directed accordingly. From these photographs, two models of Pantellaria were made by Central Interpretation Unit (2) and flown to North Africa so that the formation of the island and the location of all the defences might be carefully studied by the Air Force planners. After each bomber attack on the gun positions, damage assessment sorties were flown in order that further effort could be redirected and regulated as required to disrupt the defences. A rather unusual experiment was carried out in this respect, scientific methods being used to decide the bomb loads and the targets for each attack. Professor Zuckermann, the well-known geologist, was sent to North Africa by Air Ministry to conduct this experiment, and his team of civilian scientists worked alongside a detachment of photographic interpreters from North Africa's Photographic Interpretation Unit. A careful record was made from damage assessment photographs of every hit and every crater, from which the scientists estimated how many hits were made for each bomb load, and which type of bomb was proving most effective. Thus they were able to calculate how many bombs of a certain type were required to wipe out each target, and raids were made in increasing intensity to a total of 18 and 20 each day, until the essential targets had been eliminated completely.

When Pantellaria's garrison surrendered on 11th June, for the first time in history a heavily defended objective was completely reduced by air power, assisted by air intelligence. Lampedusa was a simple operation by comparison, though here again her defences were fully covered by photographic reconnaissance.

By the end of June, photographic work for "Husky" and for the subsequent invasion of Italy, combined with the normal requirements of the Navy and the Air Force, became more than could be undertaken by the existing P.R. forces. In response to an appeal by the Supreme Commander on the 30th June, four Mark IX P.R. Mosquitoes and crews were loaned to Mediterranean Air Command for six weeks. The Army required daily photographic cover of the immediate areas designated as battle

(1) In spite of this arrangement D.A. Sorties were frequently flown from Malta for raids made by M.E. bombers, and many sorties over Pantellaria were flown from N. Africa.

(2) Most models for 'Husky' were made at C.I.U., though later models of Sicily and Italy were made by the Special Section of Middle East I.U.

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report.

Malta
IPS/101/12/Ops.

fields, including the beaches, and the enemy gun areas for counter-battery purposes. These sorties were flown exclusively by No. 683 Squadron, Malta, including large scale photography of beach defences which had to be repeated each week to keep them up to date. The Tunisian campaign having been successfully concluded in May, No. 680 Squadron (Middle East) detachment with the 8th Army returned to the Delta area, and two Mosquitoes of No. 60 S.A.A.F. Squadron were released by the 8th Army to undertake survey requirements in Sicily still to be completed. These Mosquitoes were then lent by the Desert Air Force to the North African P.R. Wing for the purpose. At the end of June, the Army Photographic Interpretation Unit moved from Middle East to Malta and became responsible for the interpretation of all sorties over Sicily requested by the military authorities, which by that time formed the bulk of the work for the invasion. Nevertheless, on behalf of the Navy continuous photographic reconnaissance over the Italian ports was made by the North African P.R. Wing and Malta's P.R. Squadron, to keep watch on possible movements of the Italian battle fleet, and on behalf of the R.A.F. enemy airfields in Sicily were constantly photographed both before and after the attacks which were the precursors of the Allied landings.

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By the date of the assault, which took place on the 9th/10th July, a complete picture of the enemy's dispositions and movements had been obtained by photographic reconnaissance. The vertical and low oblique photographs of the coastline which General Patton considered "essential to the success of the operation" were of the highest value to the whole force. Operation "Torch" had shown how necessary such photographs were to Force Commanders and staffs during the assault phase, and arrangements were made to supply all H.Q. ships with copies of the latest cover of the assault beaches.

For the actual landings, and for some short period previously, a detachment of the North African P.R. Wing was based on Malta to assist No. 683 Squadron in carrying out their work, and as soon as airfield facilities were available in Sicily, a detachment moved on there to work directly with the Allied assault forces, together with a Mobile Field Photographic Section and an Army Photographic Interpretation Section. After D-Day strategic cover of the rest of Sicily and the toe of the Italian mainland was secured daily, and tactical information was obtained by building up a daily picture from photographic and visual reconnaissance sorties of every enemy activity. The value of the pre-invasion attacks on the enemy airfields was soon evident in the lack of serious opposition encountered by the Allied air forces, and before the invasion of Sicily was complete, photographic reconnaissance arrangements for the invasion of Italy were already well in hand.

F. The Invasion of Italy

The conquest of Sicily, completed on the 17th August, placed a spring-board in Allied hands from which the invasion of Southern Europe could be launched.

The advantages of looking far ahead to make the best use of aerial photography had been emphasised by the success of the Sicilian campaign, with its air intelligence built up over a lengthy period. Before Sicily was conquered, the planners had looked ahead to the invasion of Italy and the necessary photographic reconnaissance work was in full swing.

Almost the whole of the Italian Peninsular was covered with small scale vertical photography by the end of August, and this proved invaluable for map revision before the actual landings took place. The bulk of this work was carried out by

American Combat Mapping squadrons, whilst Nos. 682 and 683 Squadrons were responsible for watching airfields, harbours, railways, shipping movements, and taking the necessary photographs of the landing beaches.

As part of a plan to force the enemy to abandon his Sicilian bridgehead, attacks on Naples and the vital communication centres of Southern Italy were frequent, and were based upon air intelligence secured by P.R. Spitfires from Malta. One of the highlights of this period was the first bomber raid on Rome which took place on the 19th July. No. 682 Squadron from North Africa was responsible for excellent damage photography of the target, revealing that all the military objectives had been successfully attacked without any damage to the City of Rome itself, other than in the vicinity of the Lorenzo railway yards. The raid was repeated on the 13th August when again No. 682 Squadron flew sorties which showed the repeated damage to marshalling yards and airfields, whilst that done to non-industrial and historic buildings was negligible.

During the lull in the ground fighting - 19th August to 2nd September - photographic reconnaissance both strategic and tactical was continued over Italy, and No. 682 and 683 Squadrons were kept busy with damage assessment sorties following the heavy attacks on enemy bases and lines of communication. Up to the 26th August the heel and toe of Italy, Foggia and Naples were covered by No. 683 Squadron from Malta whilst No. 682 photographed Salerno, Rome, Northern Italy, Sardinia and Corsica. After the 26th August a new division of responsibility gave the North African P.R. Wing most of Italy other than the extreme south, whilst Malta concentrated more on the Eastern Adriatic, Albania and Yugoslavia. First and second phase interpretation of all these sorties was done by the North African Interpretation Unit of which Malta had become a part, the films afterwards being sent to the Middle East Interpretation Unit for retention and any third phase interpretation which might be necessary.

The beginning of the Italian Campaign called for the highest degree of activity on the part of the Mediterranean Air Command's P.R. organisation, though for the most part its aircraft were engaged in routine tasks. No. 682 Squadron fulfilled the majority of the Army demands during the early invasion period, whilst No. 683 Squadron, Malta, watched the Italian ports until the surrender of the Italian Fleet took place. By October, the forward move of the armies in Italy made it necessary to operate a P.R. Detachment there, and a Flight of No. 682 Squadron moved to Foggia to continue co-operation with the Army. There was now very little work left for Malta's P.R. Unit, as the capture of its immediate operational areas meant that Malta had outlived its usefulness as a base. No. 683 Squadron therefore moved to Tunis in November to operate under No. 336 Wing and was only able to undertake a very few operational sorties before the entire Wing moved to San Severo in December.

As the Italian Campaign proceeded, less tactical photographic reconnaissance was required, and with the arrival of more Mosquitoes in the Mediterranean long distance sorties became numerous and easy of achievement. In addition to commitments in the battle areas, therefore, photographic reconnaissance was called upon more frequently towards the end of 1943 for target information in connection with the strategic bombing policy, both from Mediterranean and from United Kingdom bases.

G. Special Operations in the Aegean

From the beginning of 1943 enemy-occupied islands in the Aegean had been constantly harassed by Middle East's coastal

aircraft in an effort to interfere with the reinforcements and supplies brought to the islands.

To create a diversion at the moment when the Allies were to assault Italy, and to weaken Germany's Eastern Mediterranean defences, it was decided to launch a parallel assault upon Rhodes and the Dodecanese Islands. As even the nearest of these islands was out of effective range of single-engined fighters from Cyrenaica or Cyprus, possession of one of the island's airfields was essential for the success of any invasion, and Rhodes, with its two good airfields was selected as the first objective to be achieved.

During the summer of 1943, Middle East's P.R. Squadron - No. 680 - released from its commitments in the Tunisian Campaign, was used to carry out a photographic reconnaissance of all the main harbours and airfields in the Dodecanese. The principal islands were completely mosaiced, and 36" vertical cover was obtained of the entire coastline of Rhodes, with oblique cover of selected beaches. A detached flight of No. 680 P.R. Squadron was located on Cyprus for this purpose, and completed its task by the end of August, all films being flown back to Middle East for interpretation. Unfortunately, the strong air support necessary for an invasion of Rhodes could not be supplied owing to prior claims in Italy, and when the Italians capitulated on the 8th September the Allies were unable to prevent the Germans on Rhodes from seizing control from their late Axis partners. The only alternative airfield available was on Cos, and by the 18th September this island, together with the neighbouring ones of Leros and Samos, was in our hands. It thus became necessary to keep a closer watch on enemy activities on Rhodes, to note changes in beach defences, in their air strength, and details of the effectiveness of Allied bombing attacks on the island's airfields and shipping, lest the enemy should be inclined to make an effort to retake the island of Cos. The arrangement of completing interpretation of Cyprus sorties at the Middle East Interpretation Unit was no longer satisfactory. It was therefore agreed that a small detachment of photographic interpreters should move to Cyprus forthwith. Unfortunately, they did not arrive until the 1st October, and owing to lack of equipment and water, were unable to interpret enemy shipping movements in the area before the Germans had invaded Cos on the 3rd October.⁽¹⁾ On the 2nd October, a new type of German assault craft was first photographed in the Piraeus; it was used for the subsequent invasion of Leros. These craft were made of prefabricated parts brought down by rail and assembled at local shipyards. Photographic reconnaissance and interpretation from Cyprus provided very accurate information of German activity leading up to the invasion of Leros and the subsequent Allied evacuation of all the islands (except Castel Rosso) by the 27th November.

Having successfully occupied the Aegean Islands, the enemy had to supply them, and for the rest of 1943 bombing attacks from Middle East were directed at the Greek ports and airfields from whence these supplies came. Photographic interpretation for these raids continued to be made by the 680 Squadron detachment on Cyprus, and a similar detachment at Toora. Photographic cover, combined with visual reconnaissance by Baltimores, was so effective that movements of convoys were

(1) It is interesting to mention that the photographic interpreters in this instance were W.A.A.F. officers, the first serving women on the island and by virtue of their work in charge of the R.A.F. Photographic Section sent with them.

accurately forecast and no enemy convoy reached its destination without detection and attack.

In the Dodecanese campaign the Photographic Reconnaissance organisation was faced with an enormous task in trying to cover an island-strewn area like the Aegean when hampered by insufficient equipment and often by bad weather, but nevertheless they undertook a very full share of the operation. During November and December the Cyprus P.R. detachment completed over 200 sorties, the first time either flight of No.680 Squadron had exceeded 100 sorties per month.

H. Operation "Starkey"

1943 saw the birth of the 2nd Tactical Air Force, and the final preparations for the invasion of the Continent began to take shape. Up to this time, strategical photographic reconnaissance had been undertaken for the Army G.H.Q. Home Forces by No.140 Squadron of Army Co-Operation Command, which now continued the same work in the Tactical Air Force under their Photographic Reconnaissance Wing, No.34 Wing. Tactical photographic reconnaissance was done for the Army and the Air Forces destined to operate on the Continent by the Reconnaissance Units of Nos.35 and 39 Wings.

All these Units combined for the first time with No.106 Wing and the U.S. P.R. Squadrons in a large scale amphibious venture - Operation "Starkey" - which took place at the end of August and the beginning of September 1943. This combined operation was designed primarily to compel the German Air Force to engage in air battles in strength and thus to assist in building up sufficient Allied air superiority to facilitate subsequent operations against the Continent. Whilst the operation was unsuccessful, owing to the failure of the enemy to react, as it had been hoped, to the threat of invasion, many useful lessons were learned therefrom regarding the use of strategical and tactical photographic reconnaissances in such an operation.

During the preliminary phase, several fruitful combats were made with enemy aircraft and it was appreciated that air attacks on certain airfields would mean dispersal of the German Air Force to others. One of the primary tasks of the photographic reconnaissance squadrons, therefore, was the photographing of enemy airfields within range to locate the enemy Air Force. This was done with considerable success. As soon as photographic reconnaissance had established that the enemy were using certain airfields, medium bombers attacked them in force, which entailed many bomb damage assessment sorties every day. Between the 4th and the 8th September the Allied air offensive switched to the marshalling yards in France, and here again many bomb damage reconnaissances were made to confirm the heavy damage done.

The main difficulty encountered during the operation was to co-ordinate the increased demands for airfield reconnaissances and bomb damage assessment with the extensive programme of the Army who required both strategic and tactical reconnaissance of railway centres, roads, enemy Headquarters, enemy movements, beach defences and heavy coastal batteries. At this time the Benson squadrons had many prior claims on their services and could not undertake a full programme of strategic reconnaissance for the operation. They therefore undertook the railway centres and military objectives requiring deep penetration, whilst No.140 Squadron undertook the medium sorties. The rest of the photographic reconnaissance was carried out successfully by the Mustang Squadrons of Nos.35 and 39 Wings. In spite of the fact that the weather was often unsuitable for high level photography, No.106 Wing and the U.S. Photographic Group together flew 93 photo producing sorties during the period of the operation.

J. The Battle against the Flying Bomb - Phase I

In all the operations recorded in this narrative, photographic reconnaissance and interpretation have played a responsible part, but in no major operation has that part been so complete as in the battle against the Flying Bomb. To the P.R. organisation fell the task of first identifying the enemy's secret weapon and its launching sites, and then supplying the information upon which the necessary counter measures could be based. It will be understood that photographic reconnaissance in this instance was largely assisted by ground intelligence from various sources, which was used as a guide in all the interpretation carried out. It is not the purpose of this narrative, however, to record the full story of the flying bomb campaign which has already been recorded elsewhere; (1) this tells the story from the photographic reconnaissance angle only and in no way detracts from the work of all the other intelligence organisations which combined to combat Germany's secret weapons.

It may be remembered that when Peenemünde aerodrome was first photographed in May 1942, heavy constructional work was in progress but no disturbing implications were drawn from this fact. In March 1943, the Central Interpretation Unit received the first official information that ground intelligence had indicated that secret experimental work was in hand at Peenemünde. This work was stated to be in connection with a "long-range" secret weapon, and many reports were received from various sources giving conflicting details of the weapon. It was, however, then agreed that the projectile was a heavy one and would require to be launched from some kind of platform within reach of main gauge rail facilities.

In April 1943, a review was made of all the prints covering the area Peenemünde to Swinemünde, searching for the characteristics outlined. Photographs of Peenemünde showed reclamation work in progress on the airfield, where there was an elliptical emplacement with some of these characteristics, but it had been in existence for nearly a year. Nevertheless there was a ramp of fairly steep gradient, good service by rail and heavy handling machinery. In the same month, reports from ground intelligence gave the first indication that the long-range weapon was likely to be in the form of a giant rocket, and in June 1943, when two photographic reconnaissances were made over Peenemünde, photographs showed two large objects which appeared to be rockets, and there seemed little doubt that a long-range rocket did exist. The Prime Minister instructed that in view of the threat which definitely existed, no means was to be neglected to ensure that photographic reconnaissance requirements were undertaken in the most thorough and rapid manner. Regular cover was flown to watch developments at Peenemünde, the Mosquitoes of No. 540 Squadron making frequent and successful trips during the summer and autumn of 1943, (2) although the exact use of the installation remained unexplained. It was noticed that in June 1943 a new electrical railway line to Peenemünde was installed and an unusual type of railway wagon was visible, and about the same time certain unexplained "military excavations" in Northern France were first photographed. These were watched carefully to see if similar rail installations and large sheds would be erected like those at Peenemünde. These large sites at Watten, Wissant, Marquise, Noires,

MDM/
M.S. 34

C.I.U.
D.S. 1.
29.4.43

C.I.U.
D.S. 16a.
28.6.43

- (1) Air Historical Branch narrative.
(2) Seven trips made in first six months of 1943, by which the whole area of the experimental station was covered and a mosaic prepared.

COS(43)
388(0)
19/7/43

Bernes Warbringue and Bruneval were watched by the Spitfires of No. 542 Squadron, but although it was felt that they were in some way connected with the secret weapon, there were no characteristics corresponding to those at Peenemünde.

COS(43)
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19/8/43

Peenemünde became the target for a bomber attack on the 17th August, and a photographic reconnaissance by a Mosquito of No. 540 Squadron on the 20th August showed the great success of the raid and the intense concentration of bombing within a limited area, which was estimated to cause some delay to the work carried on there. It was decided not to repeat the attack until more was known of what the Germans would continue to do there, but No. 540 Squadron continued to keep watch upon it each month. On the 3rd October, a photographic reconnaissance of Peenemünde revealed a miniature aircraft with a wing span of about 20 feet and length of 19 feet. Search of earlier sorties revealed the presence of such an aircraft on two previous occasions. This was named the "Peenemünde 20" and was thought likely to be a jet propelled machine, but no actual connection was then made between the aircraft and the ramps, which were discarded as being connected with the reclamation work on the airfield.

During the summer and early autumn, No. 541 Squadron Spitfires frequently photographed the North of France dealing with cover of radio and radar installations, enemy airfields, and other information required for various reasons, and on photographs it was noticed that military installations of a new type had begun to appear in the Pas de Calais area. Activity at one such site at Bois d'Esquerdes was first reported on the 24th September, and shortly afterwards an agent's report gave six pinpoints in Northern France as "secret weapon launching sites". The search for these and other suspected sites was commenced on the 3rd November, when Spitfires of No. 541 Squadron flew six sorties photographing pinpoints given under the new code name of "Crossbow". This was to become a familiar word to the P.R. pilots for many months to come, as it later became the code word for all sorties flown in connection with the secret weapon installations. The installations photographed were found to be similar to the one first seen in September and all possessed identical features. The most advanced state of building was found at Bois Carré, which name was later given to the original flying bomb launching sites.

A.I.
No.
31524

On the 8th November, representatives of the Central Interpretation Unit attended a meeting called at the request of the Prime Minister, and under the chairmanship of Sir Stafford Cripps, to review the evidence so far obtained of the actual existence of enemy secret weapons. When the C.I.U. representative announced that 19 peculiar installations had been found on photographs of the Pas de Calais area, including all of those at the pinpoints given by the secret agent, none of them rail served, all of them situated in woods, built with three "ski-shaped" buildings and a platform pointing in the direction of London, the meeting was adjourned so that photographs of further areas could be examined. Whilst the Spitfires of No. 541 Squadron continued their reconnaissance of numerous pinpoints and suspected areas in a coastal strip 100 miles deep, stretching from Pas de Calais to the Cherbourg Peninsula, a further detailed report was issued by the Central Interpretation Unit using low oblique photographs of the Bois Carré site. In this report it was suggested that the skis and other buildings on the site would soon appear on all others of the same type, and if this were so there was every evidence for regarding them as the firing sites. It appeared that the platform was the point from which projection took place, but nothing had yet been seen to indicate the method of projection or the type of missile, which was now not considered to be of the rocket type. Reports had then reached the authorities

that some kind of pilotless aircraft was being developed in addition to the long-range rocket, but at this stage of the investigation there was considerable confusion between the two types of secret weapon and their launching sites.

The intensive search for more ski sites continued and by the end of November, that is in 27 days, 72 Bois Carré sites had been identified in Northern France, seven in the Cherbourg Peninsula. Every site was studied in minute detail in order to ascertain the probable purpose of each component, and it was found possible to calculate the rate of construction, which was estimated at 0.75 per cent per day; in other words, each site took rather over four months to complete. Those in the Pas de Calais/Dieppe area all pointed in the direction of London and were within 140 miles of their target, whilst those in the Cherbourg area were within 100 miles of Southampton and Portsmouth and 140 miles of Bristol.

Meanwhile, on the 28th November, two Mosquitoes of No. 540 Squadron set off to photograph bomb damage at Berlin⁽¹⁾. They both found the target covered by 10/10ths cloud and so went on to photograph their secondary targets - the Baltic Ports and Peenemünde airfield. They both obtained successful photographs, and the first aircraft also took successful photographs of Zinnowitz⁽²⁾, 8 miles south-east of Peenemünde, in connection with the location of a Wireless Station. When the photographs of this area were interpreted, an installation was discovered similar in every way to the Bois Carré sites, without skis but with a ramp similar to Peenemünde's inclined at about 10° and pointing out to sea.⁽³⁾

On the 1st December 1943, two representatives of the Central Interpretation Unit met the members of the Joint Intelligence Committee "Crossbow" Sub-Committee to report on and explain verbally the theories which they had evolved from an intensive study of all the photographs obtained, including those of Zinnowitz. The Committee was informed that a good deal had been discovered about the supply organisation behind the secret weapon campaign and that several supply sites had already been identified from photographs. It was also suggested that the weapon would be a type of pilotless aircraft, and a satisfactory theory had been evolved as to the method used at the launching sites. The Committee then requested that these theories should be submitted as a report at the Committee meeting on the following day. Meanwhile, further research was being carried out at Medmenham on the Zinnowitz photographs. The photographs of Peenemünde taken with 36" lens on the same sortie were again re-examined, when a small aircraft of the type seen on the airfield in October was discerned on one of the ramps. The "military constructions" in North-West France were explained; they were launching sites for a type of pilotless aircraft or flying bomb.

C.I.O.
Report
B.S.
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3/12/43

J.I.C/43
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A report was accordingly prepared during the night of the 1st/2nd December, incorporating not only the theories already put forward but further vital information confirmed by the

(1) Pilots - S/Ldr. J. R. H. Merrifield D.F.C. left base 0955 hours, F/Lt. Baird left 1045).

(2) Referred to in the Air Historical Branch narrative on the Flying Bomb as Zempin.

(3) Whether the securing the photographs of Zinnowitz and Peenemünde on this day was fortuitous must remain a matter for conjecture, since the covering of their primary objective might have taken the pilots some considerable flying time, they might have been intercepted etc. and in this way it is possible that neither of them might have gone to Peenemünde at the crucial moment.

finding of the aircraft on the ramp. This report was taken to the full meeting of the J.I.C. "Crossbow" Committee on the 2nd December, and the conclusions embodied therein are worth recording in full:-

- (i) Bois Carre type sites are designed for the projection of glider bombs of the Peenemünde 20 type (wing span approximately 19 - 20 feet, length 19 feet).
- (ii) The site at Zinnowitz confirms that the body of the bomb must pass through the larger rectangular building.
- (iii) The absence of the skis at Zinnowitz tends to confirm that these are for storage.
- (iv) The firing points in Northern France are being developed on similar lines to the early stages of the construction of the prototype firing ramps at Peenemünde airfield, and it seems probable that they will follow the same later stages until reaching the final form seen both at Peenemünde and Zinnowitz."

C.I.U.
B.S.174

At the same time, a report was issued on the six supply sites already identified and on the firing sites at Peenemünde and Zinnowitz. Comparison of the various photographs taken showed that these consisted of rails mounted on inclined ramps with a small square building at the lower end. Four of these were on the Peenemünde airfield and three had been built between January and November 1943. They were watched carefully, and in December a fifth ramp appeared at Peenemünde. It was then concluded that the first two were development sites used when experiments were in progress but that the second three were prototype firing sites from which flying bombs would eventually be launched.

C.I.U.
B.S.213

On the 4th December, photographic reconnaissance of all Northern France within a radius of 140 miles of London and Portsmouth was ordered. No.542 Squadron continued to search for the ski sites, and during December discovered a further 17, making a total of 87 already discovered out of the ultimate total of 96.

Bombing of the Bois Carre sites became part of Operation "Crossbow" on the 5th December, damage assessment flights being made immediately after each attack to ascertain the accuracy and effectiveness of the bombing. The progress of the building of each site was watched on photographs, so that the best time could be selected for attack, in order that the bombing should do the maximum amount of damage. Towards the end of December, No.34 P.R. Wing of 2nd T.A.F. was called in to assist in this work and from thenceforward they played a part in photographing the sites before and after raids. As it was not then possible to estimate any date by which the projectile might be used, owing to insufficient information being available about production, it was of the highest importance that the enemy's efforts should be negated by the continual damage done to the firing sites. By the end of 1943, 52 sites had been attacked mostly by the Medium bombers of 2nd T.A.F. and the VIIIth U.S. Air Force 42 of them were photographed during the same period for damage assessment, showing that 36 had been affected by the bombing, 21 seriously.

C.O.S.(44)
4(0)

Up to the end of November 1943, "Crossbow" had been largely an intelligence problem, in which the P.R. organisation had played a large and important part, and may be said to have forged the final link in the chain of circumstances which led to the discovery of Germany's first long-range secret weapon. During the following year, "Crossbow" became an operational problem in which photographic reconnaissance still had as great a part, but not so important a part to play.

K. Special Supply and Agent Dropping Operations

The supply of special topographical information in connection with the highly secret work of landing supplies and secret agents in enemy-occupied countries merits a space in this narrative, for although this work was not often connected directly with a particular photographic reconnaissance operation, the work of the photographic interpreters at the Central Interpretation Unit in connection with secret operations on the Continent was of the highest value to their success.

During 1942, certain requests had been made to the Central Interpretation Unit from time to time for topographical details of certain areas, but with no indication as to the reason for these requests. By the middle of July 1943 these requests had increased enormously and the purpose of them was revealed to the few specially selected photographic interpreters who dealt with them - the information was required to select suitable points for such operations as landing aircraft to set down or pick up secret service agents, dropping agents and saboteurs by parachute, and dropping supplies to resistance organisations in enemy-occupied countries. Once the purpose of these requests was made known it was possible for the Central Interpretation Unit to assess the best methods of fulfilling the requirements and to offer alternatives should the positions originally selected be unsuitable for the task outlined.

As an example of the information sought, here are a few of the points which required answers in connection with an agent-dropping operation. Referring to a certain locality, the length and width of the wood, the density of the undergrowth and what cover it would offer had to be given. Were the trees evergreen, was any work in progress in the wood, what was the density of the scrub, was it gorse, were a few more of the queries to be answered. In addition, statements were required regarding the size of the bridge over a stream, the width of the stream, the height of the main river bank where the stream joined it, the existence of a footpath beside the stream, and the nature of the surrounding pastures.

Between January and December 1942, 157 reports of this kind were issued by the Central Interpretation Unit, entailing the description of 304 areas. Where photographic cover did not exist, special sorties were flown, generally by No. 544 Squadron, but the pilots were not aware of the reason for the sorties. Generally speaking, 36" cameras were used for ground detail with a 6" camera for general topography and contour. In June 1943, when requests for this type of information became more numerous, a special method of supplying the details required was first evolved, by means of an annotated trace which could be laid over the photograph, leaving the actual print available for study clear of any annotations.

During 1943 the bulk of the work done was in connection with S.D. operations in France, but extensive requests were also received in connection with areas of Norway for secret operations in that country. The great majority of the French operations were based entirely on information supplied by the Central Interpretation Unit, and quite a fair proportion of those in Holland, Norway and Denmark, although in these latter countries the patriot organisations were so efficient that it was possible to undertake many S.D. Operations without the need for photographic intelligence.

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(passim)

MDM/
M.S.4.
(passim)

Dec 42 - Dec 43

The period under review showed a steady increase in the amount of photographic reconnaissance undertaken and in the number of P.R. aircraft, both at home and overseas.

p 19.

The final target figures for P.R. Squadrons were achieved during the year. At home No.543 Squadron was disbanded and Nos.540, 541, 542 and 544 Squadrons were reformed, each to an establishment of 20 aircraft; when the new No.106 Wing was formed in June 1943 they were placed under its operational control. From Middle East's No.2 P.R.U., the P.R. Detachment in Malta and No.4 P.R.U. in North Africa, three squadrons were formed in February - Nos.680, 682 and 683 - which, later in the year, were to join No.60 S.A.A.F. Squadron in the North African P.R. Wing, making the total British P.R. aircraft in the Mediterranean Air Command 20 Mosquitoes and 20 Spitfires. India's No.3 P.R.U. became No.681 Squadron, and in August her 2nd P.R. Squadron - No.684 - was formed, ultimately giving South East Asia 20 Spitfires and 20 Mosquitoes for photographic reconnaissance work. Added to all these was the P.R. Organisation specially formed during 1943 to prepare for the invasion of North West Europe; No.140 Squadron from Army Co-operation Command going to 2nd Tactical Air Force in June where it was joined by No.16 Squadron, both with an establishment of 18 aircraft, whilst Nos.4 and 400 R.C.A.F. Squadrons became the P.R. Squadrons for the composite T.A.F. Groups, accompanied in each case by two Tactical Reconnaissance Squadrons capable of taking photographs. By March 1943 also, the American 7th Photo Group was in full operation and thenceforward took over the responsibility for many of the requirements which had previously been undertaken by the R.A.F. P.R. Squadrons in the United Kingdom.

Home

What had seemed outstanding achievements in 1942 became normal routine flights in 1943, and as the Allies conquered more enemy-held territories so bases became available from which P.R. aircraft could operate over a still wider field. With the completion of the Tunisian Campaign, it became a simple matter for Benson-based aircraft to use Tunisia as a refuelling base, and similar use was made of Sicily after its fall in August 1943. These alternate bases made it a comparatively easy matter to photograph the German/Polish frontier and Austria, and on the 20th August excellent quality photographs of the German/Polish border were taken by a Mosquito of No.540 Squadron showing much constructional work in progress(1). After having been airborne for 8½ hours the pilot landed at Algiers, refuelled, and returned to Benson the next day. Similarly, on the 11th August a Mosquito of No.540 Squadron photographed targets in Germany, Northern Italy and Central France, refuelled in North Africa and returned to London the same day(2). In this month it was agreed that when U.K. aircraft landed in North Africa the North African P.R. Wing at La Marsa should process the films taken, thus securing a duplicate negative for Mediterranean Air Command and ensuring the security of the photographs should the aircraft fail to return to base. Hungary and Roumania came also within the easier limits which could be reached by aircraft refuelling in Sicily.

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Night photography for reconnaissance purposes began serious development in 1943. In December 1942 the first

(1) Pilot - P/O W. J. White.

(2) Pilot W/Cdr. Lord M. Douglas-Hamilton O.B.E.

operational night photographic reconnaissance took place using a Wellington aircraft of No.544 Squadron, and on the 22nd and 28th March 1943 some excellent night photographs of St. Nazaire were secured. By May 1943 the Mosquito had been introduced for night photographic reconnaissance work with good results. During the ensuing months a number of night sorties over Northern France produced satisfactory results, although the height at which the aircraft were forced to operate produced only small scale photographs.

P32
P33
In addition to all the special operations outlined in the preceding paragraphs, it goes without saying that the routine tasks of reviewing German shipping and U-boat building, war industries and defences went on undiminished through 1943. Reviews of German shipbuilding by the Central Interpretation Unit showed that the main effort was now being concentrated on U-boats, and R.A.F. and U.S. attacks were directed on U-boat yards and pens where photographic interpretation indicated that the most damage could be effected. New photographs of important industrial works in Germany were secured during the year to assist in compiling the target material for the Allied bombers. Amongst these was the important Magnesium Works at Herringen on Werra, photographed for the first time in March 1943. During the same month the Skoda Works at Pilsen was covered for the first time since May 1942, showing that considerable activity had taken place in the interval. In June, excellent photographs were taken of the severely battered Ruhr towns, such as Krefeld, Dortmund and Dusseldorf, and on the 16th July a sortie to Weiner Neustadt provided cover for the first attack on this target in the following August.

By September, photographic reconnaissance had reached the furthest limits yet achieved, and from this country its sorties now reached from Narvik to the Spanish border and to Budapest and Belgrade. The year 1943 finished with a flourish, 310 sorties being flown during December by aircraft of No.106 Wing, of which 215 were successful. The figures for the year were:-

	<u>Sorties flown</u>	<u>Sorties successful</u>	<u>Percentage successful</u>
1943	2,989	2,252	75%
1942 - given for comparison	2,777	2,203	78%

During the last six months of the year twelve P.R. aircraft of No.106 Wing were listed as missing. A record day's production (at Benson alone) was made on the 20th December 1943 when 5,937 negatives and 18,979 prints were processed, as compared with the daily average for the year of 830 negatives and 2,080 prints.

P19
The only technical development of note during the year was the first operational sortie by a Mosquito Mark IX which took place in December 1942.

Overseas

P.R. activity overseas made tremendous strides during the year, both in the Mediterranean and in India. Although most of the effort in the Mediterranean was directly in connection with the successive campaigns in Tunisia, Sicily and Italy, many sorties were flown to obtain target material and bomb damage assessments to assist the activities of Allied heavy bombers based in Middle East, and by the end of the year fewer tactical sorties were being flown as the strategic policy of bombing Southern Germany and Austria from Mediterranean bases was put into effect.

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 The North African P.R. Wing kept a close watch on the movements of the Italian Navy. In April 1943 a photographic reconnaissance of Sardinia established that two of the three Italian heavy cruisers were at La Maddalena. This led to heavy attacks on the port by U.S. bombers, when the "Trieste" was sunk and its fellow cruiser the "Gorizi" damaged, a severe blow to Italian naval circles. In June, Malta's photographic reconnaissance Spitfires covered all the main Italian harbours, which resulted in heavy bombing attacks on Spezia, damaging two of the three Littorio-class battleships there. In September, this task came to an end, for with the capitulation of Italy, photographs of Spezia, Genoa and other Italian harbours showed that Italian naval ships were either putting to sea to surrender, or being scuttled in dock.

One of the outstanding heavy bomber raids from Middle East was on Ploesti oilfields in Roumania, when on 1st August the first low level attack of its kind was made by U.S. bombers. For this task, models were made by the Central Interpretation Unit of the general target and certain specific targets to aid in briefing the attacking force. After the attack, special bomb damage assessment sorties were flown by P.R. Mosquitoes on the 3rd August and the 19th August, representing a two thousand mile trip. The photographs secured showed a high degree of damage inflicted, whilst photographs secured by the North African P.R. Wing as late as the 25th October showed that repairs to the damage were being effected. Another important bombing attack took place on 13th August when the first raid from the Middle East on Greater Germany was made, the objective being Weiner Neustadt. Although the target material for this flight was secured by No. 544 Squadron, the damage assessment sorties were flown by the North African P.R. Wing.

By October, more photographic reconnaissance of the Balkans was made possible than ever before by the increasing numbers of P.R. Mosquitoes in Mediterranean Air Command. Regions previously difficult to reach were now coming within comparatively easy range, and Bratislava and other areas of Czechoslovakia were photographed for the first time by P.R. aircraft based in North Africa. The weather over Italy was very bad through October and November, but every opportunity was taken to photograph airfields and communication centres in Central and Northern Italy. Happily, weather conditions over Southern Germany and Austria were good and frequently when home-based P.R. aircraft could not operate owing to conditions at base, Mediterranean Air Command's P.R. Units were able to undertake sorties in these areas.

As the Italian campaign progressed the North African P.R. Wing, now the Mediterranean allied P.R. Wing, grew, the American side in particular being reinforced strongly in October. At the end of this month a new Reconnaissance Wing was formed - No. 336 P.R. Wing - to take operational control of Nos. 682, 683 and 60 S.A.A.F. Squadrons, under the Mediterranean Allied P.R. Wing. These Units continued to function from North Africa until the end of the year, but by December the Allied line was well above Naples and operations from the mainland of Italy became desirable, particularly as the work of the Photographic Organisation in the Mediterranean was now to become more strategic and less tactical. The Wing moved to San Severo at the end of December, in readiness to take up these tasks in the new year.

One of the most notable features of 1943 was the development of photographic reconnaissance in India. The P.R. Spitfires received there at the end of 1942 were soon put to

*P70/73

pp 70-75
year?

good use and by the following August No.681 Squadron had been allotted its first two Mosquitoes, which were of tremendous assistance in covering the longer distances so necessary in the Burma Campaign.

As early as March a special photographic reconnaissance of the Arakan coast was undertaken to provide information for a possible subsequent combined operation. Strategic reconnaissance of enemy-occupied territory in Burma, China, Assam and the Andaman Islands was carried out from No.681 Squadron's base in the Calcutta area, and operations continued throughout the monsoon period. As a result, close estimates of enemy strength and dispositions could be made which had hitherto been difficult of achievement. Sorties which had averaged 30 to 40 per month during the early part of the year reached into the hundreds during October, November and December. In November, No.681 Squadron and the newly-formed No.684 Squadron were placed under the operational control of No.171 P.R. Wing, the first step towards complete co-ordination with the U.S. Photographic Reconnaissance Units in South East Asia, which up to this time had been operating quite independently.

43.

On the 15th December photographic cover of Bangkok was obtained for the first time since the evacuation of Burma. This was the longest trip so far undertaken by a photographic reconnaissance aircraft from India and excellent photographs were secured. The aircraft in question - a Mosquito of No.684 Squadron⁽¹⁾ - brought back valuable information regarding Japanese dispositions and airfields there. In December also, regular sorties commenced to the Andaman Islands to secure information on enemy anti-shipping activities.

During 1943, the first year of serious photographic reconnaissance in South East Asia, 1,053 sorties were flown by aircraft of No.681 and 684 Squadrons.

(1) Pilot - S/Ldr. B. Jones.

4. JANUARY TO JUNE 1944

The first six months of 1944 was a period of the greatest activity in the Photographic Reconnaissance Organisation. All the general and routine tasks of the past years now had superimposed upon them the special tasks dictated by the far-reaching requirements of the various Services for the forthcoming assault on the Continent of Europe.

Work for the planning of the invasion had started in 1942 and the photographic intelligence required had been collected over a lengthy period, but right up to the final hour before D-Day there remained the checking of all the minute details, the careful watch on every move of the enemy and the photography required for last minute changes of plans, all of which contributed to the success of the operation.

In addition, the battle of the flying bomb was in full swing and every measure possible was undertaken to prevent the threat of the German secret weapon menacing the mounting of Operation "Overlord".

This does not mean that the routine work was neglected. Watch still had to be kept as frequently as ever upon the remaining major units of the German Fleet, and a second P.R. detachment went to Russia in the Spring of 1944 to keep track of the movements of the Tirpitz.

The R.A.F. and American bombers in greater numbers still carried out a ceaseless offensive against Germany and the rest of occupied Europe for which target material and damage assessments were in constant demand.

The use of larger drop tanks helped to achieve long range photographic reconnaissance cover more easily and frequently than ever before, and the volume and value of the photographic intelligence produced during the first six months of 1944 exceeded any previous record set up by the P.R. Organisation.

A. German Major Naval Units

Although the Scharnhorst had been sunk, the Tirpitz crippled and the Gneisenau dismantled during 1943, the remaining German Naval Units still required close watching and photographic reconnaissance of the Baltic Ports went on unabated into 1944. No. 540 Squadron photographed Sweenemunde and Stettin on two occasions during January when the Admiral Scheer was seen to have returned to Sweenemunde from her stay in Alten Fjord. Cover was continued during February when all the German Major Units were photographed in the Eastern Baltic, with the exception of the Tirpitz and the pocket battleship Lutzow. On February 19th a record flight was made to photograph Königsberg and Pillau⁽¹⁾, a Mosquito from Leuchars being airborne for 8 hours on this occasion and photographing and covering Elbing, Gdynia and Danzig in the same flight.

At the beginning of March the Tirpitz was reported to have left Alten Fjord with five destroyers. It was thought that her repairs had progressed sufficiently to allow trials to be held and she was once more a potential threat to the North Russian convoys. The Admiralty had already expressed a desire to put her out of action again and plans were in hand for an attack by carrier-borne aircraft of the Fleet Air Arm.

(1) Pilot - S/Ldr. Merifield, D.S.O., D.F.C.

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& 115

p32

March was the earliest month in the year that gave sufficient photographic light to enable P.R. aircraft to operate over Alten Fjord and accordingly a P.R. Detachment of three Spitfires Mark V from No. 542 Squadron left for Russia on March 7th to operate from Vaenga again. To avoid alarming the Germans, the Russians had been asked to keep up regular Spitfire sorties over Kaa Fjord until the R.A.F. detachment was ready to operate, and this was done with the Spitfires which had been left to the Russians in 1943⁽¹⁾. The first sortie of the detachment was flown on March 12th and although clouds obscured the Tirpitz, satisfactory photographs were obtained of the approaches to Kaa Fjord from the sea, and other minor details necessary to the Fleet Air Arm plans. The following day full cover of the fjord was made, revealing the Tirpitz in the identical berth she had occupied in the autumn of 1943. The other shipping present was identified as well as the position of the neighbouring anti-aircraft batteries. Films of the first two sorties were then sent back to the United Kingdom by Catalina, arriving at the Central Interpretation Unit in so short a time that the interpreter's report was in the hands of the Admiralty 30½ hours after the second reconnaissance aircraft returned to its North Russian base.

As these two sorties fulfilled successfully all the major requirements, a distant watch was kept on the Tirpitz with oblique cameras from some miles off in order not to draw the German's attention to R.A.F. interest in the vessel. Up to April 2nd one Russian sortie and seven further R.A.F. sorties were made over Kaa Fjord, the last of which obtained very satisfactory cover in spite of the fact that the Spitfire's oil tank froze with the extreme cold. The Fleet Air Arm attack followed on the 3rd, when aircraft from H.M.S. "Victorious" and "Furious" scored hits on the battleship, but the weather was so bad for the next few days that no damage assessment flights were possible. On April 7th a successful assessment flight was made, but the interpreters were hampered in their work by the fact that the whole of the port side of the Tirpitz was in deep shadow, caused by the Arctic sunshine. Nevertheless, it was possible to state that damage had been sustained although the extent of it could not be assessed.

The Admiralty decided to make further attacks during April and May, and photographic reconnaissance from Russia was continued accordingly. Four attempts were planned but none was made as the weather conditions deteriorated rapidly with the approach of summer. On May 15th photographs showed that the Tirpitz had moved into a new berth across the fjord but after the abandonment of the fourth attempt, scheduled for a date between May 31st and June 2nd, the P.R. detachment was ordered to cease operations, which throughout had been hampered by the use of the outmoded Spitfire Vs. Attempts to obtain replacements of Mark XIs had proved fruitless for obvious political reasons; so far the Russians had not been supplied with the latest Marks of Spitfire. During the Detachment's stay in North Russia 19 sorties, 14 of them successful, were flown over Kaa Fjord.

Meanwhile the check on the Baltic Ports continued. On the 8th April Scheer and Nurnburg were photographed at Swinemünde and on the 14th April Königsberg was visited again, when all the larger units other than the Tirpitz were located -

(1) Although the United Kingdom squadrons were operating with Spitfires Mark XI in 1944, political reasons prevented their use in Russian territory.

the Admiral Hipper, the Leipzig and the Gneisenau at Gdynia, the Prinz Eugen and the Lutzow lying off the port. On May 9th a reconnaissance of Copenhagen showed that the Lutzow had arrived there; whilst on May 12th the Scheer was photographed again at Sweenemünde. On the 13th May the Lutzow returned to Gdynia but the Nurnburg had departed from Swinemünde, whilst by the 13th June the Scheer had also left the port. On the 19th June the Leipzig was in Swinemünde, whilst the Admiral Hipper, the Lutzow, Nurnburg and Koln were at Gdynia. These movements illustrate the care with which these vessels had to be watched, lest one of them should slip out into the shipping routes.

B. The Amiens Prison Raid

An unusual feat in which photographic reconnaissance played a part was the raid on Amiens Prison in February 1944. This was unusual because the purpose of the raid was not to destroy the prison, but to attack it in an attempt to breach the walls and allow the escape of a number of French patriots imprisoned there awaiting the death sentence. In order that the attack should be absolutely accurate, a good deal of information was required regarding the construction of the prison, and most of this was obtained from air photographs. No. 542 Spitfire Squadron had taken some excellent photographs of the prison during a sortie flown on the 20th December, 1943, and from these a model was made for the purpose of briefing the attacking crews. In addition, on the 15th February 1944 the Central Interpretation Unit was asked to supply detailed information on such points as the height and thickness of the outer wall surrounding the prison, the dimensions of the area enclosed by the wall, and the number of stories in the main building. The position of machine-gun posts was also carefully noted, together with details of the neighbouring houses and the special wing of the prison in which the German guards were quartered.

MDM/MS.16.

With the information derived from photographic interpretation, together with ground information obtained from French Resistance sources, it was possible to plan the attack in detail, and to use a strong force against the German guards' quarters whilst only damaging the prison buildings and walls sufficiently to release the prisoners. On February 18th the attack was carried out by a Mosquito Wing of 2nd T.A.F. after each crew had been briefed with the model of the prison and the particular part they were to play in the raid explained to them. In spite of the small target, the precision bombing was almost entirely successful. A further Mosquito from the wing followed up the raid making three runs over the objective to take photographs of the damage done. Photographs taken showed the breaches in the outer wall, the ends of the building broken, and the patriots running across the snow outside the prison.

C. Operation "Crossbow" - the Battle Against the Flying Bomb - Phase 2

The end of 1943 produced a series of logical findings on the German pilotless aircraft, secured by photographic intelligence from the closest examination of large numbers of photographs taken by the P.R. Squadrons. The beginning of 1944 was to see the confirmation of those theories in all major details.

On the 6th January copies of official German plans issued to contractors for the building of Bois Carré sites were secured, and corroborated the findings of the Central Interpretation Unit on the construction of these sites. After comparing the plans with photographs, certain additional information was obtained about the sites, but only of a minor

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nature. On the 12th February, a sortie flown to Peenemunde by a Mosquito of No.540 Squadron⁽¹⁾ brought back a photograph which showed three blast marks near the second prototype launching range on the airfield, one in front and one on either side. This discounted the theory that the projectile was rocket assisted or fired from a catapult, and it was fairly certain evidence that it was jet-propelled.

MDM/MS34
(passim)

The search for further ski sites continued in 1944, and a further seven were discovered in January, making 96 in all, of which eight were in the Cherbourg Peninsula. Constant photographic cover failed to find any more, and in fact the number found constituted the full total of Bois Carré sites actually built in North-West France. A mounting scale of attack was made on the ski sites during the first three months of 1944, and also upon the large installations whose purpose was still unknown but was invariably connected with the rocket. Immediate bomb damage sorties were flown whenever possible after each raid, and in January an examination of these photographs showed that the scale of our attacks had taken the Germans by surprise, no concerted effort having been made to organise themselves against such raids. After attacks they made every effort to improve camouflage, and by February repairs were in progress at 28 out of the 73 damaged sites, although there was little photographic evidence of any comprehensive repair policy. From this month, too, the supply sites were watched by constant photographic reconnaissance and further evidence of their purpose was obtained. By the 7th April three supply sites were completed and several others nearly so. Of the 96 Bois Carré sites, 88 were put out of action by bombing, based on target material and bomb damage assessment supplied by the P.R. Organisation and the Central Interpretation Unit, and there is no evidence that the remaining few were ever used.

In all these "Crossbow" tasks and those still to come, the P.R. Squadrons of 106 Wing were ably assisted by the U.S. 7th Photo Group, No.34 P.R. of 2nd T.A.F. and the Mustang Squadrons of Nos.35 and 39 Recce Wings, the latter taking some remarkable low level photographs of sites where high level vertical photography was not possible owing to adverse weather conditions.

It is fair to say that the P.R. Organisation as a whole was the biggest single factor in the discovery of the flying bomb and in the success of the consequent bombing policy which prevented the enemy attack taking place during the winter months. A winter attack could not only have rendered counter measures far more difficult, but the long nights would have made such an attack a very arduous burden for the civilian population of Southern England.

C.O.S.(44)
419C

By April 1944, however, the Germans realised that their original sites were difficult to conceal with their standard lay-out and multiplicity of buildings, and work on them was practically abandoned. On the 27th of that month, a scrutiny of photographs taken in the Cherbourg area revealed a suspected new site near the village of Belhamelin. Examination of various photographs and fresh reconnaissances showed that a programme of new sites was in progress, each site based on a modified pattern with all non-essential buildings deleted and the other buildings, with the exception of a small square building, often replaced by existing farm buildings. The square building was later found to be of a non-magnetic character in which the flying bomb gyroscopes were set prior to launching. The Germans made the greatest possible use of

(1) Pilot - F/Lt. Leaning, D.F.C.

woods and orchards in siting these modified installations, and ramps often followed the line of roads to gain effective camouflage. By the 13th May, notwithstanding the difficulty of locating the modified sites, 20 new sites had been identified, 9 in the Pas de Calais and 11 in the Cherbourg Peninsula. During the next three weeks the whole of the so-called 'Rocket Coast' was covered by intensive photographic reconnaissance sorties, in spite of the now imminent invasion of the Continent, and by the 12th June, 66 modified sites had been identified. These were difficult targets for bombing however, and the Air Ministry felt that it might be more politic to attack the special sites and so affect the transport of missiles and fuel. There seemed to be little connection, as far as photographic reconnaissance could discern, between the location of the special sites and the location of the modified sites, but on the 26th May the Chiefs of Staff recommended that an attack should be made by heavy day bombers on one of the special sites, and if followed closely by photographic reconnaissance it might reveal the contents of the various buildings. The special site at Beauvoir was selected for the purpose, and attacked on the 29th May, but it added nothing to the information required - photographic reconnaissance only revealed that the Germans were making no attempt to repair breaches in the railway lines leading to the site and there was no indication that supplies were being moved to other sites.

C.O.S. (44)
461(0)

Between the 4th and 10th June no photographic cover of the rocket coast was possible owing to unfavourable weather and the prior demands of the invasion. On the 11th June cover of the Pas de Calais was resumed, and 9 sites were photographed. When the photographs were examined at Medmenham, great activity and progress was seen at six sites, rails had been laid on the launching ramps at four sites, and at all six sites the square non-magnetic building was completed. This, coupled with the ground information that a train of 33 wagons loaded with "rockets" had passed through Belgium a few days previously on its way to Northern France, was evidence that the pilotless aircraft might be brought into operation at a very early date. This forecast was correct, and the first attack took place in the early hours of the 13th June.

Between May and September, a total of 133 modified sites were found by photographic reconnaissance in Northern France, pin-pointed and targeted by the Central Interpretation Unit. There were only eight sites built which were not revealed by aerial photographs, and it was later proved by ground information that seven of these were 100 per cent effectively camouflaged and did not show on any photographs taken of the area. No launching ramp could escape detection by photographic reconnaissance, however, once it had been used for firing as the scorch marks made showed up very clearly on the photographs. From then onwards it was the work of the Allied Air Forces to put the site out of action, but the story of how successfully it was done, with the aid of damage assessments supplied by photographic reconnaissance, belongs to the final section of this narrative.

D. Photographic Reconnaissance in Operation "Overlord"

The building-up of the vast quantity of information required for an invasion of the Continent represented many months of work for the Allied Intelligence Services, and photographic intelligence was not the least of the sources whence this vast fund of information was obtained. The build-up of photographic intelligence in the two years before D-Day was not made so much through the medium of special sorties with set objectives, but was derived more from the thousands of

D32

routine sorties undertaken over North West Europe. Almost every photograph taken during those two years revealed some detail needed for one or more of the many requirements of the planners.

No.140 (Army Co-operation) Squadron was given the earlier tasks of obtaining photographic information for the Army, (G.H.Q., Home Forces), and during 1942/43 this included the photography of beach defences from Calais to Cherbourg, and round the Brest Peninsula as far as the mouth of the Loire, photographs of beach gradients in the same areas, as well as general photographic cover for a revision of all the maps of North West France and Belgium. The P.R. Squadrons based on Benson also carried out certain of these tasks, the result of all their efforts being interpreted and collated by the Army Photographic Intelligence Section whose main task in the years of preparation was to provide the Chiefs of Staff and the various planning formations with a complete picture of German defences in North West Europe.

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In May 1942 a special Army Photographic Interpretation Section was set up at G.H.Q., Home Forces to provide all the information obtainable from air photographs taken of a strip of the Continent 30 miles wide, stretching from Den Helder to the Spanish frontier. In the summer of 1943 the work became more directly connected with the invasion plans and the planning staffs were supplied with oblique panoramas of the French Channel coast. From distant and close oblique sorties flown, suitable cover was selected, and mosaics of the coast were made and annotated with all the information possible which was likely to be of use to forces approaching from sea or air; topography of cliffs and beaches, heights, gradients, beach exits and footpaths were a few of the details included. In August 1943 the general "Overlord" area was decided and it was then possible to concentrate in still greater detail on the Calvados district. Complete sets of maps and traces were provided and amended meticulously from the latest sorties flown right up to the end of May 1944.

The Army Photographic Interpretation Section of G.H.Q., Home Forces was transferred to the 21st Army Group in July 1943 to continue its special task, and in the following December was attached to the Theatre Intelligence Section of C.O.S.S.A.C. (later of S.H.A.E.F.). In March 1944 a separate detachment was set up at Benson for the sole purpose of interpreting and watching rail and road movement of enemy transport. The information obtained was passed direct to S.H.A.E.F. in order that an appreciation could be made each day of the movements of German Army Divisions, and an interdiction programme laid on for attack by Allied aircraft with a minimum of delay.

One of the earliest participants in the "Overlord" task was the Model Section of C.I.U. As early as June 1942 when the pre "Overlord" plans known as "Round-Up" were in course of preparation, the planners laid down as a requirement for the early stages of planning that large scale models should be prepared of a considerable portion of the Continent on either side of the possible areas of attack. The models of the coast, moreover, were to show a contour relief on the seaward side down to low water level. All models required for the early planning stages were completed by November 1942 and illustrated different areas of coast from Dunkirk to the Gironde. No.140 Squadron and the Benson P.R. Squadrons shared the task of obtaining the necessary photographs and as the commitments grew the accommodation demands by Medmenham for the making and storing of these models became enormous. In spite of the intervention of requirements for such operations as Dieppe, North Africa and Sicily, the work continued apace and from September 1943 onwards the work of the Model Section

was concentrated almost entirely upon "Overlord". A number of American model makers joined the Section at the end of 1943 and models for the American portions of the landing beaches were undertaken.

The models produced were of three main types -

(a) Those of large areas of Northern France showing communications, built-up areas, and rivers. These were produced at a vertical scale of 1/12,500 or 1/6,250 and 32 originals of this kind were made each 5' x 3'. Plaster copies were then produced and despatched to the various formations concerned.

(b) Those of coastline areas up to a depth of 12 miles inland. Those of selected operational areas were made on the scale of 1/5,000 and showed land and surface variations, topographical features in detail, defences, tide lines and communications; they were in fact complete replicas in miniature of the actual places. In all, 63 of these model sections were made, each approximately 16 feet square and from them 186 copies were constructed and despatched to the planning staffs.

(c) Those used for the planning of the special airborne landings. Two of these models were made to a scale of 1/900 and included the most minute details.

Many models were also made for post D-Day use, but those employed in the planning and briefing of the D-Day landings made a very real contribution to the ultimate success of the operation.

In June 1942 the task of compiling a comprehensive library of photographs of France, Belgium and Holland began. Sorties over the Continent became more and more frequent, increasing from an average of 310 a month in December 1943 to 1,085 a month by May 1944. The European countries concerned were divided into six regions and a weekly record was maintained to ascertain how many sorties were made over the actual "Overlord" area in comparison with the rest of North West Europe. In order to prevent arousing the enemy's suspicions by a disproportionate amount of reconnaissance flying over any particular part of the coast, this record was used to balance the sorties evenly over the whole of North West Europe.

One of the earlier tasks undertaken by the Army interpreters at the Central Interpretation Unit was that of studying and plotting all enemy batteries in the coastal areas, and in October 1942 detailed studies of selected batteries were made. From these studies it was possible to report enemy activity and identify correctly all the defence building proceeding on the Channel coast in connection with casemates for light and medium coastal guns. As D-Day approached, immediate interpretation reports were issued to record all changes to batteries and to give estimates of the amount of damage inflicted by Allied aerial bombardment. A check on enemy coastal artillery carried out later in 1944 showed that photographic interpretation had succeeded in identifying 90% of the batteries actually in existence, the remaining 10% being mainly mobile flak batteries.

Another portion of the work directly connected with D-Day was the photographing and identifying of underwater obstacles off the invasion beaches, and the identification and plotting of these obstacles proved to be a most exacting task. During the Dieppe raid in 1942 some of our landing craft had encountered steel stakes driven into the sand below the water line. In the spring of 1943 ground intelligence was obtained

to the effect that similar obstacles were being set in place at various coastal resorts, and oblique photographs taken during a sortie by a Spitfire of No. 541 Squadron on the 12th May 1943 showed curved rails off the shore at Quineville. Careful air survey revealed no further underwater obstacles off the rest of the coast of occupied Europe, and it was later ascertained that Quineville was an experimental area. In early 1944 No. 35 P.R. Wing of 2nd T.A.F. undertook the photography of the sea bed off the Normandy coast, and on the 20th February photographs taken showed that the work of laying underwater obstacles had commenced off the landing beaches. Thenceforward, photographic cover of the beaches was regularly undertaken to watch the enemy progress and a fortunate accident revealed that the Germans were attaching mines to the obstacles. During an Allied air attack upon a coastal battery one aircraft dropped a stray bomb in the sea 700 yards off shore and the strike photographs taken at the time showed a series of fourteen small explosions. At the time of photographing, the obstacles were covered by the tide but when the strike photographs were plotted and compared with other photographs of the area they showed that the explosions had occurred within the depth of the belt of obstacles. During April and May the American P.R. Lightnings gave great assistance in this particular task. With cameras fitted in the aircraft noses they flew at zero feet along the line of obstacles and revealed the various types, how they were mined and the methods of erection. The new moving film camera was also used in the last stages to obtain large scale photographs of the obstacles from 6,000 feet. Daily sorties were flown over the beaches before D-Day and the latest information was obtained and issued to the invading armies right up to the evening of June 5th.

Another type of obstacle which also formed the subject of P.R. sorties was the "anti-air landing" obstacle. Up to the beginning of 1944 photographs of Normandy showed very few areas of open ground obstructed by poles, but in March it was noticed on photographs that an abnormal amount of tree felling was taking place in the "Overlord" area and it was assumed that a programme of obstruction against aircraft landing was about to begin. Careful notes were made of all the areas so obstructed, but the obstacles did not prevent the landing of Allied gliders. The enemy's intention was to link the obstacles with wire and attach mines to the wires, but fortunately this part of the programme was not put into effect by D-Day.

All these tasks and those of photographing the general defences, minefields, anti tank obstacles, flak and anti-tank guns, observation posts, and movements of enemy troops were mainly undertaken for the benefit of the invading armies, but the combined P.R. organisations of No. 106 Group, the U.S. P.R. Wing and 2nd T.A.F.'s P.R. Units carried out a number of additional undertakings on behalf of the R.A.F. These included firstly, the photography of the Luftwaffe on French airfields in order that a picture might be built up of the enemy's potential air strength on D-Day, and after each attack on these airfields by Allied aircraft an assessment of the damage done to that strength was made. Secondly, the photography with survey cameras of 91 small areas in Normandy for the purpose of selecting sites upon which the future airfields of 2nd T.A.F. and the U.S.A.A.F. were to be built when the ground had been captured. This involved flying over the targets at 9,000 feet, a hazardous undertaking by the vulnerable P.R. Mosquitoes in the midst of the enemy FW.190s and ME.109s. Nevertheless, the task was completed without loss by April 1944, mainly by No. 34 P.R. Wing.

Thirdly, immediately prior to D-Day the U.S.A.A.F. Wing

carried out photography of the bridges over the Loire which involved much low level flying, but provided invaluable information to the Allied bombers in their work of denying supplies to the German armies during the battle of France.

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Lastly, and perhaps the most important task of all, was the work done by the P.R. Organisation to assist in the neutralisation of the enemy radar system in the invasion area. As the result of 2½ years intensive research by the Radio and Radar Section at the Central Interpretation Unit a full picture of the German radar system had been built up, and it presented a truly formidable problem. It was decided that an essential feature in the preparations for the invasion must be a concentrated onslaught on all the radar apparatus within a prescribed area around the proposed landing beaches, and the length of the coast selected stretched for 450 miles from the Franco-Belgian frontier to Cap Frehel in Brittany. On this strip there were nearly 100 radar stations, most of which comprised a number of separate installations. It was calculated that there was one radar instrument for every 4½ miles of coastline over the whole range and every one of these had to be silenced if the security of the Allied landings was to be ensured.

On March 1st the Central Interpretation Unit commenced the task of producing target material on these installations suitable for briefing pilots to carry out the actual attacks. A great deal depended upon the comprehensiveness of the investigations since if any active installation, however small, was overlooked the whole operation might be in jeopardy. On the 1st April, after the most concentrated efforts, a full report was ready. 253 copies were prepared, each of 300 pages (76,000 sheets) and all of these were collated and bound within 'G' Section to safeguard the security of the operations. The result was known as "Rhubarb" Operations, Appendix XII. This document gave full descriptions of each target, three types of selected and annotated photographs and large scale plans of each single piece of apparatus, small scale maps showing their position and a brief description of their functions, and notes upon the most vulnerable spots for attack, for the guidance of the pilots taking part in the operation.

An experiment was then carried out to see if rocket projectiles would be effective in damaging radar installations, and an enemy radar station in Holland was chosen as the experimental target. After the attack, oblique photographs failed to show the damage and the Central Interpretation Unit briefed one of 2nd T.A.F.'s Mustang Reconnaissance Squadrons (No.168 Squadron) to take close oblique photographs. A sortie flown for this purpose on the 16th May brought back photographs showing that the attack had been completely successful.

On the 22nd May a systematic shattering of enemy radar targets began by rocket-firing Typhoons and Spitfire fighter bombers. The onslaught was continuous for the next two weeks and photographic reconnaissance aircraft took low obliques immediately after each attack, followed by high level photographs after 48 hours and again at intervals of three to five days. Repairs and replacements were closely watched so that no installation should be left in a state capable of operation immediately preceding or on D-Day. On June 6th only five out of 98 installations were heard to function at all; their elimination had been a complete success, and had allowed our vast air and sea fleets to rendezvous 24 hours beforehand and attain their objectives without detection or interference in any form, a significant fact in the light of the acknowledged part played by our own

radar devices in the defeat of the German Air Force during the Battle of Britain.

At least some of the credit for the initial surprise of the invasion should go to photographic reconnaissance and photographic interpretation, and it must be appreciated that had any installation evaded the interpreters' scrutiny the security of the landings could have been nullified by the activity of that installation at the crucial moment.

In addition to all the tasks already outlined in detail, the P.R. organisation also kept a watch on the ports in the "Overlord" area for the Navy, noting booms and obstructions and keeping careful check on the movements of enemy naval and merchant shipping.

Photographic reconnaissance not only played its part in wresting the secrets of the enemy's defences and movements on the Continent from them before the invasion but it was also used to assist the Allies in obtaining security from the eyes of German photographic reconnaissance aircraft. Concentrations of dummy landing craft were made at various ports to deceive enemy reconnaissance planes. Our P.R. aircraft then photographed these from the air and the photographic interpreters listed the details which might disclose that they were dummies, when compared with photographs of real craft. All necessary steps were then taken to make these indistinguishable from real landing craft when seen from the air. Photography of concentrations and dispersals of aircraft, armoured vehicles, Army transport, and similar objects were also undertaken to assist in their successful camouflage and concealment.

The A.O.C.-in-C., Allied Expeditionary Air Forces (Air Chief Marshal Sir Trafford Leigh Mallory) paid a tribute to the P.R. Organisation in "Overlord" when he stated in his Despatch on the operation - "Photographic Reconnaissance prior to D-Day was always very accurate and was throughout of vital importance". Owing to the bad weather experienced in early June many of the photographs were obtained under adverse weather conditions and he recommended that future P.R. Units should consist of one high-flying flight and one medium-flying flight consisting of medium/low reconnaissance aircraft for use in bad weather. This recommendation was put into partial effect later in June by the addition of a P.R. Mustang Flight to No. 541 Squadron.

MDM/MS/13/1.

Despatch
by A.O.C.-in-C.
A.E.A.F.
on
Operation
"Overlord".

SUMMARY JAN 44 - JUN 44

Home

The year 1944 made the largest demands of any year of the war on the strategic photographic reconnaissance organisations in the Western European theatre, but it is difficult to single out particular performances from the many which were achieved. An improvement in the organisation of the photographic forces during early 1944 was brought about by the formation of No. 106 Group to control both P.R. squadrons and the Central Interpretation Unit, and by the formation of the Joint Photographic Reconnaissance Committee to control the operations of No. 106 Group and No. 325 Photo Recce Wing of the U.S.A.A.F. Thus, unified control was established over the whole field of strategic photographic reconnaissance in the Western European theatre.

The smooth working and harmonious collaboration of the U.S.A.A.F. Recce Wing with the R.A.F. P.R. squadrons did much to assist in accomplishing the many tasks demanded of the

Photographic Reconnaissance Organisation in the months prior to the invasion, and the American P.R. Units took their full share of the work throughout(1).

When the area of the Tactical air forces was defined it was agreed that the strategical organisation in the United Kingdom should continue to carry out all reconnaissances of ports, flying bomb installations, and all targets attacked by Bomber Command. Before and during the invasion, when Bomber Command was heavily committed in putting out of operation the railway facilities and marshalling yards in France and Germany, the volume of work in assessment of damage to these targets reached considerable proportions, very constant reconnaissance being necessary to the evaluation of results in order to use the available forces in the best and most economical manner.

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In February, two complete photographic records were made of the damage done to Berlin after a disappointment of nearly two months due to adverse weather conditions. At the end of February, a series of attacks was made by the U.S. VIIIth Air Force on vital aircraft factories deep in Germany. P.R. aircraft followed within a few hours of the attacks, photographing smoke and flames pouring from the factory buildings, and vast numbers of craters in the snow. In the same month the attack on a Bomber Component factory near Nurnburg was photographed by No. 542 Squadron from 27,000 feet one hour after the attack on February 25th. In March, six attacks were made upon Frankfurt followed up by a damage assessment sortie on the 24th March showing that the main weight of bombs had fallen in the centre of the city which was wholly devastated. In March also, night photography was used to assess an attack on Berlin, the pattern of the incendiaries being plotted as they fell along the streets, canals and rivers where they formed lines which could be matched with the town plan of Berlin.

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May was an outstanding month for the extensive and unprecedented cover of territory obtained by photographic reconnaissance in following up bomber attacks on synthetic oil plants, marshalling yards, bridges, aircraft factories and airfields. On the 12th May was struck the first major blow in the new campaign aimed at Germany's oil production, when the oil installations at Brux in Sudetenland were raided. Immediate photographic reconnaissance showed that the whole plant was temporarily out of action and watch was kept to ensure that repair work should not be completed before a further attack was made. In June strategic photographic reconnaissance organisations were engaged in damage assessment during the pre-invasion softening process and after D-Day in discovering the effects of bombing enemy communications. After Bomber Command's heavy attacks on Boulogne and Le Havre had destroyed a large part of the enemy's light naval channel forces, spectacular photographs were taken of the damage done.

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U-boat building was carefully watched throughout the period. From February onwards the whole U-boat situation altered; no new boats were seen on the slips and it appeared that either U-boat warfare was to be abandoned or something new was being prepared. In April photographs of Danzig revealed for the first time whole sections of a U-boat on the slips, which demonstrated clearly that the hulls were being assembled from prefabricated parts. It was also known that midget U-boats about 100 feet long were being planned

(1) See Part I Sections 2 and 6.

by the Germans, and in May their bases were successfully located on photographs, when they were seen for the first time at Hamburg and Bremen.

There were some important technical developments during the period under review. With all the problems which photographic reconnaissance faced at the beginning of 1944, intensive research was necessary to find equipment and methods best suited to deal with them. For invasion tasks it was considered essential to have available means of obtaining large scale low-level cover in unfavourable weather, and for this the moving film camera was evolved, designed to compensate for image movement due to the velocity of the aircraft. Vertical cover could be obtained from as low as 100 feet with this camera, first used on May 15th 1944 to photograph flying bomb sites. For similar purposes the forward-facing oblique camera was also developed to take low-level stereographic oblique cover of small targets such as radar installations, and this was first used operationally on the 12th June 1944. Three days later the first operational sortie was made with the newest type of P.R. Spitfire, the Mark XIX, which possessed a smaller range than its predecessors but had a greatly improved performance which was to be of value later in the year, against the German jet-propelled machines. In February, photographs of Lechfeld, near Augsburg, had already revealed the first German jet propelled aircraft, the ME.262, which was to prove such a menace to our P.R. Mosquitoes when it became operational in a few months' time.

The use of increasingly large drop tanks, both on Mosquitoes and Spitfires, during 1944 resulted in some very long sorties, and in February an outstanding example was the flight made with the aid of these tanks to photograph Königsberg and Pillau, referred to in a previous paragraph. A Mosquito of No. 540 Squadron(1) flew 1,880 miles in 6 hours 40 minutes to cover the Baltic ports. Königsberg ranked with Tromsø as one of the most inaccessible objectives for P.R. aircraft and had only been covered once before, in March 1942, and by the same pilot. Extensive and valuable cover of Kiel Bay was also obtained on this flight, for although Kiel had been regularly photographed only the immediate neighbourhood of the naval base had been covered before. On the 14th April Königsberg was photographed for the third time, on this occasion by a Mosquito of No. 544 Squadron.(2)

This summary gives only a very few examples of the routine tasks carried out with regularity during the period, in spite of all the special demands made for photographic reconnaissance. The moment the Allied forces set foot on the soil of France one part of the P.R. Organisation's work came to fruition and months of patient research by photographic interpreters enabled our air forces to plaster the German communications and defences. Nevertheless, when the Allies were established on the Continent new and increasing demands for both tactical and strategical reconnaissance allowed of no respite either to the P.R. Squadrons or to the photographic interpreters, and the busiest months were yet to come.

Overseas

Up to the end of 1943 very little long range photographic reconnaissance had been carried out in India as there had not

- (1) Pilot - S/Ldr J. R. H. Merifield D.S.O., D.F.C.
 (2) Pilot - S/Ldr R. L. Blyth D.F.C.

been time to explore the potentialities of Mosquitoes under tropical conditions. During the first six months of 1944 there was a great advance in the regularity and extent of cover obtained in South East Asia, and even places as far away as Rangoon, Bassein and Lashio came to be regarded as routine sorties even for American P.R. Lightnings and Spitfires.

In March, the operational efforts of the U.S. P.R. Unit - the IXth Photographic Reconnaissance Squadron - were co-ordinated with those of the two R.A.F. P.R. Squadrons in 171 Wing, when a Photographic Reconnaissance Force was formed for South East Asia Command. The American and British photographic interpreters worked side by side, and the operations of the P.R. aircraft were correlated to make the best and most economical use of the forces available. It was inevitable that in a country like India with the vast distances which required to be covered for photographic intelligence, the R.A.F. Mosquitoes undertook the bulk of the work.

In January survey photography of Burma began, to meet the long felt want for up-to-date maps of the area, and by May a large proportion of the work had been completed. The waterways and railways of Arakan and Central Burma were photographed frequently, and on the 27th March the longest P.R. flight yet made in South East Asia was accomplished when a Mosquito of No.684 Squadron photographed a large stretch of the Bangkok-Singapore railway in a flight of 1,860 miles. In April the same pilot broke his own record in a flight of 2,172 miles over the Malay Peninsula. Flights such as these brought all Burma, half Indo-China and all but the extreme south of Thailand within range of India-based P.R. Mosquitoes. Inevitably, No.684 Squadron Mosquitoes carried out the most outstanding sorties, but No.681 Squadron's Spitfires undertook a good deal of important short range work. In March two outstanding sorties were made by the latter squadron, one covering every airfield en route to Rangoon and in the Rangoon area, the other covering all roads between Imphal and Tamu for the 14th Army.

In May the outstanding sortie was one made to the islands in the Great Nicobar Group⁽¹⁾. A trial flight was made to see whether a sufficient fuel load could be carried to make such photography possible and on arrival over the islands the Mosquito had sufficient petrol left to carry out several photographic runs before returning.

During May and June the P.R. Force assisted in a secret operation designed to help in evacuating casualties from North Burma. Heavy rains during the monsoon made it impossible for aircraft to alight at landing strips beyond the Jap lines to bring out casualties from the airborne units operating there. A seaplane was therefore used for this evacuation scheme, operating from an advanced point on the Brahmaputra. Maps, photographs and details of the district were obtained by the P.R. Force and supplied to the rescuers to assist them in selecting the most convenient areas.

Although June proved to be a great handicap to air operations on account of bad weather and heavy clouds, the total sorties for the first six months of 1944 for Nos.681 and 684 Squadrons numbered 1,102 as compared with 1,053 for the whole of 1943. The U.S. P.R. Squadron also contributed 435 sorties to the total P.R. sorties in A.C.S.E.A.

(1) Pilot - Flight Lieutenant K. J. Newman.

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In Italy, too, long range P.R. sorties increased in number and extent, during the first six months of 1944. Up to the end of 1943 the need for giving full support to the land operations called mainly for tactical reconnaissance, but with the move of the Mediterranean Allied P.R. Wing⁽¹⁾ to Italy in December, strategical operations began to come to the fore and there was an ever-growing demand for photographic reconnaissance of German-owned aircraft factories and industries in South West Europe, bound up with the two-way bombing programme from bases in Italy and the United Kingdom.

In January many of the requirements were still tactical for photographic reconnaissance work in connection with the Anzio landings, and for the drive against Rome to sever the enemy's communications with the battle area. In this month a P.R. Detachment was sent to Sardinia to cover airfields and watch ports along the French coast. On the 10th January a photographic reconnaissance of Ploesti, flown by No. 60 S.A.A.F. Squadron and the first since the damage assessment sortie of the previous summer, brought back photographs that revealed a complete decoy town. All the essential features of Ploesti had been represented, including dummies of all the main oil refineries.

In February the Mediterranean strategic bomber attacks were fully co-ordinated with a similar offensive from Great Britain, and the Mediterranean Allied P.R. Wing became responsible for target material and damage assessment for its bomber force in an area from Munich to Ploesti covering Austria, Czechoslovakia, Hungary, Bulgaria and Roumania. A P.R. Mosquito shuttle service was put into effect between Italy and the United Kingdom, the aircraft flying straight through from San Severo or Benson taking photographs on both the outward and homeward journeys. This enabled cover of airfields and industrial targets in Poland and Czechoslovakia to be obtained from places which had hitherto been difficult of access, and the German aircraft industry in Austria, Germany, Hungary and Roumania was thus carefully watched. By this method, photographs of an aerodrome and two aircraft factories at Posen were obtained on the 22nd February, the first P.R. sortie over Poland undertaken from an Italian base.

March and April produced many routine sorties but no outstanding flights, whilst in May considerable survey work was undertaken over Southern France in preparation for its subsequent invasion, and for the same reason careful investigations were made into German radar installations in Southern Europe.

By this time the bulk of the photographic work in the Mediterranean was being undertaken in Italy, and in the Middle East there were only comparatively unimportant tasks. In April, therefore, the Middle East Interpretation Unit was amalgamated with the Mediterranean Allied P.R. Wing so that all interpretation in the Command should be centrally controlled and interpreters could be moved to whatever theatre of operations might require them.

(1) Although referred to as M.A.P.R. Wing throughout this section, the original title of "P.R. Command" was in use until April 1944.

Rome was occupied on the 4th June, and immediately a photographic reconnaissance of all the Italian ports was undertaken. The rapid advance of the Allied forces caused the Germans to redouble their efforts to render useless all the facilities of ports which might fall into Allied hands. Leghorn had already been blocked, and photographs of all the other chief ports showed that similar preparations were in hand there.

One other special assignment given to the Photographic Reconnaissance Organisation in June was the photographing of the Danube and its river traffic in preparation for aerial mining, and to show its results.

5. JULY 1944 TO AUGUST 1945

Once the invasion of the Continent had been successfully launched the photographic reconnaissance required became more of a routine and less of a spectacular nature, and there were few highlights to record in the last twelve months of the campaign.

The role of the various P.R. Units had been clearly defined up to this point, No. 106 Group being responsible for strategic tasks whilst 2nd T.A.F.'s P.R. Units fulfilled the tactical requirements of the invading forces; but as the Battle of Europe moved to its close the day-to-day tactical needs became uppermost and the strategic planning of the previous years now reaped its well-earned reward.

The success of the Allies on the Continent also assisted in terminating the work of the P.R. Organisation in other directions. When the flying bomb sites in Southern France were cut off by the forward move of our armies in September 1944 the well-fought battle against this German menace came to an end. Likewise, the rocket offensive of 1945 ceased as the victorious armies drew nearer to the gates of Berlin. That long-guarded target - the battleship Tirpitz - was also brought to its inglorious end in November 1944, when the approach of the Russian armies to Northern Norway caused her to move to an anchorage within the range of Bomber Command's home-based Lancasters.

Perhaps the greatest achievement of this period was the culmination of the long investigation into Germany's oil and synthetic oil production and the subsequent systematic and successful bomber attacks upon the oil installations of enemy-occupied Europe.

A. German Major Naval Units

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Although it was thought that the Tirpitz had been sufficiently damaged in April to prevent her taking part in an offensive operation for some time, the unflinching constancy with which she was watched by the P.R. Organisation had to be maintained. At the end of April the Mosquito Detachment at Leuchars (at that date from No. 544 Squadron) had been withdrawn to Benson owing to the heavy commitments over North West Europe and it was decided that the Norway sorties could be undertaken from Benson by refuelling at one of the Scottish aerodromes. At the end of June, when the heavy commitments for "Overlord" had eased a little, a temporary Detachment of No. 544 Squadron went to Leuchars and on the 12th July an outstanding sortie was made to photograph the Tirpitz in Alten Fjord. A Mosquito XVI(1), refuelling at Sumburgh on the outward trip and Wick on the return, took photographs of the Tirpitz and other German units in the fjord from between 8 and 10,000 feet. During the trip the top escape hatch blew off, but in spite of this the successful photographs included one very large scale photograph of the Tirpitz taken from 8,500 feet, showing no change since she was photographed on the 25th May. The aircraft eventually made a night landing at Leuchars 9 hours 25 minutes after taking off from there, the actual time of the aircraft's flight after refuelling being 7 hours 40 minutes. The landing at Wick for refuelling on the return journey was effected with only 10 gallons of petrol left in the tanks after covering a distance of 2,175 miles. This was one of the longest durations in flight ever made by a P.R. aircraft.

(1) Pilot - Flight Lieutenant F. L. Dodd, who received the immediate award of the D.S.O. for this flight.

Up to this time the main object of the attacks on the Tirpitz had been to cripple her and heavy bomber attacks had not been possible owing to the extreme range. It was now decided that the time had arrived when an effort should be made to put her out of action permanently, and plans were made for a detachment of Lancasters from No.5 Group to operate from a base in North Russia. Photographic reconnaissance of the Tirpitz was required both immediately before and after the attack, and accordingly one P.R. Mosquito was seconded to the Bomber detachment during its sojourn in North Russia. Several excellent P.R. sorties for briefing purposes were made from the N. Russian base by this Mosquito. The raid on the Tirpitz was carried out by seven Lancasters from a high altitude on September 15th and a photographic reconnaissance flight to assess the damage was made at the earliest possible date - September 20th. Unfortunately, the heavy smoke screen which surrounded the Tirpitz made a definite interpretation impossible and further attacks were therefore planned to make sure of her destruction(1).

In October, a detachment of No.540 Squadron was moved to Dyce to keep watch on any attempt to move the Tirpitz south, which was anticipated in view of the damage she had sustained and the approach of the Russian armies to Northern Norway. On the 18th October this suspicion was proved to have been well founded, when the Tirpitz was photographed by a Mosquito pilot(2) from Dyce who carried out a flight of 2,300 miles in spite of the failure of one long range tank and located her in a boom-protected berth some four miles west of Tromso. In such a position it was possible to attack her from this country with long-range bombers, and on the 28th/29th October 33 Bomber Command Lancasters made an attack upon the enemy ship in her new anchorage. Heavy cloud interfered with accuracy, and it was not believed that any further damage resulted. A further attack was scheduled for a few days later, however, and on this occasion a Lancaster of the R.A.F. Film Unit, equipped with 3 ciné-cameras was detailed to accompany the bombers on their trip and photograph the result of the raid. The last attack, which proved to be the death blow to the Tirpitz, was delivered on the 12th November 1944 when 29 Lancasters, each equipped with one 12,000 lb. bomb, made a completely successful attack. Several direct hits were scored, and photographs taken by the Film Unit showed the ship completely capsized with her keel above water. The damage was confirmed by a P.R. sortie(3) by No.540 Squadron made only one hour and forty minutes after the raid on the 12th November when the photographs taken showed the Tirpitz lying almost upside down with no super-structure visible.

Thus Germany's greatest battleship, which had been a threat to Allied shipping since 1941, came to her ignoble end three years later, and one of the P.R. Organisation's best known targets could be struck off the list of sorties at last.

To complete the record however, mention must be made of a final sortie on March 22nd 1945 - appropriately performed by the crew of the Mosquito(4) who had made such an outstanding flight to photograph the Tirpitz in the previous July. The Mosquito left Benson, refuelled at Sumburgh, flew to Tromso

(1) It has since become known that the Tirpitz was extensively damaged in this raid and received one direct hit.

(2) F/O. H. S. Powell, D.F.C.

(3) Pilot - F/Lt. A. R. Cussons.

(4) Pilot - S/Ldr. F. L. Dodd, D.S.O. and P/O A. Hill, D.F.M.
- Pilot received D.F.C. for this flight.

and obtained from zero feet some magnificent oblique and vertical pictures of the sunken ship. The aircraft then returned to Sumburgh for refuelling and landed at Benson all on the same day, after a flight of ten and half hours and a distance of over 3,000 miles. This flight holds the record for the longest time airborne on a P.R. sortie.

As for the few still uncrippled German Naval Units, they spent the remainder of their careers in German home waters. The light cruiser Köln was put out of action during a raid on the port of Wilhelmshaven by U.S. bombers on the 30th March 1945, and subsequent damage assessment sorties showed that two heavy bombs had hit the vessel on the port side tearing large holes in her side. The Admiral Scheer also came to its end when a heavy attack was made upon Kiel by Bomber Command on the 9th/10th April. The Lutzow, which had been at Gdynia during most of 1944, was made to seek refuge elsewhere early in 1945 when the Russian armies were advancing towards the Baltic. In April she was located by a P.R. aircraft in the Kaiserfahrt Canal near Swinemunde, and here Bomber Command aircraft attacked her with 12,000 lbs bombs on the 16th April. Photographs subsequently revealed that a near miss on the edge of the canal bank caused such severe damage to the ship that she sank and lay in her berth down by the stern. The sortie which photographed her end also showed the Prinz Eugen passing Copenhagen, and it was in this port that she and the Nürnberg were located when the German Navy capitulated to the Allies on the 3rd May. A P.R. sortie was ordered after the surrender to confirm the position of the various naval units, and the aircraft concerned sighted nearly 150 vessels of all sizes going north from Kiel, the Admiral Hipper being on fire. All Allied attacks were called off on May 4th, and one more task of photographic reconnaissance was at an end.

B. Prefabricated U-Boats

Not the least important contribution of photographic intelligence to the Admiralty was the investigation undertaken by the Central Interpretation Unit into the German programme of prefabricated U-boats. It has already been recorded that the photographs taken in April 1944 revealed for the first time that U-boat hulls were being assembled from prefabricated parts.

A careful watch was kept on all likely bases where U-boats might be assembled and by the end of July 1944, photographs of both the small and larger types had been secured in sufficient numbers to make possible the issue of fairly comprehensive reports on their dimensions and construction. Photographs of Hamburg taken by the U.S. 7th Photo Group in June showed both types in the floating dock there and gave a good idea of their appearance.

The construction of their hull differed considerably from the usual type, being designed on much finer lines, and the whole thing was assembled from sections apparently made elsewhere and transported to the assembly yards. The 240' type was assembled on slipways at Bremen, Hamburg and Danzig, while the small 110' type appeared to be assembled mainly at Hamburg. Up to the end of June 1944, 21 of the larger type U-boats and 11 small ones had been photographed under assembly, and it was estimated that the average time for assembly and fitting of each U-boat was 2½ to 3 months. It would appear therefore that had the invasion not been as successful as it was, by the end of 1944 these prefabricated U-boats might have become a grave menace to our shipping and would have rapidly replaced operational losses of normal

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U-boats. The compilation of photographic evidence, however, resulted in heavy bomber attacks upon the shipyards concerned, which frustrated the German efforts to carry on U-boat warfare in strength before their ports were captured or cut off by the Allied armies.

C. Opposition of Enemy Jet-Propelled Aircraft

The enemy aircraft production programme had always been carefully watched through the medium of photographic reconnaissance coupled with other sources of information, but when it became known that Germany was developing various forms of jet-propelled aircraft the watch was still further intensified. To locate their bases and to ascertain the progress made in this direction, over one hundred airfields and industrial plants were photographed where it was known or suspected that jet propelled aircraft might be in production at the end of 1943, and beginning of 1944. In February 1944 the intensified search had its reward when photographs of Lechfeld near Augsburg revealed the first German jet propelled fighter, the ME.262. It was known that another jet propelled fighter, the ME.163, was also being developed, and it was feared that when this aircraft became operational it would prove a serious menace to our P.R. aircraft which up to now, with only a few exceptions, had been able to outstrip any enemy fighter performance.

On July 25th a Mosquito of No. 544 Squadron⁽¹⁾ was operating over Munich when it was intercepted and attacked by an ME.262 - the first knowledge that this type was operational. The engagement lasted twenty minutes and eventually the Mosquito evaded its opponent in the clouds over the Austrian Tyrol and made an emergency landing at Fermo on the shores of the Adriatic.

Within the next three weeks there were thirteen P.R. sorties over the Munich area during which three aircraft were intercepted by a ME.262 and managed to return to base, but a fourth aircraft was missing, believed to be through a similar interception. This emphasised what had already been realised, that there was a need for the very latest types of P.R. aircraft for use over the Continent, and in areas where there was likely to be much opposition from jet propelled aircraft, the new Spitfire XIX's manoeuvrability at height would make it a better choice than the P.R. Mosquito, which was more visible at height to approaching aircraft. Every effort was made to equip all Spitfire P.R. units with the new Mark as soon as possible, but meanwhile another two U.S. aircraft and four P.R. aircraft were intercepted by enemy jet fighters, one of our P.R. aircraft being badly damaged and only just managing to crash land in Italy. The casualties for September were double those for June; of the total P.R. Mosquito sorties over Germany in the former month only 0.6% were casualties, whereas three months later this figure had risen to 2.95%. Such an increase in losses could only be caused by the ME.262, since 50% of the casualties were in the area where the enemy jet fighters operated. It was obvious that the ME.262 was using the Mosquito as a test for performance and tactics.

To counteract these losses it was suggested that sorties south of latitude 49°N should be carried out by the aircraft of the Mediterranean Allied P.R. Wing from Italy, and the results flown to the United Kingdom, all routine tasks being flown from Italy and only high priorities and damage assessment in the area being flown from the United Kingdom by

(1) Pilot - Flight Lieutenant A. E. Wall.

Spitfires carrying a drop tank. The advantage of photographing south-west Germany from Italy was that, as the range was shorter, Spitfires without drop tanks could be used and the choice of approach to the targets was greater from the south.

By the end of September Mediterranean Allied Air Forces had reported that this commitment was causing them casualties and abortive sorties due to interception by jet aircraft, and Spitfire XIX's were requested as a matter of urgency. Their demand was met in October and this, added to the provision of refuelling bases on the Continent for Spitfires whose targets were out of easy reach of England, helped to obviate further losses. The time soon came when the Allies entered Germany, and from thenceforward strategic photographic reconnaissance was no longer of such importance. Moreover, the heavy bomber attacks upon aircraft factories where jet propelled aircraft were produced had aided in keeping their numbers at a reasonably small total, and finally succeeded in driving their product underground. There is no doubt that had the European war not terminated early in 1945 our P.R. Units would have been provided with jet propelled aircraft equal or superior in performance to anything the Germans had produced.

One encounter with both enemy jet propelled and normal fighters during April 1945 is worthy of record, if only for the efforts of the pilot in bringing back his damaged aircraft to a friendly base. A Mosquito of No. 544 Squadron⁽¹⁾ set out on April 16th for targets in Germany. Whilst over Leipzig, flying at 30,000 feet, the pilot saw two jet propelled fighters (ME.163s) practically at ground level but climbing rapidly towards him. Within three minutes both enemy aircraft were at the Mosquito's height and split formation to attack simultaneously on either beam. The pilot did a half roll and dived vertically, pulling out at 12,000 feet, when he saw he was being attacked by three ME.163s from above, who all opened fire. A steep diving turn was then made and the enemy aircraft were not seen again, but the Mosquito's starboard engine had been hit by cannon shell and was without power. The pilot feathered the damaged engine and made course for the Allied lines. After half an hour the navigator saw an ME.109 approaching. The Mosquito dived and flew up and down to lose contact with the enemy fighter, which it was successful in doing. Approximately forty-five minutes later when flying at low level on account of loss of power, intense and accurate flak was directed at the aircraft from a small unidentified town. The aircraft was hit and the navigator wounded. Despite this the pilot flew on, making "Mayday" calls on his V.H.F. set for assistance, but without result. An hour later he sighted Lille and approached to land, unaware that one tyre had been punctured by enemy aircraft. As he touched down the undercarriage collapsed and the aircraft was severely damaged but the pilot was unhurt. Further investigation showed that the ME.163s' cannon shell had penetrated the starboard engine nacelle and fractured the glycol tank, whilst the flak had hit the starboard propeller spraying the fuselage and engine with fragments.

D. The Invasion of Southern France

The invasion of Southern France, known as Operation "Anvil" and later as "Dragoon", had as its purpose a link-up of the Southern European forces with the invading armies in North-west Europe for a combined drive upon Germany. So

(1) Pilot - P/O Hays.

successful was this operation, mainly owing to the lessons learned from the previous large scale assaults, that the careful planning made to bring about the result is often overlooked. Photographic reconnaissance for planning purposes commenced exactly twelve months before the assault, when our invading armies had not even arrived in Italy, and it involved many months of flying over beaches, pinpoints, coastal areas, roads, rivers, valleys and mountains. No other amphibious operation in the Mediterranean was supported by so many photographic sorties or such skilfully used photographic intelligence.

The main photographic programme started in earnest in January 1944 when a detachment of No. 682 P.R. Squadron was sent to Sardinia, to be based at Alghero. From here, supported by elements both of the 23rd U.S. Photographic Squadron and of a Fighting French Photographic Squadron, frequent sorties were made over Southern France to photograph ports, coastlines and shipping activities. Mapping surveys were undertaken up to more than one hundred miles inland to meet the area flown southward from England. As with the Normandy invasion, frequent sorties were made over the beaches so that invading armies might be provided with accurate details of the terrain over which they had to operate, the photographs being taken by Spitfires fitted with 36" cameras.

For the actual invasion a U.S. P.R. Detachment was moved to Corsica in direct support of the Mediterranean Allied Tactical Air Forces. In addition, the forces already in Sardinia were also moved to Corsica, but so rapidly did the invaders move to meet their brothers from the north that only routine tasks were required of the photographic reconnaissance forces engaged.

E. The Battle of the Flying Bomb - Final Phase

Whilst the invasion needs and the battle against Germany's war industries had priority as targets for our bombers, all effort that could be spared was used against the "Crossbow" targets. With target material obtained by photographic reconnaissance, the Allied bombing attacks against the firing sites were so successful that never more than approximately one-third of the total was capable of launching flying bombs at any one time. As part of the plan of attack it was decided to launch heavy raids upon the supply sites, and also upon the areas where flying bombs or their fuel might be manufactured, when industrial targets in Germany were thought to be connected with this production. It was soon ascertained from ground information, and confirmed by photographic reconnaissance, that a number of storage depots were being prepared in the vicinity of the flying bomb sites and that these were of more importance as targets than the supply sites. In an effort to escape notice and to nullify the effects of our bombing, most of these were situated under-ground, in caves, quarry sides and similar positions, and vertical photography was of little use to obtain the details necessary for successful bombing. Remarkable results were obtained by low flying pilots using Mosquitoes with a single forward facing oblique camera fitted in the nose, the aircraft diving straight on to the target at the moment of photography. This method subjected the aircraft to great danger from flak, as it flew straight on to its target at a height of about 200 feet, and No. 106 Group did its best to discourage such sorties unless absolutely essential. Three Mustangs with short focal length cameras were also lent by A.E.A.F. to No. 541 Squadron for this special task, and their pilots were able to take photographs below cloud level at 3,000 to 5,000 feet. They could obtain obliques without flying straight on to the target, although the results were not quite as good as those of the forward facing camera. On the 15th August, two of these Mustangs⁽¹⁾ took amazing low level obliques of the entrance to mushroom caves at Leu d'Esserent which had been enlarged, fitted with steel and concrete doors and used as a flying bomb storage depot. These sorties supplied the technical data necessary for successful bombing of the storage site, which blocked the entrance by causing heavy subsidence of the overhanging soil.

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By August, the Luftwaffe had been practically eliminated from the French coastal area, which meant that the "Crossbow" sorties did not meet with so much interference. This was a great advantage, as it had been found necessary to take damage assessment photographs of launching sites at a height not exceeding 15,000 feet in order to obtain the necessary scale to provide sufficient detail. Whilst it was still agreed that connection with both Bomber Command and the U.S. VIIIth Air Force attacks, that "Crossbow" should not interfere with the bombing policy of the German economic targets, and this decision likewise affected photographic reconnaissance, all available aircraft were used during August to prevent the launching sites being used. In September, the sites in the Pas de Calais were cut off by the forward move of the Allies, and the main attack was at an end, but not before there had been a scare that sites in Belgium and Holland were being used for launching flying bombs from the west. On the 9th July, bombs were tracked arriving in a direction which brought them along the Thames Estuary, but although a photographic reconnaissance was made of the Dunkirk and Ostend areas as soon as weather permitted on 28th July, no new constructions were found, the explanation

(1) Pilots - Capt. Williams, S.A.A.F. and Lt. Godden, S.A.A.F.

being that these were the flying bombs launched from piloted aircraft.

With the termination of the main attack one of photographic reconnaissance's chief commitments was practically at an end, although in October, when attacks were made against Allied-held positions in Belgium and France, further calls were made on photographic reconnaissance, chiefly on No. 34 P.R. Wing then operating from the Continent. No high priority was given to this task, however, and it was not long before it faded in the background behind the serious threat of rocket attacks.

To all the squadrons of No. 106 Group and 325 (late 7th) U.S. Photographic Group, together with P.R. and Tac.R. Squadrons of 2nd T.A.F. must go the credit for the flying of the 3,000 sorties undertaken in the battle of the flying bomb. To the Central Interpretation Unit must go the credit for the interpretation of over 1,200,000 photographs and quantities of reports on the flying bomb war in all its aspects, which were issued between April 1943 and the end of 1944. Even the Mediterranean Allied Air Forces contributed a share to the battle when Ober Raderach, where hydrogen peroxide was manufactured as a fuel for flying bombs, was attacked by Italian-based Liberators. The Mediterranean Allied Photographic Reconnaissance Wing supplied both the target material and the bomb damage assessment for this attack, by which the plant was put out of action.

F. A Failure for Photographic Reconnaissance - The Long-Range Rocket

Whilst photographic reconnaissance played a large and important part in the battle with Germany's first secret weapon, the flying bomb, in combatting their second weapon - the long-range rocket - photographic reconnaissance and interpretation played a most inconspicuous part. Although a large amount of work was done upon rocket investigation, the sum total of useful information secured by photographic interpretation was extremely little.

In the early days of the investigation, in 1943, there was no distinction between the rocket and the pilotless aircraft as the possible secret weapon, but little was achieved by photography to corroborate or amend the many and conflicting agents' reports on the existence of the long-range rocket. In a sortie over Peenemünde made on the 22nd April, "cylindrical objects" approximately 38 feet tall and 8 feet in diameter were seen on railway flats on the airfield but no particular attention was given to this, and again on the 20th May "a cylindrical object on a railway truck" was noted. On the first of the two Peenemünde sorties in June, a similar cylindrical object was again noted, and on the 23rd June two torpedo-like objects were described fully in a report by the Central Interpretation Unit. They were identical except in colour, one being greyish, the other pale; they were both 38 feet long, each with a tail of three fins springing from the body. By this time scientists were satisfied that a long-range rocket did exist, and it seemed possible that the objects photographed were examples. Between the end of June and the end of August four further sorties over Peenemünde were made. On each occasion similar products were seen in or near the elliptical earth works, but no headway could be made as to the method of launching.

In the meantime, the intensive photographic reconnaissance search in Northern France for construction work of a suspicious character had led to the finding of a large concrete emplacement of an abnormal kind at the end of a specially laid railway

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siding at Wissant at Cap Gris Nez. The work was not sufficiently advanced for detailed interpretation, but it was obviously an installation of some importance, since it was already guarded by A.A. defences. At the beginning of July, excavations of a suspicious character were also found on photographs of Watton near Ypres and Bruneval near Fécamp, and their progress was carefully watched by the P.R. organisation. Later in the month, similar excavations were found at Noires Bernes, Wambringue and Marquise. The activity at Watton was most marked, and all through July and August the building made rapid progress, although its purpose remained obscure. A model of the site was made from photographs at the Central Interpretation Unit and examined by constructional engineers and scientists, whose verdict was that it had not been erected for any normal purpose and was possibly "connected with the filling of rockets". As it was likely that the building would soon be covered with a concrete roof which would make it difficult to inflict serious damage by bombing and hide from the reconnaissance camera the activity on the site, it was suggested that it should be attacked by heavy bombers. Whilst it was not certain that Watton was connected with rockets, the Chiefs of Staff agreed to the attack which was made by U.S. bombers on August 27th/28th. A damage assessment sortie on the 30th August revealed that great damage had been done, causing six weeks to three months delay in completing the construction. Nevertheless, by the end of 1943 the Germans had made rapid progress in reconstruction.

The seven large sites were covered by many P.R. sorties during the winter of 1943/44 and bombed whenever construction was shown to be making good progress. They were also invariably connected with rockets in the minds of the authorities, and so once the existence of the flying bomb had become known they were not considered to constitute such an immediate threat as the flying bomb launching sites. Nevertheless their photography constituted a considerable part of the "Crossbow" work undertaken by the P.R. Organisation.

Soon after the invasion and the start of the flying bomb campaign, attention was again turned to these sites in case they should have any connection with the flying bomb.⁽¹⁾ Photographs of Watton taken with a forward facing oblique camera in a Mosquito on the 14th/15th June showed that large amounts of supplies had arrived and the contractors' plant had gone. Several heavy attacks were made upon it and by July 6th large scale bomb-damage photographs showed that the whole site was in a state of chaos. Work on the Marquise (Mimoyecques) site was also continued at high pressure despite bombing until July 1944, when it was abandoned to the Allies. In addition to the large sites which fell into Allied hands early in the campaign, a so-called "rocket launching site" had been captured at Chateau du Molay in the Calvados area, but even with these sites in their hands the Allies were unable to find any evidence of how the rocket was fired.

During July, photographs were taken of the captured rocket site and a nearby rocket dump, but after careful examination the Central Interpretation Unit was forced to record that even when the exact position of the site was known it was almost impossible to pick out the location on a photograph. In August, ground intelligence was obtained which stated that the rocket was fired vertically. Re-examination of

(1) After capture of these sites, experts were able to establish that they were not connected with the rockets, but were intended as 'monster' cannon emplacements from which England could be heavily shelled.

photographs of Peenemünde was then made and on numerous sorties flown from June 1943 onwards, objects which had previously been dismissed as "thick vertical columns" were carefully measured and re-examined and identified as rockets in the vertical firing position. In the absence of any fixed launching apparatus it was considered that they were launched from a mobile firing point, and in view of the activity frequently noticed on the fan-shaped foreshore at Peenemünde it was suggested that this was the experimental launching site.

Redoubled efforts were then made to identify operational launching sites in France, but all proved unavailing although interpreters searched through thousands of photographs. The search by photographic reconnaissance was given up, a decision partly dictated by the shortage of photographic interpreters and the high priority given to other subjects.

The first rocket was fired in an attack on the Allied lines on the 8th September 1944, and the search re-started in Holland without result. It was later ascertained that the rocket needed no static launching site, but that any open space or road sufficed. Only when a pilot actually saw a rocket being fired and then photographed its point of origin was it possible to locate the firing site, although small clearings in the woods at Rijs, already indicated by radar as being operational sites, were confirmed by photographs taken on the 5th October and the 5th November, whilst on the 29th December 13 rockets were photographed under the leafless trees in the Haagsche Bosch near the Hague.

In January 1945, when the rocket constituted a serious threat to this country, an intensive search for V-2 sites in Holland was undertaken both by the units of 106 Group and 2nd T.A.F.'s P.R. Squadrons. Finally, on the 26th February, after seven months of searching and the investigation of over a quarter of a million photographs, a rocket was photographed by No. 544 Squadron in the vertical launching position with its attendant vehicles on a road through a wood at Duindigt near the Hague. As though in mockery, fate ordained that three aircraft of No. 544 Squadron operating independently should photograph this site within five minutes of one another. When the Allies had nearly gained complete victory in the West a month later, the rocket offensive ceased, having enjoyed almost complete immunity from the eyes of the interpreters.

G. German Oil Installations

Photographic reconnaissance proved to be a most successful method of watching the enemy's efforts to obtain the maximum oil production from Germany and the occupied countries. Their oil production came not only from existing oilfields, but from the hydrogenation of coal in large synthetic oil plants.

Both existing oilfields and synthetic oil installations were carefully watched from 1941 onwards and all such items as drilling programmes, extensions to oilfields and plants, and newly constructed oil pipe lines were noted in detail so that an estimate of the oil output could be made in an effort to determine Germany's total oil resources.

The productive capacity and layout of some of the synthetic plants had been known to us before the war, and detailed plans of these plants were made at the Central Interpretation Unit with the aid of enlarged photos, so that here again the potential output of each plant could be

estimated and the various buildings identified. For example, in May 1942, on the evidence of a newspaper advertisement in a German periodical for an oil technician, the first aerial cover of Brux in the Sudetenland had been obtained which revealed the presence of a large synthetic oil plant under construction. From that time onwards, photographic sorties made it possible to watch the progress of its construction and trace the increase in output, which early in 1944 was placed at 700,000 tons per annum.

Interpretation of the photographs revealed one highly vulnerable section of the works. The whole of the gas generators were concentrated in an area of 200 feet square and there was no alternative source of supply. The first heavy blow at Germany's oil production was made on the 12th May 1944 when this vulnerable area at Brux was selected as the pinpoint for a bomber attack. Subsequent damage assessment photographs showed that the gas generators were severely damaged and the whole plant put out of action for more than two months. From then onwards there were repeated attempts to repair the plant, but photographic reconnaissance aircraft maintained a close watch and further attacks were made to put the plant out of action once more.

Other important features in the German oil supply picture were the storage dumps, which in some cases consisted of large capacity tanks entirely buried underground, and in others of well protected and camouflaged tanks hidden in forests and woods. Most of these were discovered on aerial photographs and their total storage capacities estimated so that an assessment might be made of Germany's possible oil reserves.

Although comparatively light attacks had been made on oil installations from time to time during the first half of 1944, once the pre-invasion tasks were completed the greater part of the weight of Bomber Command's and Eighth Bomber Command's heavy bombers was switched to German industrial targets, of which oil was perhaps the most important, and large and increasing attacks on the German oil resources were made from July 1944 onwards. Attacks on oil-fields were not considered practicable as individual wells were scattered and small, and therefore the refineries which distilled the crude oil and the synthetic plants were made targets of first priority. All the information regarding these targets accumulated over the years by the Central Interpretation Unit was of assistance in planning the series of large scale attacks which now began. Immediate interpretation reports were made as soon as photographic cover of any plant was received, and by comparison with previous cover of the same plant an estimate of the probable scale of production could be made and the scale of attack assessed accordingly. As soon as possible after each attack, damage assessment photographs were obtained from which it was possible to estimate the effect of the damage done and the possible length of time needed to put the plant in partial or full operation again. Chiefly on the basis of these reports, Bomber Command decided whether, and when, the next attack should take place. By co-ordination of the photographic intelligence with bombing activity the production of the German-owned refineries was reduced from approximately 697,000 tons per month before July 1944 to about 33,000 tons per month in April 1945, equivalent to only 4 $\frac{1}{2}$ % of their potential output. Similarly, the production output of their synthetic plants was reduced to 3% of their potential output by April 1945.

As these effects were felt by Germany the production of

benzole from coke ovens became very important. At the end of 1944 these, too, became targets for our bombers and the original output from the plants was seriously reduced by the co-ordinated use of photographic evidence.

It is not within the scope of this narrative to decide how deeply the German defensive was hampered in the early days of 1945 by a shortage of oil, but if other documents should prove that this was an important factor in the ultimate surrender of Germany, photographic reconnaissance must be regarded as one of the determining factors in bringing about such a result.

H. Photographic Reconnaissance on the Continent

For the first two months after D-Day 2nd T.A.F.'s P.R. Organisation operated over the Continent from airfields in the United Kingdom. Although Nos. 35 and 39 (Recce) Wings were responsible for tactical photography in support of the invading armies, their tasks were almost strategic during the bridgehead period when their main targets were the railways in the vicinity, in order to trace the moves of German reinforcements.

No. 34 P.R. Wing, on the other hand, after photographing the airborne landings and the glider operations on D-Day carried out more work for the Navy during the early bridgehead period, including daily cover of the beaches from Ouistreham to St. Vaast, and watching the progress of the construction of the Mulberry Harbours. During July the Wing was given three main routine tasks. The first was the cover of the principal railway lines in Northern France, for Supreme Headquarters Allied Expeditionary Forces, to detect movements of German reinforcements. The priority of this work was high, and when the weather conditions were bad it had to be carried out at low level - a dangerous procedure on account of the heavy flak experienced. Owing to the strong attacks on enemy railways by R.A.F. and U.S. bombers for months before D-Day the Germans had installed anti-aircraft defences on trains as well as around all the principal stations and marshalling yards. The second of No. 34 Wing's tasks was to keep watch on repairs at marshalling yards behind the enemy lines. As the tactical forces tended more and more to confine their activities to the forward areas, the aircraft of No. 106 Group were called upon to take over more of these railway targets for S.H.A.E.F., and the number of sorties over railways and marshalling yards grew daily to enable enemy traffic to be studied in detail and to note the results of our aerial attacks upon their communications.

A further responsibility of No. 34 Wing was the provision of up-to-date Orders of Battle of the German Air Force and details of construction of any new airfields. In addition the Wing undertook bomb damage assessment sorties for the light bombers of No. 2 Group, all other bomb damage assessment being flown by No. 106 Group and the U.S. 7th Photographic Group. The night reconnaissance squadron of the Wing (No. 69 Squadron) watched the moves of German reinforcements beyond their forward line, which usually took place under cover of darkness, particularly in mid-August when the Germans were forced back across the Seine. On the 26th August this squadron took some good night photographs of German transport waiting to be ferried across the Seine. The air forces were called up to attack and a further P.R. sortie showed the vehicles burning fiercely.

At the end of July, Nos. 35 and 39 Recce Wings both took up their destined positions with the armies in the field, and early in August were operating from French bases

over the area of the Falaise advance. Photographs taken on the 15th August showed many signs of the enemy's efforts to escape from the pocket. By the end of August the Recce Wings had been joined on the Continent by the Units of No.34 P.R. Wing, and one of their first tasks from their new Continental base was the photography of the Arnhem area for the Allied airborne landings there. The operation took place on the 17th September and as soon as it had been accomplished it was essential for photographs to be taken of the airfields held by our own troops to ascertain the conditions of the fields and the construction of the landing strips, to allow reinforcements to land by glider. No.34 Wing aircraft were unsuccessful in their attempt to obtain this cover and the photographs were secured by home based Spitfires of No.541 Squadron, but shortly afterwards two American P.R. pilots lost their lives in an endeavour to obtain essential low level obliques of the Arnhem bridges.

Apart from Arnhem - Operation "Market" - September provided little for T.A.F.'s P.R. squadrons, for after clearance of the Seine the Allied armies moved rapidly across Belgium. Some outstanding low level photographs of Venlo Bridge were obtained by Spitfires of No.16 Squadron during the month, after an attack by aircraft of No.2 Group. The advent of the German jet propelled ME.262 at this period made the Mosquitoes of No.34 Wing too slow and vulnerable for daylight work over Germany, and from then onwards most of T.A.F. P.R. sorties were undertaken by the Spitfires of No.16 Squadron, the day Mosquitoes of No.140 Squadron being converted to night photography before the end of 1944.

Many sorties were flown during October and November to check movements on roads and railways behind the enemy lines, and the Recce Wings were occupied with such tasks as searching the Dutch island waterways for escaping shipping, and watching the railways and roads of Holland as Antwerp was captured. From then onwards until February work was very much of a routine nature and hampered by severe weather conditions. Whilst these conditions mitigated against day sorties they were sufficiently good for some excellent photography at night, particularly in December and January during the Ardennes offensive when the quality of the prints taken was enhanced by the snow-covered ground. On December 25th a sortie over Heligoland by No.16 Squadron was used to prepare maps which Bomber Command employed during their big raid in the following April. During December three P.R. Spitfires of No.541 Squadron were detached from the United Kingdom to Melsbroeck Airfield, Brussels, to join No.34 Wing there and cover targets for the Allied airborne armies which could not be undertaken by the T.A.F. Squadrons.

On January 1st 1945 the P.R. Organisation on the Continent received a severe blow and the German Air Force achieved a short lived triumph, when Melsbroeck Airfield was attacked by 40 German aircraft. 6 Spitfires, 6 Mosquitoes and 11 Wellingtons of No.34 Wing were destroyed and there were 6 fatal casualties among the men.

During January and February P.R. efforts from the Continent were only of a routine nature, but night photographs continued to prove of exceptional value when weather handicapped daylight photographic reconnaissance, and during the last week of March No.140 Squadron flew no less than 53 night sorties. On March 23rd/24th the British and Canadian armies crossed the Rhine, and T.A.F.'s Recce Wings were busy covering the army fronts and watching for enemy attempts to pull out of Holland. From this time forward, however, the army was unable to forecast its requirements for strategic photographic reconnaissance, and few more sorties were flown, whilst by the

end of April normal photographic reconnaissance from the Continent had ceased. It was perhaps unfortunate that a P.R. Wing had moved from England to the Continent during March at the request of S.H.A.E.F., to be nearer their targets and thus enable them to take better advantage of the short periods of good weather. By the time that they had become fully operational there was little left for them to do, and even T.A.F.'s P.R. Squadrons were employed on "odd jobs" such as shipping reconnaissance, anti-submarine patrols off the Dutch coast and ferrying maps and photographs from Brussels to 2nd Army Headquarters in Hanover.

On May 3rd, the day on which the German Navy surrendered, the aircraft of No.34 Wing photographed a convoy of 200 enemy ships off Denmark trying to evacuate troops to Norway. Coastal Command and 2nd T.A.F. were called up to attack them and prevent a German "Dunkirk". On May 5th all operational tasks were cancelled, and on May 7th T.A.F.'s last P.R. operation was to carry out a reconnaissance up the Denmark coast and round the Dutch German Frisian islands to ensure the validity of the surrender.

SUMMARY JUL 44 - AUG 45

Home

The multiplicity of tasks undertaken by No.106 Group and the U.S. 7th Photo Group up to D-Day increased rather than decreased when "Overlord" had been launched, and exactly one month after D-Day, on July 6th, the Allied home-based P.R. organisation reached a record high level with a combined total of 114 sorties for the day.

Just after D-Day No.34 Wing called upon No.106 Group for tactical assistance, as the needs of the army were more than they could undertake alone, and from then onwards No.106 Group was called upon to assist the T.A.F. Squadrons in many semi-tactical roles, including a great deal of the work of covering the railways and marshalling yards of France for S.H.A.E.F. On the 2nd July No.540 Squadron had a most successful day in this direction when eight excellent sorties were made photographing enemy traffic, railways and stations in France. In view of the changed strategic situation, the diminishing importance of the French West Coast, and the heavy demands upon Benson, the St. Eval and Gibraltar detachments were withdrawn to Benson during July and August thus severing the long connection of these two locations with the P.R. units.

In August the initial cover of Germany's eastern defences 80 miles east of Berlin was begun, and considerable work on this had been done by the end of the month. Flying bomb and rocket sites engaged a good deal of flying time during August also, and several outstanding flights into the quarry sites at Wizernes and Watton were made, both by Mosquitoes with forward facing oblique cameras and by the low flying Mustang detachment of No.541 Squadron.

During the years 1941 to 1943 R.A.F. P.R. sorties from home bases averaged 200 to 300 per month, but during 1944 the average rose to 460, and in August 1944 the figure for the month was 799, the highest ever achieved. During the first week of August 1,302 different targets were covered at the request of various authorities, including railways, airfields, flying bomb sites, oilfields and shipping, at the request of Air Ministry, Bomber Command, Coastal Command, Admiralty, War Office, Allied Expeditionary Air Forces,

VIIIth U.S.A.A.F. and M.A.A.F. amongst others. This demonstrates the very varied field of intelligence served by photographic reconnaissance in the later stages of the war.

In September a watch was kept upon enemy preparations for blocking and demolishing the Dutch ports, and Port Construction Groups were supplied with details and photographs so that they should be able to repair them when captured. On September 17th No. 541 Squadron photographed the Arnhem airborne landings and subsequently covered the Allied-held airfields to assist in the dropping of reinforcements. Many photographs and mosaics of the area were made to contribute to the success of the largest airborne landings to date. By the end of September little of France was left for photography as most of the important parts were already in Allied hands. However, the success of our armies made it possible to provide facilities for refuelling two Spitfires each day at St. Dizier airfield, thus bringing within reach of Spitfires targets which hitherto had needed Mosquitoes to photograph them.

At the end of September Bomber Command made a heavy attack on the Dortmund-Ems Canal, and a successful photographic reconnaissance on the 2nd October showed both branches of the aqueduct breached and the bed of the canal dry. By this time also an air courier service had been instituted and put into operation to fly photographs and maps to and from the Continent. Originally the service was flown between Benson, France and Italy, later to Belgium, and ultimately between Benson and Germany.

In October a special task for photographic reconnaissance which kept No. 541 Squadron busy, was covering the breaches of the dykes in Holland, and many high level sorties were flown by Spitfires to obtain photographs of the amount of flooding that followed Bomber Command's attacks. To assess the exact damage, low level obliques were also flown at intervals to find out the effect of high tides on the damage already done. By this time the Allies held the whole of Belgium and eastwards behind Aachen, so the territory to be covered by photographic reconnaissance was fast diminishing. Northwards of the Scheldt and the few parts of France still in enemy hands were covered at intervals, but from thenceforward, although increased rail cover for S.H.A.E.F. was still being demanded, most of the P.R. effort was directed at Germany and those enemy-occupied countries still in her hands. Much photographic evidence was obtained at this time to show that the German war industries were being dispersed underground in the face of our constant bombing raids.

During October the Prime Minister paid a visit to Moscow, and the P.R. Mosquitoes of No. 106 Group were called upon to form a courier service to deliver diplomatic mail to the Prime Minister and his staff. Between the 9th and the 23rd October 29 flights were made in this connection covering 46,000 miles without loss, and one non-stop flight from Benson to Cairo was made in the record time of 6 hours 25 minutes.

In November weather conditions became very indifferent, and S.H.A.E.F. indicated to Air Ministry the need to base a P.R. Squadron on the Continent for strategic purposes, in order to reduce the flying distances and to take advantage of better weather conditions. Whilst the request was under consideration a P.R. detachment of Spitfires of No. 541 Squadron was sent to Brussels on the 15th December to undertake tasks for the first Allied Airborne Army. A study of the combined defences of the Rhine bridges was made with the aid of this detachment, which proved of great assistance in the crossing of the Rhine a little later.

In December the bad weather conditions continued and difficulty was experienced in obtaining many of the damage assessment photographs so badly needed by Bomber Command in planning its attacks, particularly as the bomber offensive had been increased to parry the Ardennes thrust. Of 35 aircraft that took off from Benson between the 25th and the 28th December, all but one was forced to land away from base after completion of its sortie, and on December 29th Benson had 35 aircraft scattered over 11 other airfields in the United Kingdom.

In January and February 1945, sorties from the United Kingdom were still hampered by weather conditions, but another courier service was put into operation for diplomatic mail during the Yalta Conference. Between the 31st January and the 20th February Mosquitoes of No.544 Squadron carried out flights between Benson, the Crimea and Athens to a total of 303 flying hours.

34 Railways and communications deep in Germany formed most of the targets in February and March, and once the Rhine crossings had been achieved attention was given to the Redoubt area and the numerous underground installations in Central Germany, which, had they been allowed to develop, would have meant safety to the enemy from Allied bombing. Happily there was no necessity for the completion of this task, and by the end of April little of operational importance was left for the P.R. Squadrons to deal with. One of their last tasks was to obtain air cover of prisoner of war camps to provide information to assist the authorities in planning the speedy return of our prisoners to the United Kingdom.

S.H.A.E.F.'s request for a strategic P.R. Squadron on the Continent had been met at the end of February when agreement was made to the formation of No.104 P.R. Wing to operate from Coulommiers. Ten Mosquitoes from No.540 Squadron and ten Spitfires from No.541 Squadron formed the aircraft complement of the Wing, but by the time they had settled in their new base it was the 31st March, and few operations were left them to undertake.

A number of outstanding flights took place during the last year of the war, two of which are particularly worthy of mention. On the 27th August one of the longest P.R. flights was achieved when a Mosquito XVI of No.540 Squadron⁽¹⁾ took off from Benson at 0600 hours and landed at San Severo, Italy, at 1210 hours having photographed on the way Gdynia, Rahmel, Danzig, Königsberg (the morning after a big bomber raid), Bromberg in Poland, Gleiwitz in South-East Germany, oil installations at Blechhammer, Bratislavia, and Zarza on the Dalmation coast. The aircraft left Italy the same afternoon at 1500 hours after refuelling, and landed at Benson at 1900 hours photographing Pola, Trieste, Millstadt in the Tyrol and Le Havre on the return trip.

The other flight is of interest because it was one of the few in which an unarmed P.R. Spitfire destroyed a German by clever flying tactics. On the 6th October 1944 a Spitfire of No.541 Squadron⁽²⁾ engaged in a sortie over the Rhine sighted two F.W.190s one of which closed in and commenced to do battle. The pilot immediately put the aircraft into a tight spiral dive going down to zero feet, and pulling out over some trees with the Focke Wulf in pursuit. The enemy aircraft failed to avoid the trees, crashed into the wood and blew up. One unarmed Spit had claimed one F.W.190

(1) Pilot - W/Cdr. Merifield D.S.O., D.F.C.

(2) F/Lieut. R. F. Garvey - who received an immediate award of the D.F.C. for this sortie.

destroyed! The next day the same pilot returned, at his own request, to finish the job and before starting to take photographs received a direct hit from A.A. fire as the result of which he lost elevator control. In spite of this he completed his photographic task controlling the aircraft by the throttle only, and returned to base "safe but late!"

Overseas

From July 1944 to the capitulation of the German armies in Italy, photographic reconnaissance in the Mediterranean was of a routine nature without any outstanding highlights. The strategic tasks were mainly for target material and damage assessment, whilst the tactical work was in support of the 8th and 7th armies during their attacks upon the German lines.

During September the American Photographic Units in the Mediterranean formed an independent unit and the Mediterranean Allied P.R. Wing was disbanded shortly afterwards, No.336 P.R. Wing continuing to fulfil all British demands for photographic reconnaissance from then onwards.

The 8th Army planned an attempt to break through the Gothic Line before the retiring Germans could man it in numbers, and many photographs and mosaics over the area were obtained by photographic sorties. All vulnerable bridges and points were carefully noted and the mosaics annotated accordingly. The battle for the Gothic Line began on the 25th August, and as soon as enemy strong-points were reported by prisoners or agents, sorties were flown to identify them on photographs. The resulting information provided targets for the Desert Air Force in their attacks upon the Line. Winter rains and floods halted the attack, and the attention of P.R. aircraft was switched to bridges and locks in Italy, Austria and Yugoslavia from January to March 1945. During the same months a close photographic watch was kept upon the enemy-held port of Venice. This two months' work culminated in the attack of March 22nd when great material damage was done to enemy shipping and installations in the port.

During March the bridges over the Po and the Adige were photographed frequently and attacked almost as often, but by April most operational photographic reconnaissance was at an end. Even after the surrender in Italy, however, the uncertainty of moves in Yugoslavia kept the aircraft of No.336 Wing occupied, and complete mosaic cover of Istria was prepared in case of any trouble there.

Whereas there had been a disbandment of the Anglo-American Photographic Reconnaissance Organisation in M.A.A.F. during this period, the recently formed joint R.A.F. and U.S. Photographic Reconnaissance Force in South East Asia went from strength to strength. As well as the Spitfires and Mosquitoes of No.681 and 684 Squadrons operating in the joint organisation from Alipore, there were three U.S. Photographic Squadrons operating in A.C.S.E.A. under this force, and they were joined by a fourth squadron, this time of Lightnings, in September 1944.

In August advantage was taken of the northward passage of the monsoon to procure the first large scale and survey cover of North Sumatra, by the use of P.R. Mosquitoes specially detached to Ceylon. Other detachments were sent to operate with the forward units of the Tactical Air Force in preparation for the forthcoming campaign in Burma. With the return of fair weather conditions in October, the effort of the P.R. squadrons rose considerably and constant cover of enemy airfields, communications and other targets was obtained. Successful cover of the waterfront at Akyab was

secured in November 1944 by two Spitfires flying as low as 50 feet, whilst the Mosquito sorties increased in range month by month.

In preparation for an assault upon Akyab Island early in 1945, new cover of the island's coast lines and low obliques and large scale vertical photographs was obtained by four Spitfires of No.681 Squadron in one day. Not a single shot was fired at the aircraft during their low level sorties - the reason was not apparent until it was found later that the enemy had been steadily evacuating the island for some time. Last minute photographs of Akyab before the invasion were obtained by a Spitfire of No.681 Squadron on the 2nd January, and the following day when the landings took place four sorties were flown over the landing area. On the 21st January the invasion of Ramree also began after heavy bombing attacks. Target areas were photographed by No.681 Squadron and thereafter repeatedly to provide tactical information for the invading forces.

As far as No.684 Squadron was concerned, on the 30th December 1944 the first cover of Puket Island was obtained, a round trip of 2,100 miles and the furthest penetration yet made in this area(1). This record was eclipsed in January 1945 when a Mosquito flew 2,431 miles in 8 hours 20 minutes to cover Moulmein and the railway from Bangkok to Phnom Fenh(2). Finally, on March 22nd a Mosquito XVI broke the long distance record for this aircraft in any theatre of war with a flight of 2,493 miles in 8 hours 45 minutes, covering the Bangkok/Singapore railway to a point south of the Malayan frontier.

The P.R. force was also responsible in co-ordination with the tactical reconnaissance squadrons for short range and mapping survey work. The force carried out mapping to meet the requirements of the 14th Army for their Burma Campaign and in the twelve months preceding March 1945, No.684 Squadron alone achieved three-quarters of the basic cover required for the whole campaign. When it is realised that between June 1944, when the enemy were at Imphal, and May 1945, when Rangoon was occupied by our forces, the enemy had been driven back for 800 miles, the survey work of the Photographic Reconnaissance Force and its assistance to the Burma campaign can be appreciated.

The work of photographic reconnaissance in general in the A.C.S.E.A. theatre was of greater importance than in other theatres of war owing to the comparatively meagre ground intelligence available, and for air force purposes alone it provided an indispensable factor in the maintenance of Allied air superiority.

NOTE: The authorities and references consulted for the operational part of the narrative are far too numerous to be quoted in detail, except in a few instances. Information has been obtained from reports, Operations Record Books, files, papers, intelligence records, and other documents in the possession of the Central Interpretation Unit, Medmenham and Nuneham, Headquarters No.106 Group, the R.A.F. Station, Benson, and various Air Ministry departments, particularly A.C.A.S.(I), D.D. Photos and the Air Historical Branch.

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- (1) Pilot - F/Lt. J. N. Davies.
 (2) Pilot - W/Cdr. W. E. Lowry.

6 - CONCLUSION

The first volume of this narrative dealt with the acceptance of the idea of using high-flying unarmed aircraft for photographic reconnaissance, and with the solution of this problem by the employment of the Spitfire. The second volume dealt with the development of strategic photographic reconnaissance until it became an essential component of our intelligence organisation.

It is hoped it has been demonstrated in this narrative that in war time photographic reconnaissance is one of the most important sources of all types of general intelligence. In such a role, photographic reconnaissance is rapid and comprehensive since large areas and varying objectives can all be covered in one flight, and it has the added advantage of being difficult to influence through false information deliberately inspired by an enemy.

On the other hand, the information obtainable from photographs is limited to what can be seen and interpreted, and frequently they cannot provide all the details required. Furthermore, photographic reconnaissance is only possible when weather conditions permit, when the targets are within reach of available aircraft, and when enemy opposition does not prevent photography. Of these obstacles, the weather is the main difficulty to overcome, since the development of fast and high-flying aircraft piloted by skilled pilots can overcome the other difficulties. No doubt new and improved technique and navigational aids can do much to combat bad weather on the route to the targets, but whether scientists can evolve cameras which can photograph targets successfully through layers of cloud and in bad light is, as yet, unknown. It is clear that new types of aircraft will dictate the new types of camera to be used in the future, and continual experiments with aircraft and cameras are essential both in peace and war.

It is difficult to quote any conspicuous failures of photographic reconnaissance during the war other than those caused by weather. The failure to locate long range rocket installations on photographs is perhaps the only one which is brought to mind. Otherwise failures were few, except in the early days when lack of comparative cover and the small scale of the photographs secured combined to make certain errors and omissions which would never have occurred once the organisation had been fully developed. There is no doubt as to the value of the Photographic Reconnaissance Organisation in war, and in this respect one small example may be quoted, an extract from the report by the British Bombing Survey Unit.

B.B.S.U.
Report
No. F.24.

"Interpretation of the number of bombs dropped assessed from air cover averaged about 78% of the bombs (later) found by ground survey, the percentages for direct hits and near misses being similar."

In considering the post-war tasks of photographic reconnaissance, during the occupation of enemy countries two immediate demands have been already undertaken; the preparation of an adequate survey of Europe and policing work in connection with disarmament. The lasting needs of peace can also be met in many instances by photographic reconnaissance - town and country planning, revision of ordnance survey maps, and geological surveys are but a few of the tasks which, both in this country and in the Empire, can be undertaken side by side with scientific development of photographic reconnaissance technique.

APPENDICES

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DS 74661/1(182)

PHOTOGRAPHIC RECONNAISSANCE ORGANISATION IN THE UNITED KINGDOM

CONTROL, COMMAND AND ADMINISTRATION

C.O.S.

Air Ministry

U.S.S.T.A.F.

Coastal Command (Admin. only)

Eighth Recce. Wing

No. 106 (Recce. Group)

No. 7 (U.S.S.A.F.)
Photo. Group

A.C.I.U.

No. 8 P.R. O.T.U.
Dyce

Nos. 540
541
542
544
Squadrons

No. 309 Ferry
Training and
Aircraft
Despatch Unit

American
Section
C.I.U.

British
Section
C.I.U.

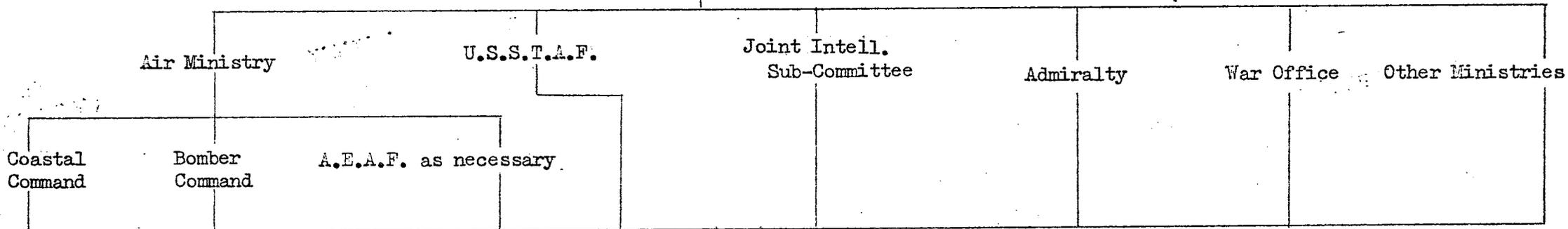
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APPENDIX A.1.

PHOTOGRAPHIC RECONNAISSANCE ORGANISATION IN THE UNITED KINGDOM

PHOTOGRAPHIC REQUIREMENTS

C.O.S.



Joint Photographic Recce. Committee

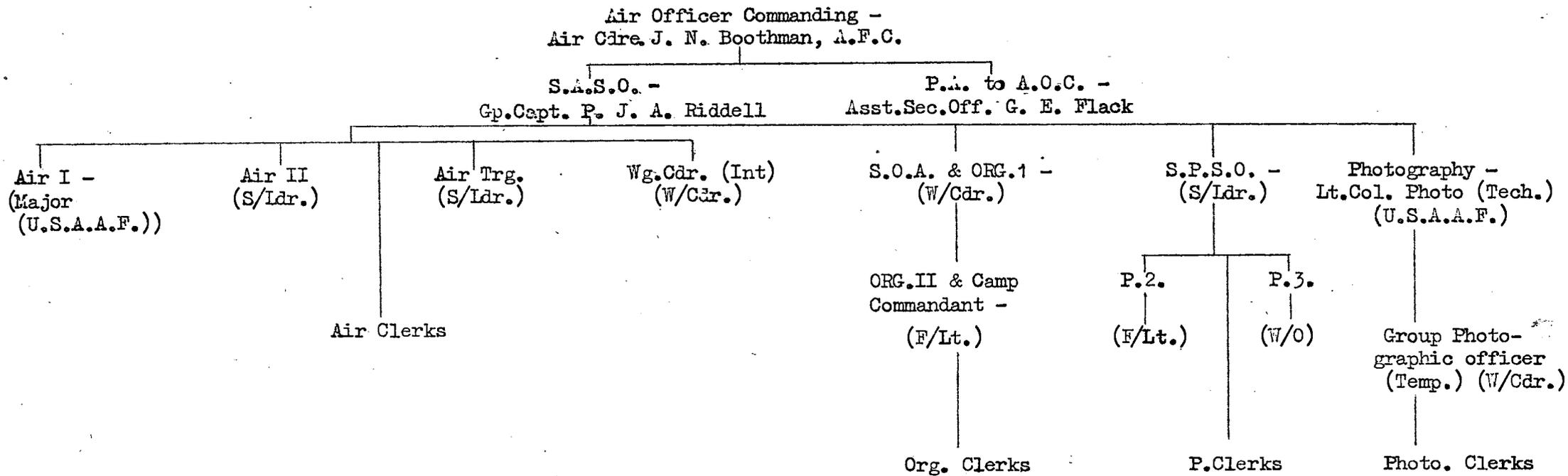
No. 106 (Recce.) Group

No. 7 (U.S.S.A.F.)
Photo. Group

Nos. 540
541
542
544
Squadrons

DS 74661/1(184)

ORGANISATION CHART - HEADQUARTERS, NO.106 (P.R.) GROUP



AIR STAFF ADVISORS

- Group Engineer Officer (W/Cdr.)
- Group Medical Officer (S/Ldr.)
- Group Defence Officer (Lt/Col.)
- Group Security Officer (F/Lt.)
- Group Signals Officer (S/Ldr.)
- Group Photographic Officer (W/Cdr.)
- W.A.A.F. Staff Officer (Sq/Off.)

- J.P.R.C.
- R.N.
- Army
- R.A.F.
- U.S.A.

} 2 Representatives
each

Note: Accounts and Equipment matters are dealt with by the Senior Accountant and Equipment Officers at R.A.F. Station, Benson.

SORTIES RECEIVED AT C.I.U. 1940-1945

	1940		1941		1942		1943		1944		1945 to V.E. Day		GRAND TOTALS		
	Sorties	Prints	Sorties	Prints	Sorties	Prints	Sorties	Prints	Sorties	Prints	Sorties	Prints	Sorties	Prints	
<u>SORTIES RECEIVED AND PRINTS</u>															
R.A.F. P.R. Bomber, C.C.) T.A.F. and Others }	843	116,000	1,888	260,310	2,079	321,595	2,286	511,286	4,361	1,578,110	1,265	449,856	12,722	3,237,157	
	1,396	44,000	652	20,910	1,878	82,452	2,339	110,380	4,678	472,009	1,058	148,823	12,001	878,574	
Total British	2,239	160,000	2,540	281,220	3,957	404,047	4,625	621,666	9,039	2,050,119	2,323	598,679	24,723	4,115,731	
U.S.A.A.F. P.R. Bomber T.A.F. and MISC.	-	-	-	-	-	-	309	27,567	2,565	536,272	786	238,627	3,660	802,466	
	-	-	-	-	100	914	3,576	32,188	4,435	88,975	176	24,717	8,287	146,794	
Total USAAF	-	-	-	-	100	914	3,885	59,755	7,000	625,247	962	263,344	11,947	949,260	
Combined Total	2,239	160,000	2,540	281,220	4,057	404,961	8,510	681,421	16,039	2,675,366	3,285	862,023	36,670	5,064,991	
Sorties received from Overseas Units)	67	-	*	*	*	*	*	*	*	*	963	206,829	*	*	
Sorties flown over G.B.)	-	-	471	-	1,348	-	700	-	219	-	352	-	3,090	-	
Night films +															
Combat films	-	-	-	-	210 films		340 films		830 films		94 films		1,474 (36,000 sorties)		

* Figures not available.

+ Figures not at present available.

REPORTS ISSUED BY C.I.U. 1940-1945

	1940	1941	1942	1943	1944	1945 to VE day	Total
<u>REPORTS ISSUED</u>							
<u>1st Phase: Signals</u>	*	*	*	*	*	*	
<u>2nd Phase:-</u>							
Daily Airfield Report	-	-	230	336	353	119	1,038
Daily Railway Report	-	-	-	-	199	105	304
Shipping and General	864	2,068	1,932	1,990	3,928	1,248	11,949
<u>Total 2nd Phase</u>	864	2,068	2,162	2,245	4,480	1,472	13,291
<u>3rd Phase:-</u>							
Aircraft	-	22	32	316	744	395	1,509
Airfield	-	336	655	545	359	36	1,931
Army	-	291	562	606	1,908	443	3,810
Camouflage	-	21	20	13	14	27	95
Communications	-	152	243	298	931	353	1,977
Damage Assessment	-	103	457	893	4,015	1,171	6,639
Decoys	-	15	51	53	19	-	138
Industry and Oil	-	50	151	222	1,396	982	2,801
Night Photos	-	-	101	353	848	198	1,500
Ports and Shipping	-	57	236	221	410	111	1,035
Topographical	-	-	27	157	33	127	344
Underground Factories	-	-	-	-	9	58	67
Wireless	-	42	720	1,051	1,087	399	3,299
<u>Total 3rd Phase</u>	-	1,089	3,255	4,728	11,773	4,300	25,145
Special Planning Reports	-	-	20	28	1	-	49
<u>Combined Total</u>	864	3,157	5,437	7,001	16,254	5,772	38,485

* Figures not available.

/ Included with 2nd Phase report, as no separate serial numbers used in 1940.

C.I.U. PRODUCTION FIGURES 1940-1945

	1940	1941	1942	1943	1944	1945 to VE day	Total
<u>PRODUCTION (Other than reports)</u>							
<u>Cover Search</u>							
No. of Requests of Specified areas	-	-	-	-	1,473	795	2,268
No. of Prints involved	-	-	-	-	1,100,000 (approx.)	900,000 (approx.)	2,000,000 (approx.)
No. of traces prepared	-	-	-	-	1,104	630	1,734
<u>Damage Assessment</u>							
Damage illustrations	-	⌘	⌘	⌘	⌘	⌘	316
Damage Plots	-	⌘	⌘	⌘	⌘	⌘	432
<u>Plans etc.</u>							
Plans	312	149	259	100	232	192	1,244
Data for models	11	9	20	190	63	47	340
Computations	-	12	173	196	74	20	475
Miscellaneous	-	9	207	290	221	50	777
<u>Models Produced</u>	35	134	205	487	407	82	1,350
<u>Photographic Section</u>							
Orders received	⌘	6,554	28,422	41,768	63,590	25,809	166,143
Prints produced	⌘	257,524	1,454,742	2,062,767	8,298,209	3,545,346	15,618,588
Rotaprints	⌘	-	949,157	858,212	1,472,746	711,276	3,991,391
Complete Duplicate Sorties for Overseas	⌘	-	343	395	819	766	3,323
Mosaics constructed	⌘	117	1,076	1,251	1,855	1,190	5,489
<u>Target Section</u>							
Pinpoint illustrations	-	⌘	511	1,026	1,200	333	3,070
Strategic Target illus.	-	⌘	1,096	3,070	4,572	1,011	9,749
Tactical Target illus.	-	⌘	-	-	696	720	1,416
Information sheets and Amendments	-	⌘	995	1,480	1,150	-	3,625
District Target Maps and Misc.	-	⌘	59	6	5	-	70

⌘ Figures not available.

PERSONNEL STRENGTH OF C.I.U. 1940-1945

		1940 *	1941 *	1942	1943	1944	1945 to VE day
<u>PERSONNEL STRENGTH</u>							
R.A.F.	Officers			176	198	203	223
	O.R.S.			391	412	483	461
W.A.A.F.	Officers			100	116	126	114
	O.R.S.			365	510	588	605
Total	Air Force			1,032	1,236	1,400	1,403
Army	Officers			15	24	53	62
	O.R.S.			2	22	35	46
A.T.S.	Officers			-	1	3	11
	O.R.S.			-	17	22	34
Total	Army			17	64	113	153
Navy	Officers			7	8	12	16
W.R.N.S.	"			2	2	3	3
Total	Naval			9	10	15	19
U.S.A.	Officers			8	44	107	55
	O.R.S.			-	42	67	15
W.A.C.	Officers			-	-	9	12
Total	U.S.A.A.F.			8	86	183	82
Other Allied Officers				2	3	4	9
<u>GRAND TOTAL</u>				1,068	1,399	1,715	1,666

* Figures not available.

PERSONNEL STRENGTH OF R.A.F. STATION BENSON
(INCLUDING NO. 106 WING AND GROUP)Strength

		Officers		S.N.C.Os.		ORs.
		Grd.	Flying	Flying	Grd.	
R.A.F.	31/12/41	91	53	11	153	1637
W.A.A.F.		11			2	212
R.A.F.	31/12/42	46	54	34	98	746
W.A.A.F.		13			8	332
R.A.F.	31/12/43	73	102	94	121	1318
W.A.A.F.		12			7	374
R.A.F.	31/12/44	55	202	38	202	1293
W.A.A.F.		26			19	525
R.A.F.	9/5/45	56	120	62	192	1158
W.A.A.F.		24			18	510

LIST OF HONOURS AND AWARDS TO OFFICERS AND MEN OF No.106 (P.R.) GROUP

1939 - 1945

D.S.O.

S/Ldr. G. E. Hughes
 S/Ldr. J. R. H. Merifield
 S/Ldr. J. H. Saffery
 F/Lt. R. L. Flythe
 S/Ldr. A. E. Hill
 F/Lt. F. L. Dodd
 S/Ldr. D. M. Fairhurst
 F/Lt. E. Le Mesurier
 F/Lt. P. H. Watts
 S/Ldr. D. V. Steventon
 S/Ldr. G. Singlehurst
 F/Lt. A. M. Crow

D.F.C.

F/Lt. R. H. Niven	F/O. R. E. Mackie
F/Lt. M. V. Longbottom	F/Lt. G. W. Williams
F/Lt. E. Le Mesurier	F/Lt. A. M. Lott
F/Lt. S. L. Ring	F/Lt. B. H. F. Templar
F/O. S. G. Wise	F/Lt. B. T. Herbert
F/O. A. L. Taylor	F/O. M. B. C. Anderson
F/O. G. P. Christie	F/O. R. L. C. Blyth
F/O. G. T. V. Graxton	F/O. K. H. Bailey
F/O. S. J. Millon	P/O. J. M. K. Little
F/Lt. P. Corbishley	F/Lt. E. A. Fairhurst
F/Lt. L. D. Wilson	S/Ldr. W. R. Acott
F/Lt. G. D. Milne	P/O. W. Nelson
F/O. P. H. Watts	F/Lt. N. D. Sinclair
F/Lt. L. E. Clark	F/Lt. B. J. McMaster
F/O. Z. Wysickierski	F/Lt. G. B. Singlehurst
F/Lt. K. F. Arnold	F/O. G. R. Crakenthorp
F/Lt. A. E. Hill	F/O. E. Efford
F/Lt. M. J. B. Young	F/Lt. E. D. L. Lee
F/O. M. D. S. Hood	F/Lt. R. C. Cussons
F/O. R. F. Leavitt	P/O. A. Mcleod
F/O. J. H. L. Blaunt	F/Lt. D. R. M. Furniss
F/O. C. E. Hughes	F/O. J. R. Brew
F/Lt. H. N. G. Wheeler	F/O. A. Stewart
F/Lt. D. Salwey	F/O. J. T. Leach
F/O. D. V. Steventon	F/O. J. H. Shelmerdine
S/Ldr. N. H. E. Messervy	F/Lt. D. K. McCuaig
F/Lt. R. V. Whitehead	F/Lt. H. Reeves
F/O. W. Fanton	F/O. G. D. Scott
F/Lt. J. R. H. Merifield	F/O. L. McMillan
F/Lt. V. A. Ricketts	F/Lt. E. G. C. Leatham
F/Lt. F. A. Robinson	F/Lt. J. F. V. R. de Puyssseleyr
F/Lt. A. H. W. Ball	F/Lt. W. J. G. Morgan
F/O. J. Dearden	S/Ldr. R. A. Lenton
F/Lt. W. N. Harris	F/O. P. Riches
F/Lt. G. Watson	P/O. W. J. White
F/O. G. W. Puttick	F/O. F. G. Fray
F/O. R. M. Campbell	F/O. M. A. Mortimer
F/O. J. D. Ibbotson	F/Lt. A. P. Morgan
F/O. D. Hill	F/O. A. J. W. Crofton
F/Lt. A. R. Cussons	W/O. G. Macarthur
F/Lt. R. J. Keefer	P/O. J. A. D. Deighton
Cpt. G. A. D. Williams	F/Lt. W. R. Donaghue
F/Lt. A. R. Graham	F/Lt. J. H. Spires
P/O. J. D. Muir	F/Lt. H. C. S. Powell
F/Lt. R. N. Foster	F/Lt. J. Burfield

D.F.C. (Contd.)

F/O. S. G. Dale	F/Lt. E. G. Searle
F/Lt. G. E. Walker	S/Ldr. A. C. Graham
F/O. J. F. Samson	F/Lt. N. J. Bonnar
S/Ldr. W. R. Assheton	F/O. E. J. Sillitoe
W/O. F. H. Moseley	F/O. J. Fieldin
F/Lt. J. Bendixson	F/Lt. J. C. Webb
F/Lt. G. K. Arnold	F/Lt. J. A. M. Weatherill
F/Lt. K. Durbidge	A/Cdr. J. N. Boothman
W/O. R. E. Somervaille	F/O. J. H. Dickson
F/Lt. F. T. Pratt	F/O. T. P. Turnbull
F/C. E. H. Grennan	F/O. T. W. Osborne
F/O. H. J. Richardson	F/Lt. T. N. Clutterbuck
F/O. A. G. Shingles	F/O. G. C. D. Hunter
F/O. J. Miles	S/Ldr. F. L. Dodd

Bars to D.F.C.

S/Ldr. G. E. Hughes	S/Ldr. M. D. S. Hood
W/Cdr. J. H. Merifield	W/Cdr. D. W. Steventon
F/Lt. R. F. C. Garvey	S/Ldr. A. T. Leaning
F/Lt. G. R. Crakanthorp	F/O. A. L. Taylor
F/Lt. A. L. Taylor (2nd bar)	F/Lt. A. E. Hill
W/Cdr. M. J. B. Yany	

D.F.M.

F/Sgt. J. W. Townsend	F/Sgt. A. Barron
F/Sgt. K. G. Ellis	Sgt. J. A. M. Reid
Sgt. W. Morgan	Sgt. R. F. Walker
Sgt. G. B. Lukhmanoff	P/O. W. M. Whalley
P/O. J. R. Chubb	F/Sgt. Prescott
F/Sgt. E. Hill	

B.E. M.

F/Lt. D. P. Bamber	W/Cdr. F. S. Cotton
S/Ldr. T. W. Ellcock	P/O. W. R. Owen
F/O. A. H. R. Taylor	Sgt. D. S. Upstone

A.F.C.

F/O. N. J. Bonnar

Order of the Bath

O.B. - A/Cdr. J. N. Boothman

Order of the British Empire

O.B.E. - S/Ldr. Q. C. Craig
M.B.E. - W/Cdr. J. G. Buxton
W/O. W. A. T. Anderson

FOREIGN HONOURS AND AWARDS

APPENDIX 'D' Contd.

Air Medal - U.S.A.

P/O. J. R. Miles
 S/Ldr. D. W. Steventon
 F/O. D. Wilson
 F/O. D. G. Scott
 F/Sgt. J. Deardon

F/O. W. M. O. Jones
 F/O. G. Platts
 W/Cdr. S. L. Ring
 F/O. L. McMillan

Virtute Militaire - Poland

F/O. Z. Wysiekierski

Croix de Guerre - Belgium

P/O. A. J. E. Cantillian
 F/O. J. F. V. R. de Puyseleyr

Order of Patriotic War (1st degree) - Russia

S/Ldr. F. A. Robinson

Medal for Distinguished Battle Service - Russia

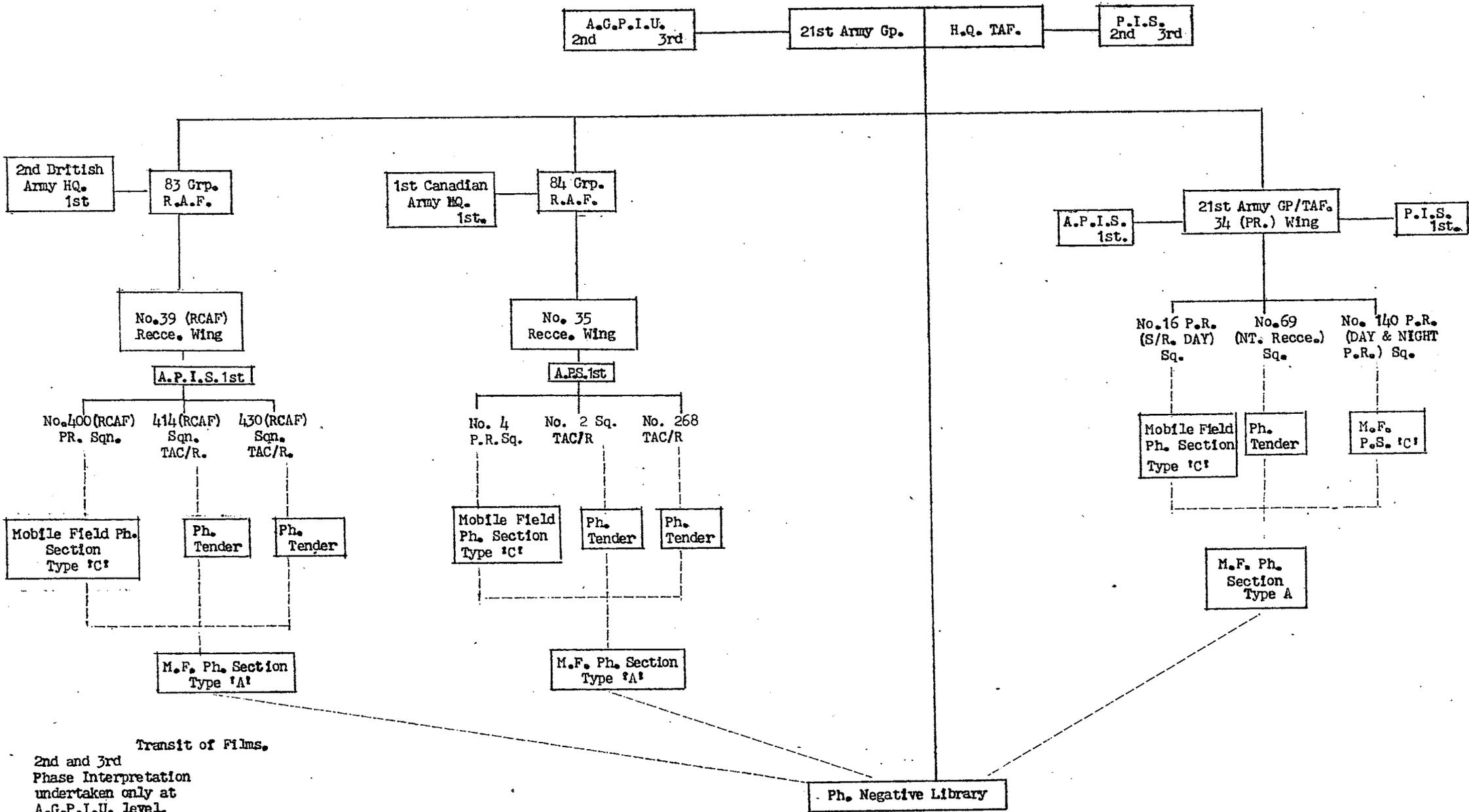
F/O. B. K. Kenwright
 F/O. J. H. Dixon

Total mentioned in despatches - 132

Note: This list may not be complete, owing to some awards being made to officers and men after leaving No.106 Group not being included.

DS 74661/1(192)

PHOTOGRAPHIC LAYOUT - TACTICAL AIR FORCE



Transit of Films.
2nd and 3rd
Phase Interpretation
undertaken only at
A.G.P.I.U. level.

SECRET

APPENDIX E

MEMORANDUM ON THE RELATION BETWEEN THE EFFORT OF
PHOTOGRAPHIC SQUADRONS AND THE PROVISION OF
PROCESSING AND PRINTING FACILITIES

Appendix "A" - Calculation of Number of Exposures made at 30,000 feet.

1. The object of this paper is to determine whether the Mobile Field Photographic Section organisation at present envisaged in the Tactical Air Force is capable of:-

(i) Processing the number of negatives exposed by the Photographic Reconnaissance Squadrons.

(ii) Producing the number of prints from those negatives which will be required by the demanders.

2. The basis on which calculations have been made is the requirement for photographic cover as stated by the various demanding formations which was set out in the memorandum on the Vertical Photographic Reconnaissance required from the T.A.F., forwarded to the Air Ministry under cover of this Headquarters letter TAF/S.354/Ops., dated 4th October, 1943, and references to this memorandum are made in the text.

NUMBER OF NEGATIVES EXPOSED

3. The number of negatives exposed is considered under two headings:-

(i) When high altitude operations by the complete Photographic Reconnaissance force are possible.

(ii) When, owing to the presence of cloud, high altitude operations are impossible.

The period for which calculations are made is one of 24 hours.

OPERATIONS BY P.R. SQUADRONS AT HIGH ALTITUDES

4. The vertical photographic cover which will be required by:-

(i) H.Q. 21 Army Group.

(ii) The two Armies.

(iii) H.Q. T.A.F.

(iv) H.Q. S.A.C.

(v) H.Q. A.E.A.F.

have been taken from Appendices 'A', 'C' and 'D' of the memorandum previously referred to. The details of this cover are set out in Appendix "A" to this paper. The Serial No. of each particular task is the same as that which appeared in the appropriate appendix of the earlier memorandum. In order to restrict reference to that memorandum to a minimum the details relevant to this calculation have been transferred to Appendix "A" (i.e., Scale, Number of Pin-points or Number and Size of Areas in each particular task).

5. In columns E and J of Appendix "A" an estimate has been made of the number of exposures which will be involved in each particular task. In arriving at these numbers the following assumptions have been made:-

(i) That aircraft will be operating at 30,000 feet.

(ii) That where large or medium scale cover is required a F.52 camera with a 36" lens will be used.

(iii) That where small scale cover is required a F.24 camera with a 20" lens will be used.

(iv) That for each single pinpoint an average of 13 exposures will be made to ensure cover.

(v) That for areas an average of 50% of the exposures made will be non-effective.

It will be seen that the assumptions made at (ii), (iii), (iv) and (v) above all err on the generous side.

6. The total number of exposures per 24 hours arrived at is:-

- (i) By No. 34 Wing..... 5,502
- (ii) By the Photographic Reconnaissance Squadron in each Composite Group..... 680

No allowance is made for night photography carried out by No. 34 Wing, but since the number of exposures that can be made is limited to the number of flashes that can be carried it will be seen that, even if the total requirement of 17 sorties per night (as stated in Appendix "B" to Memorandum on Photographic Requirements) could be flown, this number would only amount to approximately 100.

7. The great difference in the number of exposures produced by No. 34 Wing and the Composite Group Squadrons may be remarked. In view of the fact, however, that approximately 80% of the tasks are pinpoints, the number of exposures per sortie will be extremely low and thus the number of sorties required No. 34 Wing will be prohibitively high and it may therefore be necessary to "sub-contract" to the Group Squadrons a proportion of the tasks which in this calculation have been allotted to No. 34 Wing.

8. However, since the capacity of a Type "C" M.F.P.S., of which there will be three, is estimated to be 8,900 exposures per day, it is apparent that in whatever way the tasks may be divided there is no question of saturation point being reached.

OPERATIONS AT LESS THAN 30,000 FEET

9. If, owing to cloud or other reasons, photographic reconnaissance cannot be carried out at a height of 30,000 feet, the number of exposures which will be required to cover the same area may be increased. This increase will result from one or both of the following reasons:-

(i) Photographs may have to be taken at a larger scale than necessary owing to the fact that the camera with the next longest focal length lens will not produce photographs of sufficiently large scale.

(ii) In order to produce the appropriate scale, photographs may have to be taken with a F.24 camera (plate size 5" x 5"). The use of the F.52 camera (plate size 9" x 7") was one of the bases of calculation in the first part of this paper for large and medium scale cover.

10. At a height of 4,000 feet or below the above two factors will have the greatest influence on the number of exposures. At this height all cover would have to be produced at large scale irrespective of size demanded and all photographs would have to be taken with a F.24 camera. This is true because the F.24 camera with a 5" lens is the shortest focal length which we can consider for general purposes, and that the camera at 4,000 feet produces a scale of 1/10,000. It will therefore be seen that this is the worse case and although it is most unlikely that at this height all the demands which have been considered at 30,000 feet will be satisfied, it is thought worthwhile to take this case to prove beyond doubt whether or not the Type "C" M.F.P.Ss. are capable of processing the largest number of negatives that they are ever likely to be called upon to do.

11. In making the new calculations the following factors will have to be taken into account:-

- (i) Area cover taken by the 36" lens at 30,000 feet will now be produced at the same scale using a 5" camera but on a 5" x 5" negative instead of a 9" x 7". Therefore, 63/25 or approximately 2.5 times the original number of exposures will have to be made.
- (ii) Area cover demanded at small scale and taken by the 20" camera at 30,000 feet at a scale of 1/18,000 will now have to be produced at a scale of 1/10,000, and therefore 1.8 times the number of exposures will have to be made.

Pinpoints will still be covered at the same scale and although the plate size is smaller the allowance of 13 exposures per pinpoint should still be adequate and therefore no alteration will have to be made to the number of exposures.

12. The figures arrived at for the number of exposures at 5,000 feet are:-

- (i) No. 34 Wing 8,730
- (ii) The Photographic Reconnaissance Squadron in each Composite Group 994

NUMBER OF PRINTS REQUIRED

13. The multi-printers in the Type "C" M.F.P.Ss. are capable of producing 24,000 prints per day for normal working and up to 32,000 prints per day in an emergency. Taking the lower figure for our estimates this will mean that in the case of 34 Wing an average of over four prints can be run off from each negative, and in the case of the Composite Group Photographic Reconnaissance Squadrons nearly 40. This does not take into account the fact that since a generous allowance was made for pilots' errors in estimating the number of exposures, a number of negatives will not require large-scale reproduction since these will give either duplicate cover or photographs outside the area demanded.

14. From the Report of Photographic Reconnaissance for August 1943 carried out by the North African P.R. Wing it will be seen that the total output of negatives was 150,701, and the total number of prints was 813,481, or just over 5 prints per negative. To follow these figures too closely would probably be unwise, however, it is clear that if the same number of prints can be produced in the T.A.F. using only the Type "C" M.F.P.Ss. at the Airfields there should be no difficulty in producing far more than can reasonably be required when the Type "A" M.F.P.Ss. are also employed. This type M.F.P.S. will normally undertake the bulk of large scale reproduction, except in cases of demands where speed is all-important, and the total capacity for the three Type "A" M.F.P.Ss. will be a further 72,000 prints per day or, if the demands are evenly divided between squadrons, a further 100 prints per negative. This figure, taking into account the large number of demands which will be satisfied by an Interpretation Report and not by distribution of actual prints, is more than adequate.

H.Q. Tactical Air Force, R.A.F.
7th November, 1943.