

Restricted

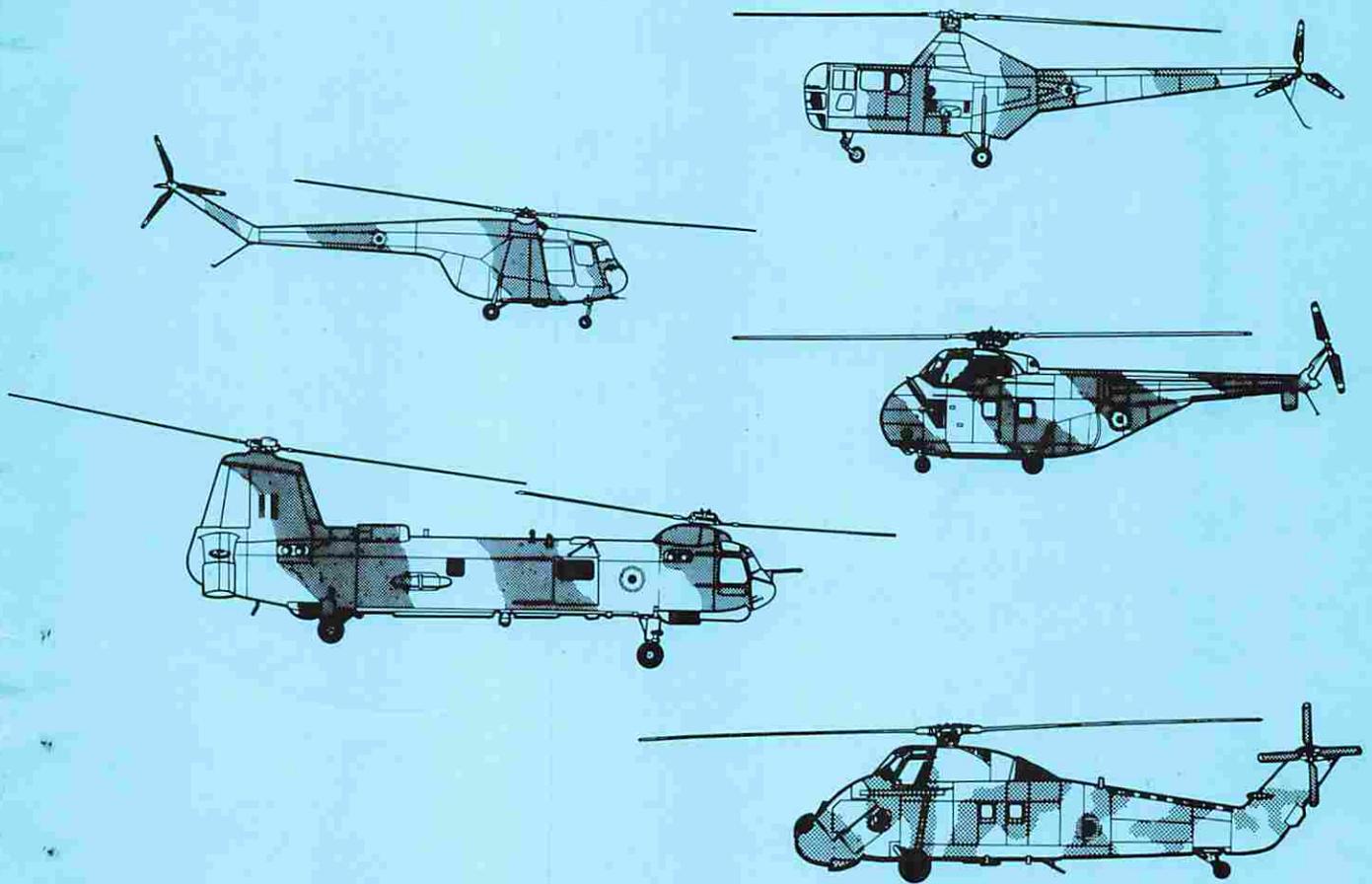
RAF HELICOPTERS

The

FIRST TWENTY YEARS

Part 2

Wing Commander J R Dowling
MBE DFC* AFC CFS* AMRAeS RAF(Retd)



Ministry of Defence

AIR HISTORICAL BRANCH (RAF)

1987

Restricted

PHASE 3—1960-1971

INTRODUCTION

The third phase of helicopter development in the RAF belongs to the years 1960-71, a period in which the helicopter force built upon the achievements of earlier types of rotary wing aircraft in both tactical operations overseas and search and rescue duties at home. Further, the more advanced helicopters now coming into service, with turbine engines, metal blades and improved controls, were able to offer a far better level of performance in all the established helicopter roles.

Fortuitously, the growing sophistication in helicopter design and performance coincided with increased operational demands: the Malayan Emergency was followed by Confrontation in Borneo, and turmoil in Cyprus by a rising tide of unrest in Aden and neighbouring territories, the main helicopter burden now falling on the Belvedere and Whirlwind Mk 10, to be joined a little later by the Wessex Mk 2.

Nearer home, the main change was the formation of tactical support helicopter (SH) squadrons in Germany and the United Kingdom, and the establishment of operational training and technical support elements at Odiham for the Belvedere, Whirlwind and Wessex units overseas. Deployment of the SAR squadrons remained much as before, except that one detachment at a time was temporarily withdrawn while it exchanged its Mk 2 Whirlwinds for Mk 10s.

Meanwhile, although the turbine-engined helicopter was now predominant, the stalwart Sycamore continued in service throughout the 1960s in the transport role from Northolt; it was also to be found in the short range transport (SRT) force now forming in the United Kingdom, and at the Central Flying School for training duties; and it continued—for a time—in the support role overseas, in El Adem, Cyprus and the Far East, Aden, and briefly in Kenya.

Minor taskings for the 1960s included a two-year limited scale support operation in British Guiana, mounted by Whirlwinds; the continuing SAR deployment in Cyprus carried out by a flight (No 1563) of Whirlwind 10s at Akrotiri; and from 1964 the provision of a communications flight in Nicosia tasked to support the United Nations Force in Cyprus (UNFICYP) and made up of a series of rotating detachments from the helicopter squadrons based in the United Kingdom and Germany (Nos 230, 18 and 72).



The three wooden-bladed pre-production Belvederes leaving Weston-super-Mare on delivery to Odiham by the Belvedere Trials Unit—October 1960.



Pre-production Belvedere of the BTU near Odiham. Note the small wheels and large tail stabilisers—both modified in the later production aircraft.

CHAPTER 8

INTRODUCTION INTO SERVICE OF THE BELVEDERE

The era of the turbine-engined helicopter began with the arrival of the Belvedere at its trials unit in 1960. With it, however, came another radical change: no longer was maximum engine power the sole criterion determining all-up-weight limitations and performance capabilities. The crucial factor now was transmission design strength which limited the amount of power to be tolerated from the new turbine engines.

The Belvedere was the first multi-engined helicopter in the RAF (its forerunner, the Bristol 173, having been the first twin-engined helicopter in the world); it was also the first RAF twin main rotor helicopter and the last purely British-designed and built large helicopter. Consequently, the history of its introduction into service and deployment overseas in the Middle and Far East is of particular interest.

The Belvedere Trials Unit

Something has already been said about early problems with the Belvedere: arguments over the tactical use of helicopters and the financial consequences of developing a new twin-engined rotary wing aircraft (see Chapter 4). During 1958 and early 1959 major technical development problems were encountered and it was found necessary to redesign the main gear box and tail plane, and introduce metal rotor blades and power assisted controls. In July 1959, with the estimated CA release date put at December 1960, it was decided to form a RAF Trials Unit of three pre-production aircraft, which were expected to become available in July 1960, although still with wooden blades and manual controls. Formation of a Trials Unit would enable valuable experience to be gained on the Belvedere before its introduction into service in the Far East.(1) Training of five pilots with Sycamore experience began at the contractors' airfield at Weston-super-Mare in July 1960, although it was not until three months later that the three pre-production aircraft were formally handed over to the unit, which then moved to Odiham to start work.

In theory the Belvedere was still competing with the Wessex Mk 2 for a place in the future SRT force (although the latter was not yet built); and in fact an investigation in early 1960 (2) had led to the decision not to place a further order for the Belvedere in preference to the Wessex on the grounds of relative costs and the number of problems with the Belvedere still to be resolved. Costs were indeed mounting: since, to save time and money, no prototype had been ordered, every change in design had to be incorporated into each production aircraft during construction and at very considerable expense. By July 1959 expenditure already amounted to £370000 per aircraft, a figure which had risen to £390000 by October;

in contrast, the estimated cost of the Wessex at that time, with a projected CA release date of 1962, was £185000.(3) Consequently, no further Belvedere order was expected.

At that time the proposal was for a force of turbine-engined Whirlwind Mk 10s and twin Gnome-engined Wessex Mk 2s, with the addition of twelve Rotodynes to provide the crane lift which the Army insisted was necessary and for which Treasury approval had already been given in spite of RAF doubts about the capability of the Rotodyne to meet the requirement.* Later, in the face of declining estimates of performance and escalating costs, the decision was taken to cancel the aircraft.

Meanwhile, although the Belvedere had been put—prematurely—into production, the radically new design of this tandem rotor, twin-engined aircraft was giving rise, predictably, to problems in two areas where bold new experiments were being carried out: power-operated controls and, particularly, transmission gearboxes. In essence, the 5000 lb or so all-up-weight Sycamore with one three-bladed main rotor had become a 20000 lb all-up-weight Belvedere with two four Sycamore-bladed main rotors and still (in 1960) with full manual controls. Further, it was to be ready for squadron service by 1961 equipped with metal and therefore completely redesigned rotor blades and fully duplicated power controls—although only one development aircraft had been ordered on which to prove these ‘modifications’, with a further two for A&AEE trials. To compound the problem, as a duplicated power system was still only in the development stage, flight testing was to go ahead on a development aircraft with only single channel power operated controls. One result of this was that as all test manoeuvres had to be demonstrated under safe control in full ‘manual’ before test measurements for clearance could be recorded under ‘servo’ control, each section of the flight envelope had first to be tried out in full manual control, something which could not be repeated in the production aircraft as these had no provision for voluntary manual reversion.

In fact, the 20000 lb all-up-weight metal-bladed Belvedere was much easier to fly in full manual than the Whirlwind, with its single three-bladed rotor and 8000 lb all-up-weight, which was manageable only for short periods, at restricted speeds and with special lateral bias assistance in the cyclic control.(5) That this should be so seems to be a point in support of Raoul Haffner’s argument that a manual

*ACAS(OR) summed up the position in October 1960: ‘This aircraft will meet the War Office requirements (three tons internally over 200 nm radius or six tons externally over 20 nm radius). However, it is a complex and expensive aircraft which will require an enormous amount of development before it is introduced into service . . . It is unlikely to be available before 1965 and because of its complexity I have grave doubts about its suitability for use in the tactical transport role.’(4)

capability should be demonstrated before power assistance was applied, a theory discounted as either impractical or irrelevant by the Sikorsky school of development, which concentrated on making a single main rotor large enough in relation to the weight to be lifted and on dealing with whatever control forces were encountered by introducing more powerful control assistance. Indeed, even by the time the Wessex came on the scene power to the controls was no longer referred to as 'assistance'; the pilot was contributing nothing whatsoever to control power and no provision was made for him to do so.*

The lateral stick forces proportional to speed felt in the single main rotor helicopters in manual control were translated in the Belvedere into a load on the rudder pedals as each counter rotating rotor experienced a lateral force in the opposite direction and opposite lateral tilt of the rotors was used in yaw control. In the development Belvedere bias assistance to oppose this force was provided by a single piece of 'bungee' or elastic cord. On the one occasion when this broke, the pilot was surprised and even momentarily disconcerted, but nothing more.(6) None of the production Belvederes ever suffered a total power control failure and consequently flight in full manual control was never experienced in the metal-bladed Belvederes, apart from the development aircraft. There is, however, no reason to believe that the result would have been more than uncomfortable, as the whole manual linkage remained and was used for control, driven by power operated jacks in parallel with the linkage.

The three pre-production aircraft used by the Belvedere Trials Unit operated in full manual control throughout the life of the unit and having the well tried Sycamore blades and tie-bar attachments produced generally acceptable stick forces. The only occasion on which manual control forces interfered with the successful completion of a manoeuvre occurred on the very last flight of the trials aircraft during a rehearsal for the Farnborough SBAC show in August 1961, when with 25 troops on board a moderately steep 'flare' position of about 20 degrees was used for deceleration to the hover. What was later described as aerodynamic interference between front and rear rotors produced a heavy lateral leftward load on the stick coupled with a steep tail down pitching movement which forced the pilot to release the collective lever in order to apply both hands to the cyclic stick and so prevent

*A further effect of the trend to increased weight was a growth in the size of tail rotors as engine power increased, and quite soon sideways facing tail rotors were using as much power as the main rotors of small helicopters. It is a matter for speculation whether this configuration would have become so universally accepted but for the untimely demise of the Air Staff's first choice for an operational helicopter: the Gyrodyne with its forward facing offset propeller to counter torque (see Chapter 2).

the aircraft rolling to the left. The aircraft sank towards a landing in a marked nose up attitude and the rear rotor struck the ground. The final landing, however, was soft enough to cause no injuries, although both the rear rotor and the front undercarriage disintegrated, the latter shearing off because of the forward motion.

As this was the last flight planned for the pre-production manual aircraft and it was clear that the metal-bladed power controlled machines would not suffer similar control problems, a detailed analysis of the causes of the accident was not considered worth while and the SBAC display went ahead successfully with the newly delivered production Belvederes.

The crash of August 1961 was the second of the only two serious accidents suffered by the Trials Unit, the first having occurred at the outset on 22 November 1960. A Belvedere with an underslung land rover and trailer experienced what seemed to be a double engine failure at about 150 feet shortly after lift-off at Odiham. One engine stopped and the pilot waited expecting the other to go to double the power selected, as it was supposed to do. As this did not happen, the load was jettisoned and an emergency landing made straight ahead. The aircraft landed softly, but ran forward slowly, the very small wheels (replaced by larger ones on the production aircraft) penetrating the soft surface and the front undercarriage shearing off. Little other damage was suffered however. It was not possible to discover exactly what had happened as the very experienced pilot had instinctively prepared for an engine-off landing at the first sign of trouble and carried out the appropriate procedure within seconds. All the same, there was a possibility that when the failure occurred he had operated the dump valve switches for the wrong engine by mistake, since the likelihood of this happening was already recognised because of the lateral disposition of switches relating to engines longitudinally disposed in the fuselage. On investigation the second engine was found to be serviceable, although it did fail a bench test to establish whether it automatically selected emergency (ie double) power when it should do; and eighteen months later fears about a possible mistake with the switches were tragically confirmed.

The Belvedere Trials Unit was tasked for intensive flying trials, but had no specific brief for flying patterns and merely proceeded to insert its three Belvederes into the current programme of Army exercises for which No 38 Group provided helicopter support. The principal squadron involved was No 225, formed from the now disbanded Joint Experimental Helicopter Unit (see Chapter 6) and still operating Sycamores and Whirlwinds 2s. The contrast, therefore, even with the trials unit Belvederes, was dramatic. With their external load lift capability of 5000 lb (soon to be raised to 6000 lb) and a capacity for 28 troops (without seats), it was immediately obvious that a new era in helicopter support had arrived and many demonstrations were arranged. Jeeps with trailers or Wombat anti-tank weapons, 105 mm guns and crews, a crashed Meteor, 80 foot sections of prefabricated bridging, a group of three assault boats, and a mobile operating theatre are examples of



Last flight of the wooden-bladed full manual controlled pre-production Belvedere, just prior to the crash while rehearsing for the 1961 SBAC show at Farnborough. The Sycamore type rotor blades are clearly shown.



The result of loss of a nut retaining part of the Belvedere control linkage—Aden.

the many loads carried, the last mentioned at a NATO field medical demonstration near Paris.*

The Belvedere inevitably dominated every exercise it attended, generating an enthusiasm among its prospective users comparable with that produced by the Casualty Evacuation Flight Dragonflies in the Far East in 1950. Not only was it the first of a new generation of truly powerful helicopters, it was also the most powerful of them all. Consequently, the trials unit crews were not likely to be unduly dismayed by the defects recorded in the fortnightly (and later monthly) reports which they prepared.(8) They were aware, for example, of the gearbox troubles described below, because they interfered from time to time with their flying programmes, but they were in no position to appreciate how close the project would come to cancellation because of these problems, particularly as support for it in Whitehall was still somewhat mixed. Requirements for a wide range of modifications, from the design of the pilot's seat cushion to major changes to the engine controls, were regularly produced in complete confidence that they would be dealt with satisfactorily as a matter of routine. What mattered to trials unit personnel were the demonstration lifts of Army vehicles and weapons, and the provision of living proof to all concerned that 28 troops could be lifted merely by removing the seats (a practice later forbidden when the numbers carried were limited to eighteen seated passengers), and that the aircraft even at the hover could remain unaffected, and needing no corrective action when one engine was voluntarily stopped, since the remaining engine immediately doubled its power output, although no rotor RPM governor was provided.**

Consequently the Trials Unit expected a solution to be found when it pointed out that the front tank could not be refuelled with the engine running (and therefore

*During the life of the Trials Unit, on 30 June 1961, one of the production Belvederes, XG 461, was flown by the test pilot from Battersea heliport to Paris, returning on 2 July, and established a record for the inter-city crossing of 1 hour 41 minutes, which was not broken until 1980 when a Sikorsky S-76 (Spirit) made the same flight in 1 hour 20 minutes. The Belvedere cruised at an airspeed of 120 knots increasing to 140 knots at very low level.

**This was accomplished by a change in the mechanical gearing between the throttle twist grip in the cockpit and the fuel metering unit for the engine which was still running, the change being initiated electrically by the loss of torque in the engine being stopped. This sequence was designed to prevent either engine operating in emergency power when the other was still running, with serious risk of overloading the transmission, while at the same time maintaining the proper relationship between the pilot's twist grip throttle control and the collective lever when one of the engines had stopped.

the rotors turning), because with the operator standing on a ladder, and uncomfortably close to the jet efflux and hot jet pipe, the four-foot long dip stick would project through the front rotor disc. No solution however was forthcoming. Again, the unit did not expect to find that the electric winch with 200 feet of cable being developed for the Belvedere would never materialise and that no alternative would be found. Another problem was one which the unit considered too well known to need further airing: as the yaw control by differential lateral tilt was part of the cyclic control system, failure here could well be catastrophic. It was known that the yaw cables which operated part of the system were being renewed more frequently than planned and that the chief designer considered that they should be replaced by rods. It was therefore assumed that a remedy would be found, but a crash in Borneo in May 1963, killing six senior Army and police passengers, followed by another yaw cable failure in Aden in October 1964, showed otherwise.

By far the most serious defect from the operators' point of view was the Cartridge/Avpin engine starting system, and the need to replace it was the most important of the major modifications sought by the Trials Unit, and one which, it knew, would take all its powers of persuasion if it was ever to be achieved.* What the Unit did not know, however, was that the fate of the Belvedere already hung in the balance and that any modification not essential to actually getting the aircraft to fly was very unlikely to be approved. A modification which involved so time consuming and costly a change in engineering policy as a new starting system would almost certainly kill the whole project for both financial and practical reasons.

The question of the Cartridge/Avpin starting system is important because the decision to retain it not only affected the whole operating pattern of the production aircraft—to say nothing of their reliability at critical moments—but also led to a number of explosions, followed by fire, causing damage varying from slight to the total loss of two aircraft.** The defect was therefore very public and the aircraft's reputation suffered accordingly. Injury to personnel was fortunately limited to

*Avpin was the service name for Iso Propyl Nitrate, a high energy fuel which burns in an oxygen free environment. In the Cartridge/Avpin starter system a cordite cartridge was fired delivering under pressure a measured quantity of Avpin into a combustion chamber and simultaneously igniting it. The resultant pressure was used to spin a starter turbine linked, during the starting cycle, to the main engine compressor turbine.

**About half way through the life of the Belvedere, in the mid 1960s, the need to provide additional protection for the pilot was accepted. However, although slight damage had already been caused by enemy ground fire in both Aden and Borneo, the only armour plating ever fitted was behind the pilot's seat, which was felt to be uncomfortably close to the obviously explosive starter turbine of the front engine.



Avpin starter explosion—Aden.



Avpin starter explosion and fire—Singapore.

occasional sprains, and a broken ankle and wrist caused by the pilot evacuating the aircraft without waiting for the ladder.

What the Trials Unit appreciated—even before taking delivery of its aircraft—was that it was inappropriate for a helicopter intended for field operations in the Far East to rely on a cordite cartridge sensitive to damp, and on a flammable and highly toxic fluid, producing a poisonous vapour, as well as being explosive under pressure and capable of burning in an oxygen-free environment (and therefore virtually inextinguishable). Additionally, as it was a substance which was likely to be available only at major bases and airfields, extra supplies would have to be carried in the aircraft at some risk. Without these two relatively exotic chemicals there was no way of starting the engines.

With hindsight the problem of the Belvedere starting system can be seen as an example of the consequences which arose from relating fixed wing practice too readily to helicopters. The engineering planning staffs had no obvious means of knowing why a starting system already standard on a number of fixed wing aircraft (the Javelin, Hunter and Canberra, for example) should not be used with similar engines on the helicopter. It may be argued that the number of starts required in the case of a tactical helicopter compared with, say, a Hunter or Canberra, was not taken fully into account with the result that the burden on the starter mechanism was more serious than was appreciated. But such an argument says little for the level of experience and technical control provided by the Ministry of Supply over the contractors concerned.*

Unfortunately this error in principle was made worse in practice by a second problem noted by the Trials Unit: even when Avpin and cartridges were available and the latter fired successfully, the number of starting failures was depressingly high. In December 1960, for example, out of 266 attempts to start, 107 were unsuccessful. Over a longer period, and in spite of the best efforts and constant attention on the part of the contractors' experts, out of 789 attempts 197 were unsuccessful, including 73 occasions on which the starting system failed to produce a high enough compressor speed.⁽⁹⁾ It seemed patently obvious that a different starter system should be developed.

That the problem had not emerged earlier was due to the fact that the manufacturer's Belvedere was equipped with relatively heavy electric motors for starting the engines. These had to be supplied with power from an external starter vehicle incorporating a generator which provided a very heavy electric load for the 25 second starting cycle. As a result the development aircraft could not be restarted away from base unless that particular type of starting generator was available.

*The Ministry of Supply, which had been formed from the Ministry of Aircraft Production and Supply in 1946, became the Ministry of Aviation in 1959.

The Cartridge/Avpin system was the choice made to replace this electric system, but there were alternatives under development for the Napier Gazelle engines, including a particularly attractive high pressure air starter, the requirement being to spin the main compressor turbine up to 8000 RPM. The air at 3000 lb/sq in was stored in a 13-inch diameter fibre glass sphere and simply discharged into a starter turbine linked to the main engine compressor turbine. There was no risk of fire or explosion and very little mechanical complication.

This was the system demanded by the Royal Australian Navy for the Wessex Mk 1s which Westland was building for it and equipping with a single Napier Gazelle engine as used in the Belvedere. The Royal Navy Wessex Mk 1 was equipped with the Cartridge/Avpin starter, but the Mk 3 was given the high pressure air starter system.

The compressed air starter was particularly well suited to the helicopter because, in theory, the aircraft could be made to recharge the air bottles once the rotors were turning without recourse to external supplies or equipment. There was, therefore, in principle an alternative and clearly preferable starting system available, but it was too late to incorporate it in the Belvedere, where the choice was stark: to make the best of the existing system or face cancellation. That the air starting system could not be fitted in the Belvedere, although the aircraft was still very much in the development stage, is a measure of the constraints operating at the time.

Other causes of starting failures were malfunctions of the starter turbine, which suffered from heavy pollution from the starter cartridges themselves, and a tendency for all three cartridges in the starter breech to fire simultaneously, so leaving a dead cartridge in position for the next attempt to start. A further difficulty was that each time the starter breech was reloaded, after an interval of ten minutes to allow the system to cool down, it was essential to refuel with Avpin—a time-consuming and messy procedure—in order to ensure that enough was available for another three starting attempts. If a cartridge was fired with too little Avpin available, an area of Avpin vapour—referred to by the manufacturers as the 'critical bubble size'—would appear in the Avpin system and almost certainly explode during the next starting attempt. These technical problems have been described in some detail because in the particular circumstances surrounding the Belvedere—questions of time scale and cost—decisions were taken which were to have important consequences.

With the Belvedere the starting problem was made worse during the trials phase by a tendency for one or other engine to stop of its own accord owing to an elaborate safety mechanism of very doubtful value incorporated by the engine manufacturers. They were concerned that if a failure occurred in the transmission

(ie in a part of the system for which they were not responsible), the free turbine, for which they were responsible, would at normal throttle settings reach a speed at which it would disintegrate in a matter of a second or so. To overcome this danger—and discounting the fact that most transmission failures in a Belvedere would be the equivalent of a main spar failure in the wing of a fixed-wing aircraft—they incorporated a torque sensor in the output side of the free turbine which, if it detected a loss of torque while the throttle was open beyond what was called 'turbine bursting fuel flow', would cut off the fuel and extinguish the engine. To ensure that the device was inoperative when the engine was started (zero torque) and run at 'ground idle speed', it was set or 'armed' only as the throttle was opened slightly. Unfortunately, 'turbine bursting fuel flow' still occurred at the low throttle settings frequently used in a lightly loaded Belvedere while decelerating to the hover, when random variations in disc loading (and therefore torque) were experienced for aerodynamic reasons, and small fluctuations in the rotor synchronising shaft reduced the torque momentarily in one or other engine past the critical figure, with the result that the engine promptly shut down.

Until a better setting could be found for the arming position for the throttle—one which had more regard for operational needs than for 'turbine bursting fuel flow'—the Belvedere needed even more frequent engine restarts, a process which could be carried out only while landed in order that the throttle for the engine to be started could be fully closed. An extract from the trials unit report describing a demonstration for the Royal Engineers at Chatham illustrates the problem. Part of the task was to lift a 74 foot section of prefabricated bridge weighing 3500 lb to a prepared position and then tow two assembled piers into place to complete a heavy pontoon bridge:

'The carriage of the MEXE bridge on the first two days was unsuccessful for reasons which will be of especial interest, the sequence of events being as follows:

- a. The aircraft lifted the bridge satisfactorily and carried it to the demonstration site, but the timing arrangements had become confused on the ground and a 15 minute delay was requested. The aircraft returned the load to the pick up point and prepared to land alongside to wait.
- b. While reducing power, No 2 engine stopped itself on the low torque trip (Mod 541 not embodied) . . .
- c. While attempting to land fully so that No 2 engine could be restarted, the small wheels dug into the ground causing onset of padding . . . The aircraft was then flown on No 1 engine to the parade ground so that the throttles could be fully closed to permit restarting of No 2 engine.

d. On attempting to start No 2 engine, it was found that all three cartridges had already fired on the previous start, and so re-cartridging and Avpin refuelling was carried out . . .

It was then too late to lift the bridge for the demonstration.

On the second day the timing was again confused, so that the order to start was late, but only slightly so. However, engine surging was experienced so shut down was necessary. Once again restarting was found to be impossible as all three cartridges had fired on one engine, and by the time the re-cartridging had been done, the audience, who were sitting in the rain, had lost interest and gone to lunch. This consequence was merely degrading and slightly absurd, but it is not difficult to imagine operational conditions in which it would have been quite serious.

The remainder of the demonstration on these days and the whole of it on the last two days was completely successful, particularly the towing sequence once the correct technique had been established. This item attracted considerable interest, and further requests perhaps with larger loads may be expected.'

A less obvious, but in the longer term more damaging, consequence of these starting problems was to reduce the Belvedere's load carrying capability. The unreliability of the starter system made it risky to shut down the engines at distant or isolated locations and in consequence refuelling was impossible because, as described above, the long dip stick would pass through the front rotor disc and with either engine running the rotors could not be stopped. As a result the Belvedere almost always carried enough fuel for its return journey to base, a procedure which added on average some 1000 lb in weight for half the total operational flying time, equal in fact to the average total payload offered by the Whirlwind Mk 10 in similar conditions. Thus the decision to choose the Cartridge/Avpin starter system, and adhere to it, had very damaging consequences not only for the aircraft itself, but also for its efficiency as a load carrier throughout its service life.

However, it may be assumed that when the Trials Unit's recommendations were turned down, the full consequences could not have been foreseen. Indeed, even without hindsight, rejection of the Unit's recommendations must have seemed justified if, as appeared likely, the alternative was to risk cancellation of the aircraft altogether, which would have been the almost inevitable result of two major problems coming to light simultaneously—over the starter system, for example, and the gearbox malfunctions which were causing widespread consternation. With hindsight, ample justification is provided by the many important tasks which the Belvedere carried out successfully, and the highly satisfactory level of performance and reliability in all other respects which the aircraft eventually achieved.

The Belvedere Trials Unit, although due to last only six months, continued for another four until the end of August 1961, when No 66 Squadron was formed with the first production Belvederes just in time for them to appear at the Farnborough SBAC show at the beginning of September. Throughout its chequered and sometimes turbulent eight-year existence the Squadron experienced no operational problems with its aircraft which the Trials Unit had not foreseen either as possible or even in some cases as likely, and the failure to take action on most of its recommendations was a constant source of bewilderment to the crews, as was what often seemed to them to be an ambivalent attitude to the Belvedere adopted by higher authority.

Meanwhile, much had been happening at staff level while the Trials Unit had been at work and during the months leading up to the formation of the three Belvedere squadrons. On 19 July 1960, before the three pre-production aircraft were formally handed over, VCAS was informed that the revised date for the first Belvedere squadron to reach the Far East was March 1961, with July as the earliest date for it to become operational. The return of the Far East Air Force Sycamores, destined for CFS, would therefore have to be delayed. The blame was put on development difficulties with the duplicated power controls. A week later the arrival date was put back still further to August 1961.(10) A&AEE tropical trials at Idris in Libya (with single power control jacks) had reported fuel metering and control difficulties at the upper end of the flight envelope (above 17000 feet).

On 17 November the delays were discussed at ministerial level and a fire at the Weston-super-Mare factory was advanced as a further reason for postponement. The CA release was now to be put back from December 1960 to March 1961 and the Trials Unit would work with a restricted flight envelope release.(11)

The possible double engine failure at Odiham already described, occurring only a month after the Trials Unit was formed, was particularly embarrassing, but in April 1961 a further very serious defect appeared when the main gears in both front and rear gearboxes failed on the test rig at Weston-super-Mare. It seemed likely that they would need redesigning and in the meantime the Trials Unit gearboxes were restricted to a life of 100 hours. With no established spares back up available at this stage there was an obvious danger of the aircraft being grounded.

A month later the whole future of the Belvedere was again in serious jeopardy. The Ministry of Aviation advised that the aircraft was unacceptable and the drafting of Trials Unit crews to the Far East Air Force was suspended. Air Plans put forward three alternatives: accept the aircraft with gearboxes limited to a life of 100 hours (the Army, however, would object on the grounds that these would soon be used up); modify the gearboxes to achieve a life of 250 hours (a palliative

inspiring little confidence); or refuse to accept the aircraft, which was the Air Plan's recommendation on the grounds that it would force the whole issue. It was argued that gearbox failure in the air would be catastrophic (and one had occurred in test after only 41 hours): depending on where the failure occurred, all power could be lost to one rotor or, at best, the linkage which kept both rotors turning at the same speed would be lost and, as the rotors overlapped, they could be expected to destroy each other. With only enough gearboxes to supply the Trials Unit for one more month, it was proposed to disband the Belvedere squadron now forming and replace the whole force of 25 Belvederes with 57 Whirlwind Mk 10s.*

There were now two schools of thought within the Air Staff, one headed by VCAS which accepted the proposal to cancel the Belvedere, and the other by DCAS, but made up of only the Operational Requirements cell (DDOR 7), which recommended that the search for a solution should continue. The latter, however, was in a somewhat difficult position as it had argued in May 1960 that the Belvedere, although previously suspect, was now showing great promise. This view had been dismissed by the aircraft's detractors with the contemptuous comment that DDOR 7's hobby horse had now 'broken into a gallop'.(13)

Fortunately, a few days later in May 1961, DCAS was able to announce a two-stage modification plan for the gearboxes with a solution promised by September or October.(14) The result would be a gearbox life of 250 hours rising by stages to 1000 hours. By July the rig testing of these modifications had been carried out satisfactorily and during the following month the transmission trials were completed. The fourteenth production Belvedere had now flown and the first two aircraft were cleared for delivery to the RAF at the end of August, allowing the Trials Unit to re-form as No 66 Squadron and preparations for the move to the Far East to be resumed.

It was now eight years since the Air Ministry had turned to the Bristol 173 as the type of helicopter best suited to its needs (see Chapter 4) and yet the aircraft had only just been brought to a difficult birth as the Bristol 192 after a very troubled gestation period, during which it had been extensively redesigned to meet the special requirements of the Royal Navy. Solutions for most of the technical problems remaining after the many complicated policy issues had been dealt with had had to be found with the aircraft already on the production line, a situation made worse by the fact that the Belvedere represented a very significant jump in three areas

*The relative payloads then expected over a 50 nm radius of action in the tropics were: 4200 lbs for the Belvedere and 1850 lbs for the Whirlwind at sea level, and 3700 lbs and 1500 lbs respectively at an altitude of 2000 feet (12)—somewhat ambitious figures for the Whirlwind which apparently took no account of crewmen or survival equipment.

of helicopter technology simultaneously: the use of turbine engines in rotary wing aircraft, the coupling of two engines to the transmission system, and the tandem rotor configuration. In many respects the Belvedere was then well in advance of its nearest rival, the Vertol 107 which later became the Boeing Vertol Chinook.

A final moment of crisis was still to come, however. In January 1962, with eight production Belvederes already delivered to No 66 Squadron at Odiham, a new fault was revealed when several sets of roller races in the transmission system were found to have collapsed. The engineering staffs predicted gloomily that rectification and testing could not be completed in less than eight months. No 66 Squadron's deployment to the Far East was postponed and all the Belvederes were grounded.⁽¹⁵⁾ However, the cause of the trouble was soon identified as cold weather which had the effect during the starting process of delaying the circulation of thickened oil to the three gearboxes from the single pump employed. The aircraft clearance was accordingly amended to forbid start up in ambient temperatures of less than plus five degrees centigrade (awkward at Odiham, but hardly a problem in the Far East) and by 9 February the deployment plan was once more in train.

The Formation of the Belvedere Squadrons

No 66 Squadron re-formed officially at Odiham from the Trials Unit on 15 September 1961, equipped with six Belvederes and two more allocated for training, as part of the light cargo force which had been established to support the Far East Land Forces (FARELF). Its personnel moved to the Far East Air Force (FEAF) in the spring of 1962 to take over its six Belvederes which had been sent there by sea. No 72 Squadron, which was to stay in the United Kingdom, formed at the end of 1961 with the Belvederes remaining at Odiham, and No 26 Squadron, destined for Aden and Air Forces Middle East (AFME) forming from it in June 1962, building up slowly and moving overseas piecemeal between January and October 1963. No 72 Squadron stayed at Odiham, acting as a training unit for No 66 Squadron and as a base for No 26 Squadron, while also providing to some extent the facilities needed to carry out and test the many airframe and engine modifications still required on the Belvedere even after it had entered operational service. No 72 Squadron was thus functioning almost as a Belvedere training and modification depot, while at the same time making an occasional contribution to Army exercises and demonstrations. One of its first tasks was to lift the spire on to the roof of the new Coventry cathedral and surmount it with a piece of impressionist sculpture (see Chapter 10).

In October 1963 three more Belvederes were sent to the Far East as part of the plan to strengthen the helicopter force there during the period of confrontation with Indonesia over Borneo. Their departure signalled the end of No 72 as a working Belvedere squadron and after two last aircraft had been despatched to Aden in

March 1964, what remained of it at Odiham was reduced to the status of a conversion unit to supply replacement aircrew to No 66 and 26 Squadrons, while No 72 Squadron itself re-formed immediately at Odiham as the second Wessex squadron.

No 26 Squadron disbanded in Aden in November 1965, having virtually collapsed at the end of 1964 after three of its aircraft had been written off in the previous six months following major technical failures, and after attempts to restore serviceability in the remaining four had met with an evident lack of success. The four were transferred to FEAF where, by contrast, No 66 Squadron was going from strength to strength, as indeed it continued to do until its disbandment in March 1969.

References to Chapter 8

- 1 IIA/11/2/30/Pt 3.
- 2 Ibid.
- 3 Ibid.
- 4 Ibid.
- 5 Author's experience.
- 6 Chief test pilot.
- 7 ID9/F1-101.
- 8 Belvedere Trials Unit reports.
- 9 Ibid.
- 10 ID9/F1-101
- 11 Ibid.
- 12 Ibid.
- 13 IIA/11/2/4/Pt 4
- 14 ID9/F1-101.
- 15 Ibid.

CHAPTER 9
POLICY CONSIDERATIONS IN THE FIRST PART
OF PHASE 3 AND THE FORMATION OF THE SRT FORCE

In a paper written in May 1959 VCAS argued that the campaigns in Malaya and Cyprus had proved conclusively that helicopters had an essential role to play in British defence policy, that they would continue to be needed through the 1960s in the Arabian Peninsula and in Africa, and that the RAF would be open to severe censure if it failed to respond. A case could therefore be made, he believed, for ordering 32 Whirlwind Mk 10s immediately in order to provide a global establishment of 21 over five years. He emphasised that these helicopters would be additional to purely Army requirements for short range transport, as the term was then defined.(1)

VCAS's paper represented the RAF's last attempt to put forward a tactical helicopter requirement of its own, basing its argument on the need to avoid a repetition of the situation which arose in the 1950s when there were too few helicopters available to deal with the Malayan and Cyprus emergencies. The RAF, however, was no more in a position in 1959 to put forward a requirement of its own than it had been in 1948, particularly as the Bingley Committee on transport requirements had only recently made it clear that the RAF's responsibility in respect of tactical helicopters should be limited to meeting Army needs—which had still to be identified. But, as a decision on them was soon to be taken, the Air Council decided to defer action until the detailed requirements for the new short range transport force had been announced.

What happened in the policy sphere at this time is of particular importance as it was to lay the foundations of the RAF's tactical helicopter force in the 1970s. In the meantime the helicopter operations in Aden and Borneo in the 1960s were another ad hoc response to sudden emergencies and the helicopters employed in those territories on counter-insurgency and anti-guerrilla duties were those scheduled to form the new short range transport and light cargo forces. Consequently, although the views which VCAS expressed in May 1959 proved justified, part at least of the proposed new helicopter force was available in time.

At the end of 1959, following a recommendation to the Chiefs of Staff by the Bingley Committee, it was decided in a Long Term Defence Review that, inter alia, the air transport force for Army support should contain an element described as a 'light cargo force' and made up of 38 Twin Pioneers and 12 B 192s, later known as Belvederes. In the case of the helicopters this ruling was interpreted to mean 25 Belvederes to support a unit establishment of 12 with a service life of 10 years.(2)

By early 1960, however, the practice of assessing tactical lift requirements in terms of 'company lifts' in the various theatres had become generally accepted. So, the short range transport (SRT) requirement for late 1961 was put at a simultaneous two-company lift (250 men) in each of five theatres: the United Kingdom, Germany, Cyprus, Aden and the Far East. It was agreed at the outset that of this total one two-company lift would be supplied by the Royal Navy, and in all subsequent discussions about the size of the SRT force, this Naval contribution was assumed to remain unchanged. Consequently, references to that discussion here take into account only the RAF contribution and assume the addition of a Naval two-company lift. To these two-company lifts was added an airborne logistic support element, referred to as the light cargo force and consisting entirely of helicopters (including the Rotodyne), with the capability of lifting a total of 100 tons a day worldwide with a 200 nm radius of action. A further element was to consist of a tactical transport force to lift two battalion groups, a task for which 30 Beverleys and 24 Hastings would be needed together with 50 Armstrong Whitworth 660s, which were described as having a STOL capability.(3)

Some time later all tactical transport helicopters came to be referred to as 'support helicopters', including those in both the short range transport force and the light cargo force, but in the early 1960s the two elements were discussed and planned quite separately. The Belvedere was thought of then as part of the light cargo force and quite distinct from the SRT force which was to progress from Sycamores and Mk 2 and 4 Whirlwinds to Whirlwind Mk 10s and Wessex Mk 2s. With only small-scale operations in Aden and none as yet in Borneo the SRT force could be whittled down in 1960 and 1961, and the Belvedere could still be regarded as a candidate for the light cargo force, and not as the heavy element of the SRT force which it inevitably became.

The process of whittling down began in December 1959 when the Land/Air Warfare Committee argued a need for only a six company lift, three being located in Germany; the requirement would then be 16 Whirlwind or Wessex squadrons and 18 Rotodynes. The Treasury promptly stepped into the arena with a strong protest against buying the Wessex, at least in the numbers proposed. They argued that the only reason for having them in addition to, or instead of, Whirlwinds appeared to be their capability to carry Jeeps underslung, and that the order should be limited to the number needed to meet that particular requirement. In reply, the War Office explained why it was preferable to have 10 men in one Wessex helicopter rather than five each in two whirlwinds. The RAF supported the Army in seeking to have the main part of the SRT force equipped with Wessex, but was not directly involved in the detailed examination carried out by the Treasury in January 1960, during which the balance of the argument tilted against the Army. At the same time, the proposed light cargo force was to consist of eight Rotodynes in Germany and 22 Belvederes divided between Aden and the Far East, with a total lift capability of one hundred tons a day.(4)

In February 1960 the Air Ministry obtained War Office agreement to putting forward a proposal for a five-company lift, a figure which, it was hoped, might prove more acceptable. It then explained to the Treasury in detail why one Wessex did not equate with two Whirlwinds and why therefore it was requesting authority to order 30 Wessex in addition to the 40 Whirlwinds already authorised. Meanwhile the Ministry of Aviation, concerned that the Rotodyne would prove too noisy for the civil market, had asked whether the RAF would accept six of them, if they were ordered for BEA and then not given clearance. The RAF, still convinced that the Rotodyne would not prove acceptable for military use, replied that it had no authority to place an order, but was then faced with a rapid change in the situation when the Chiefs of Staff, determined to press ahead with initial orders for the SRT force, invited it to obtain enough aircraft for a six company lift.(5) With the 40 Whirlwinds already authorised constituting half the requirement, what was now needed was 35 Wessex and nine Rotodynes, with a further build-up in prospect. The RAF parried with the comment that Faireys, the Rotodyne manufacturers, would need a minimum order for 12, only to find a month later that the Treasury had in fact agreed, albeit reluctantly, to the purchase of all 12 aircraft.(6)

The Belvedere, being part of the light cargo force, was not involved directly in these negotiations, as was the Rotodyne which seemed for the moment immune from any risk of cancellation because of its specialised role in the SRT force of providing the crane lift held to be essential in the battlefield area or close to it. All the same, in May 1960 the RAF carried out a high level enquiry into the possibility of replacing some of the Wessex in the proposed SRT force with Belvederes, since a heavier lift than could be provided by the Wessex—now described as an assault troop lift helicopter—would be needed if, as the RAF expected, the Rotodynes did not materialise.(7)

The situation was made more complex during these first six months of 1960 by the presence of a number of cross-currents: the future of the Belvedere itself was still in doubt (see Chapter 7), and pressure to buy the Rotodyne was intensifying,(8) although this was now being countered by a RAF proposal to replace it with the fixed-wing twin-engined Caribou. VCAS indeed wrote to the C-in-C Far East Air Force to explain that the Rotodyne would be ordered only if the government insisted and that the Caribou would be a much better proposition, an idea which the C-in-C was invited to put to the Army in the Far East as part of the campaign in London 'to help stamp out the Rotodyne'.

It will have been noted that if the Caribou could be regarded as a potential replacement for the Rotodyne, the latter must now be seen in the light cargo role rather than as the crane lift for the SRT force. That this was how the RAF had begun to look upon the Rotodyne is confirmed by a further variation in the company lift costings: in June 1960 Air Plans proposed a five-company lift, two in the United

Kingdom/Germany (21 Whirlwinds), one half in Cyprus, one and a half in Aden and Kenya (22 Wessex), and one in the Far East (27 Whirlwinds to be replaced later by 14 Wessex). The Chiefs of Staff approved these proposals, but added four Rotodynes for cargo lift in each of the three overseas theatres.(9) Clearly the argument that the presence of the Rotodyne in the SRT force was justified by a supposed crane lift requirement had been abandoned, while for its part the RAF was now convinced that the light cargo force task could be met by 14 Belvederes and 18 Caribous.(10)

In the second half of 1960, after the Belvedere Trials Unit had been formed, opinion hardened against the Rotodyne. Air Plans proposed deleting it from the Order of Battle on the grounds that it was too expensive, too late (it was not now due until 1966) and unnecessary, because its crane lift had not been shown to be essential and should a small-scale lift be needed it could probably be provided by the Belvedere up to two or even three tons.(11)

The debate was then complicated by the Army putting forward a firm requirement for 40% of the cargo lift (54 tons a day for 30 days) to be carried by VTOL aircraft over a 200 nm radius. The Rotodyne itself was not mentioned specifically, although the new Westland Westminister was suggested as a possible choice. In reply, the RAF contended that it was completely inappropriate to carry cargo over 200 nm by helicopter. What was needed was a judicious mix of fixed-wing STOL aircraft and helicopters, the latter operating over only the last 25-50 miles. Consequently, the task of lifting 136 tons a day should be carried out by a force of 14 Belvederes and 26 Caribous (an increase on the 18 originally proposed).* These were in addition to the SRT requirement, which the RAF currently put at 27 Whirlwinds and 57 Wessex, both types incidentally being now referred to as 'utility helicopters', a term not used before and seeming to indicate a growing preference for a standard, simple and rugged machine as the battlefield helicopter of the future.(12)

In October 1960 the respective Army and Air Force positions on the shape of the future light cargo force were restated by the Land/Air Warfare Committee. The Army continued to put forward a short-term demand for a mix of Belvederes with either Chinooks or Westminsters, with full supply support by VTOL aircraft as the long-term objective. The RAF however argued that a mix of STOL aircraft and Belvederes was, in all respects, the much better interim solution, but to make their proposal more palatable they offered to raise the establishment of the Belvedere element in the light cargo force to 18, so committing the entire fleet apart from

*The Army demand for the Rotodyne and later the Westminister (which the RAF also considered unsatisfactory) bore a strong resemblance to the campaign mounted in the early 1950s to buy the Air Horse (see Chapter 4).

two aircraft retained for training purposes. By November 1960 a compromise had been reached: the light cargo force was to consist of 32 Caribous delivering 172 tons a day over 165 nm, and 18 Belvederes lifting 100 tons a day over 35 nm. Meanwhile, the SRT force was still geared to a five company lift, three rising to four by Wessex, and two reducing to one by Whirlwind.(13)

These decisions, however, left the Minister of Defence in a very difficult position as he was personally committed to supporting the Rotodyne and would be faced with a soaring burden on the defence budget if civil orders too did not materialise. 'The decision already announced,' he wrote, 'about military support for the project could only be reconsidered if there was an identifiable change in the technical situation or military requirement since it had been taken . . .'(14) By now, however, matters had gone too far and there were no alternatives remaining. The Rotodyne order was cancelled and in due course the Caribou project too was dropped. In all, it was a most unfavourable moment for the Belvedere Trials Unit to draw attention to major faults in their pre-production aircraft (see Chapter 8).

As has already been seen, the Belvedere entered squadron service with some technical faults still to be remedied and in consequence the compromise reached in November 1960 was not fully implemented.(15) Instead of receiving the promised nine aircraft each the two squadrons which were to operate overseas, No 66 in the Far East and No 26 in Aden, were allotted only six each for the moment, while a third squadron, No 72, was formed with the remaining six aircraft to provide training and technical support for the overseas squadrons.(16)

Happily, there was no urgent need as yet for the Belvederes either in the Far East or in Aden; the Brunei revolt had not yet begun and in Aden the military threat was less of a concern than were the accommodation shortage and the difficulty of providing the new helicopters with hangar space and technical facilities; these were not expected to become available until March 1963.(17) By then, however, both theatres would be in deep crisis with an inevitable rise in the demand for helicopter support. This would be met, as it happened, in Aden by the Belvederes originally intended for the light cargo force and used there for gun and troop lifts until overtaken by technical problems, and in Borneo by a mix of Belvederes and SRT force Whirlwind Mk 10s, which were to fill the gap while the Wessex Mk 2s went through the seemingly normal development cycle of promises, delays, cancellation threats, reassessments and late deliveries.

The Introduction of the Wessex

In February 1961, in an unprecedented reversal of roles, the Royal Navy requested access to the Wessex Mk 2s ordered for the RAF. With previous Westland aircraft—

the Dragonfly, Whirlwind and initially the Belvedere—the Navy had been given priority, one result being the great difficulty the RAF had had in obtaining Dragonflies for the Malayan campaign (see Chapter 2). Since then naval and air force policies had diverged and when the two Services began to replace their earlier marks of Whirlwind the Navy ordered the Mk 7 (the Leonides Major piston-engined version),(18) while the RAF chose the Mk 10 with its Gnome turbine engine. The Mk 7 was not a success in terms of performance or reliability and the Navy soon ordered the Wessex to replace it, choosing however the Mk 1 with its single Napier Gazelle engine. The failure of this version to carry out the commando lift role led the Navy to ask for early access to the Mk 2 which was on order for the RAF, offering the Mk 1 in its place. The RAF's Director of Operational Requirements responded with the comment that the RAF should not be expected to suffer because of a mistake, whose consequences were entirely predictable, and that if the Mk 1 could not carry out the trooping role for the Navy, neither could it for the RAF. He suggested, however, that the Navy could be offered a number of Whirlwind Mk 10s,(19) which over a 50 nm radius of action could carry a payload of 1500 lb, compared with 550 lb for the Mk 1 Wessex and 3000 lb for the Mk 2 version. Thus the Whirlwind Mk 10s being obtained for the RAF could carry almost three times the payload offered by the Wessex Mk 1, which was the Navy's chosen replacement for its own failing Whirlwinds. The RAF's suggestion was not taken up.

By September 1961, with the future of the Belvederes virtually settled, it was the Wessex Mk 2 which became the centre of attention as the potential backbone of the new SRT force. Two factors, however, were working against the new aircraft. First, a CA release date for the order placed in 1961 had been expected by the end of 1962, but a postponement to 1963 now seemed inevitable. Second, DCAS had raised further doubts by suggesting to CAS that the decision to buy the Wessex might have been wrongly based: the War Office requirement was for a payload of 3650 lb at 7000 feet in ISA+30 degrees centigrade with a radius of action of 50 nm, whereas in those conditions the new aircraft would have a radius of action of only 30 nm. The Chinook, he added, could be available in the same timescale, with a rear loading ramp, lower initial costs and considerable development potential. He made no firm recommendation, however, to scrap the Wessex in favour of the Chinook, suggesting only that the latter should be kept in mind should the Wessex situation deteriorate further.*(20)

By May 1962 the inevitable slippage had taken place and with the Wessex not expected to enter squadron service until 1964, VCAS formally recommended that

*The Wessex Mk 2 was, in fact, a twin turbine-engined version of an old Sikorsky design which first appeared as the S-58 and was itself a development from the piston-engined Whirlwind.

it should be replaced by the Chinook.* The SRT force had now been scaled down to a four company lift worldwide—one each in Aden and the Far East, and two in the United Kingdom and Germany—and could be met by one squadron of six Chinooks in each theatre.** The total cost for the Chinooks was put at £14492000 compared with £17460000 for a further delivery of Belvederes, which would need a redesigned fuselage to enable them to carry troops. How reliable these figures were was a matter of some doubt and CAS was advised to hold an Air Council meeting and be on his guard against Ministry of Aviation opposition.(21) DCAS's submission to the Air Council meeting suggested that there were four choices open: 29 Chinooks, or 21 Chinooks and 30 Wessex, or 42 Belvederes, or 60 Wessex. The cost was put at £19 million, plus or minus £2 million, for each option, but with cheaper running costs for the Chinook. The Belvederes and Wessex, he concluded, would both need replacing by 1970, but the Chinook might run on until 1975 with only six needed to supplement the original 29 and ensure that the fleet stayed the course.(22) The effect on British industry of cancelling the Wessex would be unfortunate, he agreed, but the blame would be theirs, because they had persistently failed to meet promised delivery dates.

In the event, it was decided that the Wessex could not be cancelled, and after lengthy discussions, which included such aspects as the desirability of buying British, it was proposed to continue with it but with minimum backing only, pending possible replacement by the Chinook, which might be built in the United Kingdom.(23) At this stage the future of the Wessex looked as bleak as had that of the Belvedere at the height of its misfortunes. In mid-1962, therefore, buying the Chinook seemed a distinct possibility, a course which would have radically altered the whole subsequent development of the SRT force. In fact, the failure to follow up a number of possible developments in the case of the Belvedere, together with a reluctance to accept the Chinook, ensured the survival of the Wessex, even though it continued to suffer design and development delays, especially over the gearbox coupling for the twin engine installation. Indeed, in September 1962 the Ministry of Aviation warned that because of problems in that area CA release for the Wessex would be delayed until the end of the year. The contractor's delivery date was now March 1963, but according to confidential advice from the Ministry

*This recommendation might seem a remarkable volte face on the part of the Air Staff which had fought hard for the Wessex as the Whirlwind replacement. It was, however, the result of a very detailed study of the data then available, supported by what later proved to be a highly professional assessment of the Chinook's development potential. Although the recommendation to buy the Chinook was rejected in 1962, it stood the test of time and was put forward repeatedly in the following years until finally accepted 18 years later.

**The reduction from five company lifts to four was achieved by deleting the half company lifts intended for Cyprus and Kenya.

of Aviation more realistic dates would be September for temperate climates and some time later for tropical clearance.(24) The SRT force was further scaled down, reducing the four company lift to three, by deleting Aden from the list of locations to be served.

It might perhaps have been thought that in view of the helicopter's operational achievements and its firm place in the RAF's future plans it would have been fully accepted at last as an aspect of air power—in spite of production difficulties and reservations over delivery dates. But there were some who remained unconvinced of its lasting relevance and were awaiting the moment when fixed-wing technology would catch up, as it were, and restore aviation to its rightful path of development. In September 1962, for example, the Secretary of State for Air had reviewed the Wessex situation along with past and present problems with the Belvedere. He concluded that there seemed to be a large number of different types in service, with British helicopters prone to extraordinary difficulties, both during development and in the course of subsequent service. Capital and running costs were very high and it seemed possible—in his view—that the helicopter had only a limited future, as other VTOL developments (ie fixed-wing) might soon come to light. He could see no significant inroads being made by rotary aircraft in the field of civil aviation, and he suggested that it might be wise to discourage exclusive concentration on helicopters by civilian manufacturers such as Westlands, even if it meant company closures.*(25)

There was no radical change in the situation during 1963: the Wessex continued to survive, but with its backing limited to an order for six additional aircraft with which to prolong the service life of the Wessex fleet until 1968. The Army, meanwhile, had used the shortage of RAF helicopters in Aden and the Far East to back its own claim for more Scout helicopters and an interim purchase of Alouettes.(26) In March 1964, with the Wessex delays continuing, still due in the main to the coupling gearbox, AMSO vented his frustration on the Ministry of Aviation. He rejected any attempt to put the blame on the contractors, arguing that the present delay was due to an agreement made by the Controller of Aircraft in the Aviation Ministry to divert eight engines and four gearboxes to Iraq, an arrangement which it was promised would delay RAF deliveries by no more than a month, although it now seemed that they would not be completed until well into 1965.(27) As on a very similar occasion in 1952 when during a dire shortage of Dragonflies in Malaya export orders to Iraq and elsewhere were found to have had Foreign Office support (see Chapter 2), high level pressure had to be brought to bear. As a result the Air Council was confident that deliveries would be speeded up and that the two new Wessex squadrons would become operational by the end of 1964.(28)

*Two years earlier the then Minister of Aviation, Mr Duncan Sandys, had encouraged Westlands to absorb both Fairey Aviation helicopters and the helicopter division of the Bristol Aeroplane Company.

The Formation of the Wessex Squadrons

The Wessex Trials Unit was formed at Odiham in mid-1963 and reconstituted as No 18 Squadron at the beginning of 1964. A few months later a second Wessex squadron was formed, taking over the number plate of the home-based Belvedere squadron, No 72, now reduced in status to that of a Belvedere Conversion Unit. Both squadrons continued to operate Wessex helicopters until the beginning of the 1980s, No 72 based in the United Kingdom and No 18 mainly in Germany.

In mid-1965 a third Wessex squadron, No 78, was formed and sent to Aden to replace the ailing Belvedere squadron there, No 26. After the withdrawal from Aden in 1967 it moved to Sharjah and remained there until 1971, when British forces left the Gulf. In the last four years of its existence (1968-71) it gave rise to an independently operating SAR flight in Bahrein to which a communications task was added in 1969 (acknowledged by a change in title to Comsar Bahrein). After 1971 the aircraft along with the other assets of the two units were used to re-equip the two remaining Whirlwind squadrons in the Far East, No 28 in Hong Kong and No 103 in Tengah, and were the first Wessex to operate in that theatre.(29)

The Introduction of the Whirlwind Mk 10

The introduction of the Whirlwind Mk 10 was comparatively smooth, production delays being measured in months rather than years, as was the case with the Belvedere and Wessex. Apart from the addition of fully duplicated power controls, the only other basic change from the Mk 2 and Mk 4 was to substitute the de Havilland Gnome gas turbine for the Pratt and Whitney piston engine and make the consequent changes in the shape of the nose cowlings. The original transmission and rotors were retained, and the only significant technical problems to cause delay and continue into the operational life of the aircraft were connected with the automatic computer-controlled fuel flow device.(30)

The Whirlwind Mk 10 was the first RAF helicopter to appear with automatically governed constant rotor speed control, and an ability to revert to manual pilot control in the event of computer malfunction, not uncommon in the first few years, was a necessary provision. Computer-controlled fuel flow was incorporated as much to protect the engines as to assist the pilot, since mishandling of the manual throttle, particularly during start up, was all too easy and the resultant surge could ruin the engine in seconds. Computer failures normally had only two consequences: 'frozen fuel flow', a self-explanatory term, or, more often, engine shut down. Pilots, therefore, had to stay in practice both in reverting to manual throttle control and, especially, in making engine-off landings, an easy manoeuvre with the Whirlwind in the right terrain.

These were all mainly teething troubles, which could be overcome satisfactorily, given a little time. Consequently, the formation of Whirlwind Mk 10 squadrons went ahead without much difficulty. The use of the original Whirlwind transmission with a limiting power acceptance of 700 lb shaft horsepower (which could not be obtained with the piston engine), but now driven by a Gnome engine which was not only lighter than its predecessor but was also able to supply 1100 lb shaft horsepower, resulted in a near trebling of the payload at sea level in temperate climates, with a reduction of only three per cent in tropical conditions. A further reduction of only twenty per cent would be experienced at 7000 feet in the tropics. With the additional advantage of an increase in cruising speed of almost fifty per cent the Whirlwind Mk 10 represented as remarkable a step forward in light helicopter performance as did the Belvedere in its own heavier class.

The Formation of the Whirlwind Mk 10 Squadrons and the Short Range Transport Force

The plan formulated in 1961 included the deployment of one Whirlwind Mk 10 squadron in the United Kingdom, a second in Germany, and two more in the Far East. The United Kingdom squadron was already in existence: No 225, the first official tactical helicopter squadron, formed from the disbanded JEHU (see Chapter 6) and equipped originally with a mixture of Whirlwind Mk 2s and Sycamores; these were replaced by Whirlwind Mk 10s in mid 1962. At almost the same time a second Whirlwind Mk 10 squadron was formed by re-equipping a former Pioneer squadron, No 230; this was then despatched to RAF Germany. The two Whirlwind Mk 10 squadrons intended for overseas already existed as Sycamore squadrons, Nos 103 in Cyprus and 110 at Butterworth; both were re-equipped early in 1963 and were deployed to support operations in Borneo.*

Thus by 1963, with the Borneo campaign underway and the pace of operations quickening in Aden, the long term plans for the five company lift, reduced to four in 1961 and then to three a year later, had happily resulted in the right number of squadrons being available to meet the demands of the Borneo campaign, albeit with Whirlwinds instead of Wessex, but including No 66 Belvedere Squadron.** In Aden No 26 Belvedere Squadron, having been committed to that theatre under the 1961 plan, and being unaffected by its subsequent removal from the list of planned

*Whirlwind Mk 10s were also used to re-equip the two UK SAR squadrons, Nos 228 and 22, in late 1962; others were planned for the SAR role in Cyprus and Aden, but not for SRT duties in either theatre.

**Under the 1961 plan the Mk 10 Whirlwinds in the Far East were to be replaced by Wessex in 1964, but at the height of the Borneo operations FEAF refused to accept a third helicopter type and elected to continue with a larger number of Whirlwinds.

SRT locations, was available in time to provide SRT support for the Radfan operations.

By now it was clear that the neat and tidy concept of a separate light cargo force supporting a short range transport force was not going to materialise. The almost simultaneous appearance of the Belvedere and the Mk 10 Whirlwind, ideally complementing each other's capabilities, inevitably led to their working closely together during the Army exercises then being mounted with the support of No 38 Group. As a result it soon became apparent that there were numerous SRT tasks which only the Belvedere could perform; and so in the course of training there developed a level of co-operation between the Belvedere and Whirlwind Mk 10 elements which was to prove of considerable value during the Borneo campaign.

The Choice of helicopter for the SRT Force in the 1970s

With plans for the SRT force in the 1960s settled, the Air Ministry was able to look ahead and choose the ideal helicopter for the 1970s. But once again, as with the Dragonfly, the Sycamore, the early marks of Whirlwind, and the Wessex Mk 2, the RAF was to find itself committed to a helicopter which, although conscientiously chosen as the best available in the circumstances, fell short of what was really needed. However, the Air Ministry, aware of the Navy's errors of judgement over the Whirlwind Mk 7 and the Wessex Mk 1, and aware too of the need to find a replacement for the Belvedere in due course, entered into consultations with the Navy and raised a Joint Naval/Air Staff Target (JNAST 358) for a general purpose helicopter to be available by 1970 and combine the RAF's SRT role with the Navy's anti-submarine and commando carrier roles.(32) This target was, in fact, the latest version of the heavy lift project which originated in RAF proposals of the early 1950s and had given rise to the Rotodyne and Belvedere. It was now classified as a medium lift helicopter (MLH) to distinguish it from the heavy lift projects (over five tons payload underslung), which were then in an early stage of design in the United States.

For the RAF, JNAST 358 laid down a payload of 8000 lb over a 50 nm radius of action, or 5600 lb over 100 nm; and a crane lift capability of 10000 lb. For the Navy it was to carry 2000 lb of sonar equipment and to have a three hour loiter capability at a range of 30 nm from the carrier.(33) One possibility in this context, once the Westminister and the Rotodyne had been eliminated, was the WG-1, a Westland project inherited from Raoul Hafner's team in the helicopter division of the Bristol Aeroplane Company before it was absorbed by Westlands in 1960. The WG-1 was a development of the Belvedere and previously known to Bristols as the B-194; it had a tandem six-bladed rotor configuration and a small fixed wing as fitted to the original B-173, but was powered by four Gnome engines. Other theoretical candidates were a variant of the Chinook, also powered by four Gnome engines,(34) and

the single main rotor helicopter (CH-53) which Sikorsky was known to be planning and which was believed to have comparable performance.

The Air Ministry, however, although not wholly disinterested in these possibilities, was much more concerned in 1964 with finding a smaller and highly tactical support helicopter, since it now saw that JNAST 358 would result in an aircraft of relatively enormous size and cost. In March of that year DCAS made it clear that the main need was for a tactical helicopter and that if the crane lift requirement were shelved, JNAST 358 should be cancelled.*⁽³⁵⁾ Accordingly, four months later a new target was produced (JNAST 365) which added air portability to the other characteristics required of the tactical helicopter. The new target resulted in the eventual emergence of the twin-engined Puma, derived from the Sud Aviation 330 but with a marked resemblance to the Bristol 214, which had generated little interest when Bristols had first shown a mock-up in London in 1959.

The Expansion of the SRT Force in Borneo

The discussions just referred to took place against a background of events which had a close resemblance to the circumstance of 1952-53 when there was an unexpected surge in the demand for helicopters to take part in the Malayan campaign (see Chapter 2). By 1964 operations in Borneo were being conducted on a scale which demanded more helicopters than were available in FEAF, even after the addition of No 103 Squadron from Cyprus, all but four of No 225 Squadron's Whirlwinds from Odiham, and three more Belvederes from No 26 Squadron, which were diverted to the Far East after a No 38 Group exercise in North Africa (see Chapter 9).**

Once these reinforcements had been despatched, however, the RAF had little more room for manoeuvre. No 225 Squadron's four remaining Whirlwinds were one obvious possibility, but to send them would mean denuding No 38 Group of its last Whirlwinds and the only ones equipped to fire the SS-11 wire guided missile (see below under the Arming of Helicopters). An assessment of the other possibilities⁽³⁶⁾ showed that these amounted to the newly formed Wessex squadron, No 18; the Whirlwind squadron, No 230, based in Germany and earmarked to NATO for Saceur; the remaining Belvederes of No 26 Squadron; and the aircraft of the SAR and flying training establishments based in the United Kingdom.

As FEAF was reluctant to accept the engineering and supply complications involved in the addition of a third helicopter type to the force of Belvederes and Whirlwinds

*It was to take years of effort before the RAF obtained the MLH in the shape of the Chinook. The Navy meanwhile had found that, as with the Belvedere, it could not join in a project for a helicopter as large as that proposed in JNAST 358.

**These reinforcements from No 38 Group were known as Spine Force.

already operating in the theatre,* (the only practical possibility was No 230 Squadron in Germany. But as it was evidently not yet thought necessary to maintain continuous radio control of low flying helicopters in the European theatre, No 230's Whirlwinds were not equipped with H/F radio. In the event it was decided not to redeploy No 230 Squadron for the moment, and an offer from the Navy to provide the radios was not taken up.(37) In the following year, however, No 230 did go to Borneo, the NATO task being assumed by the Wessex of No 18 Squadron.

Meanwhile, the Royal Navy had disembarked seven of their Whirlwind Mk 7s from the Commando Carrier Albion for operations in the central and eastern brigade areas of Borneo, and there seemed little prospect of their being released to resume their seaborne role. The Navy offered them to the RAF, an idea which did not appeal to the Air Staff which had discarded all thoughts of a Whirlwind with a Leonides Major engine in 1958 (see Chapter 4). AMP replied, therefore, that he could find neither pilots nor technicians to man them, and the Navy agreed to continue operating the Mk 7s until the end of 1964 and keep six more in reserve.

However, when the question arose of providing more naval Wessex for Borneo, the Navy's Flag Officer Middle East firmly resisted any suggestion that he should send any more helicopters to the Far East. The Commando Carrier Bulwark, he argued, was already supplying Wessex to Borneo and those aboard the Carrier Centaur in the Middle East were essential for anti-submarine protection and training, and to support the Radfan operations in Aden. To this, however, the Commander-in-Chief Far East, Admiral Sir Varyl Begg, replied that the Commando Carrier's Wessex had been allocated to Borneo when only five Army battalions were deployed there; now that there were ten, more helicopter support was needed. Consequently, it was decided to form an 'ad hoc' squadron of six naval Wessex to serve in Borneo, and accept the reduction in anti-submarine capability.(38)

For the Army, the search for helicopters to serve in Borneo came at a fortunate moment, as it was currently proposing a very substantial increase in the Army Air Corps. In the circumstances the RAF was ready to support the Army bid, at least in principle, on the grounds that any further contribution to the onerous reconnaissance and communications tasks would release more of the RAF's tactical helicopters to the trooping and resupply roles. The scale of the increase proposed by the Army, however, caused considerable surprise, no less than 285 new helicopters for reconnaissance, liaison and communications duties. In the face of so wholly unrealistic a demand, and with all three Services wanting more helicopters, some coordination of the various bids was clearly essential. A RAF brief for the Minister

*Such problems did not affect the Royal Navy which could provide full second line servicing and crew rotation for their Wessex from the commando carrier in the area.

of Defence pointed out that an Army Air Corps helicopter force of 500 was obviously absurd when seen alongside a total RAF strength of 700 aircraft of which no more than 200 were fighting vehicles. The RAF, however, was prepared to support an increase in the strength of the Army Air Corps of 50 light helicopters pending a detailed study of what was required. In the short term 12 Army Scout helicopters were allocated to Borneo and after three had been detached to HQ 3 Division near Colchester on the grounds that it was 'at notice' for operations, the remaining nine joined No 225 Squadron's last four Whirlwinds in Bulwark at Portsmouth for passage to Borneo.(39)

In parallel to the steps taken to increase the size of the helicopter force in Borneo, a very determined effort was made to remedy a number of technical deficiencies in the aircraft already there. The Admiralty and Air Ministry sent a joint note to the Minister of Defence pointing out that the supply of Gazelle engines for the Belvederes and of Gnome engines for the Whirlwinds and Wessex was far from satisfactory. The shortage of engines for the Wessex, in fact, meant that the Royal Navy was having to meet the Borneo requirement by restricting flying hours in other theatres. In addition, an extensive development programme was urgently needed for the Belvedere in no less than five areas: the engine starter system (there had been three serious fires already); vibration (which could not be cured without blade tracking equipment for rotor blade adjustments); yaw control (one fatal crash had already occurred due to yaw cable failure); the automatic provision of emergency power when one engine failed (this did not always occur); and the fuel system (a crash in North Africa had been caused primarily by a failure of a fuel supply line—see Chapter 10).

But as in the early 1950s constant complaints to the manufacturers at Air Ministry level produced little result and it became clear that what was needed once again was Ministerial pressure, and indeed by May 1964 there had been some positive reaction to the energetic representations made by the Minister of Defence, Mr Peter Thorneycroft. With Rolls Royce and Bristol Siddeley representatives joining others from Westlands in the Far East the technical and supply problems began to improve.

Meanwhile the Joint Staff response to the need for a larger helicopter force in the Far East had been to look again at the calculations which determined the number of simultaneous company lifts worldwide. Earlier calculations had resulted in 1960 in five-company lifts by the RAF and two by the Royal Navy's commando carriers; in 1961 in the deletion of one company lift by the RAF (half in Cyprus and half in Kenya); and in 1962 in the deletion of a further company lift by the RAF (in Aden).(41) What remained was a combined total of five-company lifts, three by the RAF (one each in the United Kingdom, Germany and the Far East) and two by the Royal Navy (split between Albion and Bulwark).(42) The level of combined

RAF and RN capability in early 1964, however, was only three-and-a-half company lifts,* and the target of five-company lifts would not be reached until 1965 when the build-up of the Wessex Mk 2 force for the RAF and Mk 3 for the Navy would be complete.**

After taking new calculations into consideration the Chiefs of Staff decided that a combined seven-company lift would be too expensive at £21 millions in relation to the other projects which would have to be forgone, and recommended a combined six company lift at £11 millions, a price which included the purchase of twenty additional Wessex at the cost of £5 millions. It was noted, however, that the Wessex was an old design and that the increase to four RAF company lifts could not be effective until 1966.***

The reaction of the Minister of Defence to these proposals for an enlarged helicopter force was notably enthusiastic, more so in some ways even than that of the Chiefs of Staff, an in marked contrast to the reactions common in the 1950s when RAF attempts to obtain more helicopters foundered in the face of continued scepticism about the helicopter itself and fear of the expense involved—at least until General Templer forced the issue in Malaya (see Chapter 2). Thorneycroft, for his part, having had some success in pressing the manufacturers to take active steps to remedy the many technical and spares problems as yet unresolved, told the Minister of Defence for the RAF on 28 May 1964 that in his opinion not enough was being done in the field of helicopters. He had always found that they ranked high in the list of demands presented to him wherever he went overseas and he was therefore giving serious consideration to a 50% increase over the next few years in the size of the helicopter force, present and planned.

To the Chiefs of Staff he added that purely theoretical calculations based on a requirement to lift a stated number of units were clearly out of tune with all the information pouring in from every operational theatre overseas, where the constant and growing demand was for more helicopters of almost every type.(45) Shortly

*The helicopter force in Aden was excluded from this calculation, having been deleted from the long term plan.

**The convention was that successive marks of the same type of aircraft should bear even numbers for the RAF and odd numbers for the RN. Thus the naval Mk 3 Wessex was the twin Gnome engined version following the single Gazelle engined Mk 1 and was similar to the RAF Mk 2.

***A longer term study of future SRT requirements referred to the SA 330 (which entered RAF service as the Puma) with its better ferry range and better airportability as 'more suited to the age of the Belfast'.(44) So, in its origins JNAST 365, mentioned above and leading to the Puma, had links, however indirect, with the pressures brought about by the Borneo campaign.

afterwards, however, he left office following a general election, priorities changed and calculations continued to be made on the basis of the number of simultaneous company lifts which the current administration considered was necessary and could be afforded.

At about the same time an improvement was made in the Borneo situation when VCAS recommended an official establishment of 30 Whirlwinds for FEAF, instead of 14 Wessex, representing an overall increase of two-thirds of a company lift. The change from Wessex to Whirlwinds had the advantage not only of meeting FEAF's reluctance to accept Wessex at that time, but also of avoiding any modification of the tactical replacement plans which looked upon the Puma as a replacement for the Wessex.(46)

The decision was then taken to absorb the No 38 Group element of the helicopter reinforcements provided for Borneo, ie Spine Force, into the FEAF establishment. The establishments of the two FEAF Whirlwind squadrons, Nos 103 and 110, were raised from 10 to 15 aircraft each, and the separately established SAR element was absorbed between them.* No 230 Squadron, with its Whirlwinds at last equipped with H/F radio, was transferred by the Aircraft Carrier Triumph to Singapore, and thence by Bulwark to Labuan in January 1965, to replace No 225 Squadron which was disbanded later the same year. Two of the three Spine Force Belvederes were retained in Singapore, while the third was despatched to its original destination in Aden. All Belvedere personnel in Spine Force who belonged officially to No 26 Squadron were absorbed into No 66, into which they had in practice been fully integrated since their arrival in Singapore.**(47)

The Selection of Helicopter Pilots

In the mid-1960s a dramatic change took place in the official attitude to helicopter flying as part of a normal career in the RAF. Since the early days in the 1950s pilots had been selected on an ad hoc basis and inevitably from among those who were unlikely to progress to flying fast jet aircraft. Indeed, 35 was the minimum age limit in force in the years immediately following the formation of the Casualty Evacuation Flight in FEAF, a policy which had necessarily to be revised in the

*It was quite usual in overseas theatres for the SAR task to be seen as just one of the specialist tasks within the helicopter role, with allowance made for it in an appropriate squadron establishment, rather than as a full-time wholly SAR dedicated task as in the UK-based SAR squadrons.

**The Belvedere sent to Aden was the one later provided for display in the RAF Museum. It had returned to operations in Borneo when No 26 Squadron disbanded in Aden in 1965 and was transported to the museum when No 66 disbanded at Seletar in March 1969.

later 1950s during the first phase of rapid expansion in the helicopter force. But selection of helicopter pilots was still very much a matter of taking those who were thought to be unsuited, or less well suited, to flying other types of aircraft.

Attention was first drawn to the resulting imbalance by the Commander-in-Chief Transport Command, Air Marshal Sir Kenneth Cross, whose command included No 38 Group. He pointed out in February 1964 that under current policy all Cranwell and university trained pilots were sent to fixed-wing units, and that as a result there were no general list officers in helicopter units under the age of twenty-five. Helicopter squadrons, therefore, were denied a fair share of the best junior officers, and what was more, Helicopter Squadron and Flight Commander posts, and those for Test Pilots and Instructors, along with staff appointments, were filled either by less than the best material or by those with greater potential but lacking in helicopter background or experience.(48)

The seemingly radical suggestion that some Cranwell graduates should proceed to a first flying tour on helicopters was not received with much enthusiasm by the Air Ministry. Their reply included the revealing comment that new pilots needed fixed-wing experience to fit them for promotion, the implication being exactly what Sir Kenneth Cross was complaining about. It was also suggested that the Commander-in-Chief had taken too little account of the situation overseas where the proportion of general list officers in helicopter units was one to six. In returning to the attack Cross pointed out that it had become evident to all that a helicopter posting was far from a promising start to a general list career, and that it was fundamentally wrong to differentiate for career purposes between helicopter and fixed-wing flying. He also expanded on a point he had made briefly in his previous submission: the SRT force was very much in the front line, frequently required to operate independently and in difficult conditions from unprepared bases, and without doubt offered a variety of experience while calling for a considerable breadth of vision. Helicopter crews were in constant and close contact with the Army and Royal Navy while on active service, and more so than in most other roles. In all, he judged it to be important to have a fair proportion of Cranwell and university-trained pilots posted to helicopter units for their first flying tour. Replying, the Air Member for Personnel promised to discuss the matter further with the Vice Chief of the Air Staff.(49)

The subject was raised again a year or so later in July 1965 by FEAF's air Commander, Air Marshal Sir Peter Wykeham, who pointed out that while the Borneo campaign had accelerated the training of helicopter pilots, its conclusion would not negate the lessons learned during it, particularly that it was vital to maintain a vigorous helicopter force and that experience of handling it effectively would form a valuable part of any future commander's Service experience. The average age of officers in FEAF's helicopter squadrons, however, was 35; there

were few general list officers, and only the Squadron Commanders showed promise of moving into higher command. Exemplary though its performance was in Borneo, the helicopter force there lacked full career officers with leadership potential in the numbers needed to ensure that they could move freely to and from the fixed-wing roles.

Wykeham therefore suggested a selective increase in the number of permanent commission (general list) officers to perhaps one third of the total instead of the present one fifth, and an increase also in the number of high calibre flight and squadron commanders. Further, with enough helicopter pilots trained to the level which would enable them to transfer to and from the fixed-wing roles, there should be no objection to allowing some pilots to go direct from Cranwell to helicopter units.(50)

The Air Ministry's reaction was now entirely favourable and in September 1965 the Deputy Chief of the Air Staff was able to tell Wykeham that the policy of barring Cranwell graduates from a first tour in helicopters had been abandoned, and that the Air Ministry had already been at work on proposals of the kind suggested. It was now intended that from December 1965 some five cadets a year initially would be chosen at Cranwell to do their first operational tour in helicopters, returning afterwards to fixed-wing flying. These officers, together with the Squadron Commanders who would enter or re-enter the helicopter force as Squadron Leaders, would in time raise the General List proportion to nearly 30%. To achieve a lowering of the average age level of the force, half of all future intakes would be first tour pilots who would be retained on helicopters for at least five years; as a result the average age would be reduced to 26 or 27. Wykeham professed himself to be entirely satisfied with these proposals.(51)

So, by the mid 1960s the helicopter force had finally come of age: not only was its existence as a permanently operational entity now universally accepted, but it had also achieved a position of undeniable respectability in the career structure of the Royal Air Force—some 15 years after the first helicopter unit had been formed in 1950.

The Arming of Helicopters

To accept the helicopter as a standard tactical transport vehicle was one thing; to see it as a fighting aircraft equipped with fire power was a very different matter. A complex but intermittent discussion on the arming of helicopters had been in progress since the then Air Vice Marshal Wykeham had submitted a report to the Chiefs of Staff on his visit to the French Air Force in Algeria in October 1960. Partly as a result of that report the Air Council agreed in principle in September 1961 that some helicopters should be armed,(52) and in the following year proposals

were made for equipping Whirlwinds and Wessex with SS 11 wire guided missiles,* 20 mm cannon and 2-in rockets. The plan was that a number of SRT helicopters should be fully armed to the exclusion of payload and used in company with unarmed helicopters to provide protective and offensive fire in the event of ground fire being encountered. There was little support, however, for these proposals, which also raised a number of technical difficulties, and they were allowed to founder on the grounds of cost.

It was the general belief that a helicopter was far too vulnerable to be committed in the face of enemy fire, and that it could therefore never be used in an offensive role. An Air Ministry staff meeting in 1962, attended also by Admiralty, War Office and Joint Warfare staff representatives, accepted this contention in the main, and added that before a decision was taken to arm helicopters for an offensive or armed escort role, the need for such aircraft must first be established by joint service tactical trials. In any case it was also generally accepted that the SRT force was too small to allow a proportion of its aircraft to be permanently committed to the escort and armed reconnaissance roles as the Army wanted, and that there seemed to be no prospect of obtaining helicopters allocated specifically for these purposes.(53)

At the purely practical level it was left to the Assistant Chief of the Air Staff (Operations) to point out in June 1963 that SRT helicopters were not suitable for offensive roles, that the size of the helicopter force precluded the designation of specialised escort helicopters, and that consequently there would be no joint service trials. On the other hand, however, free gun mountings would be provided in SRT helicopter cabins for purely suppressive fire, two pilots would be carried when a threat existed, and the aircraft would be equipped with armour protection for the first pilot and self-sealing tanks to safeguard the minimum fuel needed to escape from an engagement. A month later the Vice Chief of the Air Staff endorsed these proposals, but declined to issue a formal statement of Air Staff policy on the question of arming helicopters. This had now become a matter of contention with the Army Air Corps, which could not intervene directly because of the weight limitation imposed on its own helicopters (see Chapter 4). VCAS directed, however, that experiments with the SS11 should continue using the four Whirlwinds of No 225 Squadron which it was planned to equip with the necessary fixed fittings.(54)

By early 1963 the Naval Staff was able to inform their Vice Chief that RAF policy was coming into line with their own: to have fixed fittings for machine guns on all tactical helicopters, with provision for a few to be fitted with guns for suppressive fire as required. A few days later, however, on 18 December, it was reported that at Pensiangan in Borneo two out of three RAF Whirlwinds had been hit by bullets,

*The SS-11 was a French rocket missile, wire guided visually by a 'joystick' in the cockpit. It weighed 63 lb including a 13 lb warhead; it had a range of 1640 to 11500 feet and was normally to be used at distances of 1000 to 3000 yards.

some of which had penetrated the fuel tanks, while at Biawak an Army Auster had force landed as a result of ground fire and the passenger, an RAF chaplain, had been killed.(55)

The policy on suppressive fire was then urgently reappraised and at a high level Air Ministry meeting it was decided that all SRT helicopters should be fitted with Bren gun mountings, immediately in FEAF and as soon as possible thereafter in Germany. As additional measures, the despatch began of armoured vests for FEAF helicopter aircrews, while Westlands set to work on the design of a more sophisticated mounting for the FN rifle, and No 38 Group on a fitting for removable guns, including the 7.62 general purpose machine gun which eventually became standard.(56)

This was far from being the end of the matter and the progressively more vexed question of how much armour the helicopter should carry and for what purpose acquired its own momentum in the late 1960s. The role of the Army Air Corps vis-à-vis the RAF in this context opened up a whole new field of operational capability, as described in outline in Chapter 14.

References to Chapter 9

- 1 ID3/943/2/Pt 1.
- 2 IIA/11/2/4/Pt 4.
- 3 Ibid.
- 4 Ibid.
- 5 COS(60) 8th Meeting.
- 6 IIA/11/2/4/Pt 4.
- 7 Ibid.
- 8 Ibid.
- 9 Ibid.
- 10 Ibid.
- 11 IIA/11/4/Pt 5.
- 12 Ibid.
- 13 Ibid.
- 14 Ibid.
- 15 AC SC(61) 16/24.
- 16 ID3/943/2/Pt 1.
- 17 ID9/F1-101.
- 18 IIA/11/2/31/Pt 2.
- 19 Ibid.
- 20 ID3/943/2/Pt 2.
- 21 Ibid.
- 22 Ibid.
- 23 AC(62) 18; AC(62) 10.
- 24 ID3/943/2/Pt 2.
- 25 Ibid.
- 26 Ibid.
- 27 Ibid.
- 28 Ibid.
- 29 Ibid.

- 30 ID9/F2-30.
- 31 ID3/943/2/Pt 2.
- 32 Ibid.
- 33 Ibid.
- 34 Ibid.
- 35 Ibid.
- 36 ID/94/10
- 37 Ibid.
- 38 Ibid.
- 39 Ibid.
- 40 Ibid.
- 41 COS(62) 1.
- 42 COS(402) 63.
- 43 COS(25) 64.
- 44 Ibid.
- 45 ID/94/10.
- 46 Ibid.
- 47 Ibid.
- 48 Ibid.
- 49 Ibid.
- 50 ID9/Q4-28.
- 51 Ibid.
- 52 AC 16 (61).
- 53 ID/94/10.
- 54 Ibid.
- 55 C-in-C FE signal.
- 56 ID/94/10.

CHAPTER 10
THE GROWTH OF THE SRT FORCE IN EUROPE

The SRT Helicopter Force, although planned on a world wide basis, in reality only functioned in the originally envisaged mobile close support role with Army units in the European Theatre, with occasional exercise excursions in North Africa using the Libyan desert as trouble-free real estate. Actual overseas operations in the Arabian Peninsula, Malaya and Borneo were very different, being dictated by local political and topographical circumstances but essentially with comparatively permanent fixed bases and centralised control of operations and resources. In Europe the practice of committing small self-supporting groups of helicopters for specific local Army operations lasting hours or days rather than months dictated the pattern of development for tactical helicopters. Interspersed with these small operations were major Army exercises in which the larger part or even the whole of the SRT Helicopter Force was committed for a few days for exercises based on temporary 'field' bases in the operational area, these being essentially larger scale versions of the smaller exercises which occurred several times each month.

This pattern of small short-term deployments had started in the last two years of the JEHU (see Chapter 6) and was thus to some extent a continuation of an existing, rather than a totally new, procedure with No 225 Squadron being formed out of the disbanding JEHU in January 1960. Although the overseas helicopter squadrons were engaged in direct tactical assistance to Army operations, these were in the main mounted from fixed or semi-permanent bases as part of a long term policy. The close support of mobile Army formations in Europe gave rise to a form of tactical self-supported detachment activity which developed naturally into the Support Helicopter Force of the 1970s. No 225 Squadron can therefore be properly described as the first Tactical Support Helicopter Squadron in this line of development, and the first helicopter element of the new No 38 Group SRT Force. (A fixed wing element already existed in the form of No 230 Squadron equipped with single and twin Pioneer aircraft).

This Squadron of piston-engined Whirlwinds Mk 2 and Sycamores belongs in one sense to Phase 2 of this History, but it more logically finds its place here in Phase 3 since it led the way into the turbine-engined era of tactical helicopter operations with the Army without changing its character or mode of operation. The fact that it was joined at Odiham by the turbine-engined Belvederes a few months before it received its own turbine-engined Whirlwinds Mk 10 does not alter its prime position in the formation of the RAF SRT Helicopter Force.

There was to be a period of nearly four years (1960-63) during which the new helicopter force of Belvederes and Whirlwinds based at Odiham was to grow and develop its tactical role before suddenly disappearing to the more dramatic oper-

ational theatres of Aden and Borneo, handing over the European exercise tasks (mainly UK and Germany) to the Wessex Mk 2 which appeared in 1964 just in time to assume the role for which it had originally been chosen. These four years were to be most stimulating for all concerned. In spite of the departure of No 66 (Belvedere) Squadron to FEAF in 1961, there was for the first time a sizeable force of helicopters in England which could be called upon to perform the numerous tasks, both military and civilian, only possible by helicopter, without encroaching with great difficulty on the otherwise committed specialist SAR or CFS training aircraft. The Belvedere was a considerable revelation even to those already accustomed to working with helicopters in the overseas theatres, and the Whirlwind Mk 10 which appeared in 1962 was, in its own way, equally surprising in its new capability.

The formation of the Tactical Air Support Group Headquarters and Squadron organisation was dramatically sudden. At Christmas 1959 there existed only No 230 (Pioneer) Squadron operating with Southern Command (Army) and, operating more or less independently, the JEHU at Middle Wallop. On New Year's Day, 1960, No 38 Group in Transport Command came into existence at Upavon (in two huts moved there from the Isle of Wight in 1919 for use as Married Quarters) having control of No 230 (Pioneer) Squadron now also at Upavon, and No 225 Helicopter Squadron formed on the same day at Andover. This constituted the SRT Force. The other element of Tactical Air Transport Support never appeared in the guise of the Light Cargo Force that had been discussed at staff level. What did exist was given the title Medium Range Transport (MRT) and consisted of Hastings, Beverleys and later Argosys of No 46 Group in Transport Command. These were allocated for use by No 38 Group in exercises as required, Hunters from Strike Command being similarly allocated for offensive support.

There was no gradual build-up initially. The new No 38 Group plunged immediately into detailed planning for the most ambitious joint Service exercise which could possibly be mounted since it committed the entire SRT Helicopter Force and much of No 230 Squadron (as well as offensive support by both Strike Command and the Royal Navy) to support of a No 3 Division Army exercise in Libya—'Starlight I'—and as much of the MRT Force as was required to transport it and operate in the exercise area. There was just time in January for a short rehearsal (Exercise Black Pearl) at Upavon of the 'Air Maintenance System' between HQ 3 Division and No 38 Group, and the organisation and control of the 'Airhead' which was to be set up in Libya at Tmimi. The main base was to be at El Adem and the exercise took place in March.(1)

Much of the development of the SRT Helicopter Force in the following 10 years was to consist of modifications of the organisation at the various levels of control needed to enable the helicopters to be properly tasked and to respond to the requirements of troop movement, logistic re-supply, casualty evacuation, reconnais-

sance and communications in the numerous exercises which were generated in that period. It is not intended to trace in detail the development of these agencies in the tasking chain beyond outlining the four levels of control initially created for Exercise 'Starlight' and continuing in more or less similar form thereafter. At the top was the Joint Headquarters shared by HQ 3 Division (Army) and HQ No 38 Group (RAF). On Exercise 'Starlight' this was called the Joint Control Operations Centre—later to be simply JOC. Included in this organisation was the ATMCC (Air Transport Movement Control Centre) which also contained the link with Transport Command. This was later to be known as ASOC or ATOC (Air Support Operations Centre for Offensive Support, and Air Transport Operations Centre for MRT and SRT Support). Further forward was the BASOC (Battlefield Air Support Operations Control) divided into BASOC (OS) and BASOC (AT) for offensive and transport support respectively. This level was responsible for translating Army bids into detailed aircraft tasking and giving advice to the Army on practical air matters. Later this agency developed into a person with similar initials—BASO (Brigade Air Support Officer) permanently attached to Brigade Headquarters. Operational control of aircraft at the point of action was provided by a Squadron Air Control team or MOT (Mobile Operations Team)—later Mobile Air Operations Team (MAOT). Initially, the SRT force was based at the Airhead—the furthest forward point reached by MRT—and the Airhead had its own Operations Control, Air Maintenance Operations, corresponding to Station Operations at a permanent base. Later, this practice was used only rarely and for large-scale major exercises, helicopters being tasked through a MAOT or directly by BASO or by a 'Forward Air Transport Operations Centre' (FATOC). For Exercise 'Starlight', the SRT Force suffered considerably from being based at the Airhead and having to tolerate the very considerable dust clouds thrown up by the Beverleys, but the main problem throughout the early years was the lack of suitable radio communications without which proper tactical deployment of the SRT helicopters was not practical.

Within the limits of being the first large scale helicopter participation in a major Army exercise, Starlight was a success. The helicopters (12 Whirlwinds) had all been airlifted to El Adem by Beverleys of the MRT Force and flew 458 hours, including 63 at night using vehicle headlights for landing areas. 242 passengers were carried and there were 99 casualty evacuations. A Forward Maintenance Area (FMA) was created and operated, troop assaults were mounted and numerous VIP and other observers carried. It was however a very leisurely deployment by later standards. Arrival at El Adem took place in February for an exercise which did not commence until mid March, and the active assault phase of which lasted only three days. Before the exercise began the helicopter squadron personnel were able to undertake two desert expeditions of 12 persons using four vehicles and lasting two or three days. After return home, virtually the whole of April was devoted to cleaning and rebuilding the aircraft after their transshipment by Beverleys of the MRT Force. The extra six Whirlwinds added for 'Starlight' were removed and the Squadron reverted to its establishment of six Whirlwinds and six Sycamores.(2)

During May 1960, No 38 Group Headquarters, No 230 (Pioneer) Squadron and No 225 (Helicopter) Squadron moved to Odiham, and the pattern of SRT support for Army exercises from that base became firmly established. Odiham thus became the permanent UK base for all the RAF helicopters operating in support of the Army.

In the same month, responsibility for No 118 (Sycamore) Squadron in Northern Ireland was assumed by Transport Command vice Coastal Command (see Chapter 7) and it became a No 38 Group SRT Unit, although remaining exclusively for operations in Northern Ireland. As such, it fell to No 225 Squadron, which initially had responsibility for providing Operational Conversion Unit services for the SRT Force, to arrange Sycamore training as a SRT Unit and standardisation services for No 118 Squadron for the remaining two years of its life. In February 1962, the IRA announced cessation of its violent campaign, and in August No 118 Squadron (three Sycamores and five pilots) was disbanded.(3)

The demand for helicopter support for Army field operations had obviously been growing for some time. From the moment when the new No 38 Group/No 225 Squadron Whirlwinds and Sycamores were available for monthly tasking, that is in May 1960 when they had recovered from Exercise 'Starlight', bids for helicopter participation in various Army unit training exercises started flooding into No 38 Group. The RAF found itself fighting hard to retain the essential flying hours for Monthly Continuation Training (MCT) for the helicopter crews. The problem, basic and therefore permanent, was the divergent requirements of the soldiers and the airmen. For the helicopter crews there was the need to practise regularly the skills inherent in aircraft handling precision manoeuvres, emergency procedures, bad weather and instrument flying and night flying with all that that implied. For the soldiers the task consisted of marshalling the troops and equipment at appropriate places, and emplaning and deplaning them efficiently and safely. The control and communications required were a common problem.

In practice, exercises designed by the Army for the Army had little relevance to the specialist training needs of the RAF, whose problem was mainly to arrive at the right place at the right time with sufficient backing to maintain whatever troop or cargo lift requirements were presented. The exercises in pure flying techniques which the RAF, with its Central Flying School purist approach, considered essential in the longer term for efficient operations, were rarely exercised in the course of the very numerous Army exercises or training sessions demanding helicopter participation. Indeed, so important for the Army was the successful performance of the helicopters that in larger scale exercises the scenario was frequently instantly re-cast to permit them to participate when real circumstances, eg weather or fuel supply problems, would have excluded them. The result was a constant tension between the pressure from the Army for more helicopter hours than could be made

available, and the RAF need to reserve an adequate proportion of the hours available to practise the skills which were rarely employed in the exercise scenarios.

In general the helicopters were tasked at about 30 hours per month per established aircraft and the pilots, established at a pilot/aircraft ration of 1.25:1 or 1.5:1 were required to fly a minimum of 15 hours per month (they usually flew considerably more) for which about 3½ were needed for pure flying training, that is, mainly night and instrument flying and emergency procedures (MCT).(4)

That the exercise scenario failed to provide realistic operational training for the helicopter crews is shown by the fact that a monthly allowance of two hours per pilot had also to be reserved for Transport Support (TS) practices, that is, training in the operational procedures associated with their specific role, although these were rarely experienced in the numerous exercises and demonstrations carried out for the Army. A further allowance of between 10 and 20 hours had to be made for operational training for each new pilot arriving on the Squadrons. For example, in April 1961, a fairly typical month containing no major exercises, Sycamores and Whirlwinds were deployed in ones and twos for two to six days at various locations on behalf of eight Army units. With a total of 222 hours each theoretically available for Whirlwinds and Sycamores, MCT plus TS plus conversion training required 54 and 80 hours respectively, while 144 and 84 respectively were expended on exercise tasks. The shortfall of 24 and 56 from the total hours theoretically available would be mainly due to exercises cancelled for weather or operational reasons, or because of aircraft unserviceability.(5)

About six times a year there were larger scale commitments requiring perhaps six or more helicopters for a Unit major exercise lasting for a week or so, and once or twice a year, major exercises involving the deployment of the whole SRT Force for up to three weeks in the UK, Germany or North Africa would be required. Except in the latter case, monthly tasking in response to numerous bids from individual units continued up to the limit of flying hours available. Allocation of the bids accepted was made by No 38 Group at a monthly meeting that invariably took the form of inviting the Army representative to allocate priorities and agree to the rejection of a large number for which flying hours were not available after the RAF had reserved its own portion for MCT, TS and pilot conversion training.

In a sense this was a healthy situation in that there was no danger of under-utilisation and consequent stagnation, but there were disadvantages. The pace of these operations left little time for constructive appraisal of what was being achieved. The fact that such a large number of Army units was involved at different places required the preparation of numerous comprehensive Operation Orders although only one or two helicopters might be involved and there was rarely any comment afterwards. The helicopters nearly always arrived, carried out the demonstration required, loaded and unloaded the soldiers presented for the event,

carried their equipment inside or underslung from point A to point B or dropped the parachutists provided, all in totally unrepresentative operational conditions, and returned to Odiham to prepare for the next demonstration. It seemed to the RAF that to train the whole British Army to operate with helicopters was an impossible task since when major exercises were mounted, and regardless of the continuous monthly troop training already carried out, none of the troops present in large numbers seemed to have seen a helicopter, and a day or two usually had to be set aside before the exercise started purely for emplaning and deplaning procedures to be practised. The need for this training was scarcely debatable—there were very few who could remember the decision taken in respect of the S-55s in Malaya in 1953 when shortage of available flying hours had encouraged the conclusion that such training for military passengers was not essential, even where no crewmen were carried and the troops had never flown at all and frequently spoke no English—see Chapter 3. But this was the UK in 1960 and the Whirlwinds Mk 2 and Sycamores still had no crewmen. The risks to the soldiers from rotor blades (both main and tail rotors in the case of the Sycamore) and to the inside of the aircraft from weapons and equipment, coupled with the need for speed and efficiency in rapid troop shuttle operations, made such practice seem almost essential.

After major exercises a variety of detailed reports were prepared covering virtually all aspects of the exercise, but as these usually took some months to complete as a composite document and then circulate, planning for the next exercise was often well under way before the report on the last was received. In any case the main message for the RAF was already well known as far as the SRT Force was concerned—there was not enough helicopter lift, it was not fast enough, it was limited severely by darkness and bad weather, and above all, it was invariably adversely affected by inadequate communications.

As the frequencies used for Air Traffic Control had risen steadily since the 1940s, the VHF sets fitted to the early helicopters were already beginning to be replaced by UHF following the fixed wing practice where the need for very low level communications over more than a few miles had virtually ceased to exist. Apart from the sets provided for long-range fixed-wing aircraft, there were no lightweight HF sets being manufactured suitable for the short-range low-level work characteristic of helicopter operations. Consequently for almost the whole of this first period when the new SRT Force was operating from Odiham, control was exclusively by VHF which meant that the helicopters were beyond radio contact when more than a few miles from their controller. Flexibility was thus seriously impaired. The Army was having its own problems in this field and the consequence was that communications difficulties figured largely in the conduct of all these exercises. It was not until operations expanded in the Far East later in the 1960s, and the consequences of losing contact with helicopters shortly after take off posed an entirely different sort of consideration in that sort of terrain, that the pressure to

obtain and fit HF communications became imperative. Thus HF radios were initially supplied only to helicopters in FEAF.

During the remainder of 1960 and for most of 1961, No 225 Squadron laboured on with the never ending task of troop training sorties interspersed with occasional 'set piece' exercises. Typical payloads were four or five soldiers in the Whirlwind and three in the Sycamore, or underslung loads of about 500 pounds. When deployed in 'field' locations on exercise, all the support equipment, including tentage and cooking facilities, plus all the ground crews, had to be transported in a convoy of vehicles, thus adding a further unrealistic element to the operational picture. Inevitably, this convoy got progressively larger as experience generated an ever-increasing demand for improved facilities at forward locations, piston-engined Whirlwinds Mk 2 and Sycamores being able to carry little of this material and support personnel when deploying over significant distances. On the other hand, the RAF aircrews were learning to live under simulated combat conditions, wearing Army combat clothing, tactically dispersed in the mud and general filth of 'field' locations, and subject to simulated commando style raids by the SAS in the middle of the night.

Into this picture of earnest tactical endeavour was inserted, in October 1960, the Belvederes Trials Unit in the form of three comparatively enormous uncamouflaged pre-production type Belvederes—the first turbine-engined helicopters in the RAF. Within a month they had demonstrated their ability, in trials to lift underslung loads of 3000 lbs and then 5000 lbs, recovered a crashed Meteor near Yeovil and carried underslung a Land Rover and trailer; the startling effect of these feats was only partly diminished by jettisoning the latter at Odiham from 150 feet, as a result of engine failure as reported in Chapter 8.

The Belvederes, in addition to their various trials, mainly with external loads but including carriage of 28 troops (settling on 25 as a realistic maximum),(6) joined in several of the Whirlwind/Sycamore Army exercise tasks carried out by No 225 Squadron, offsetting to some degree their obvious non-tactical size and appearance by their ability to carry with them all the ground crew and camping gear required for living for short periods in 'field' conditions.

Following the formation of the BTU into No 66 Squadron, Belvederes fitted with metal-blades and hydraulic-powered controls participated fully in these exercises, three of them first appearing at the SBAC Farnborough Show in September 1961, for which No 225 Squadron provided six Whirlwinds.

In October 1961, the first major exercise which involved operational Belvederes—'Spearpoint'—was mounted in Germany, seven Whirlwinds and three Sycamores of No 225 Squadron and three production type Belvederes of the newly re-formed No 66 Squadron being deployed to Gutersloh for the period. On this occasion the

opportunity presented itself of making a significant new development in the pattern of tactical helicopter procedures. The three Belvederes were in the colours appropriate to their tropical destinations—Aden and FEAF—that is, aluminium finish with white top surfaces.* Not only were they unable to nestle under the trees like the Whirlwinds and Sycamores which were disposed tactically around the periphery of a small wood which sheltered the SRT base camp, but their presence alongside provided a startling obvious eye-catching feature of very large dimensions. The Belvedere Squadron Commander offered to resolve the difficulty by utilising the capacity of the aircraft to house their own three-man crews allowing them to deploy individually either to small Army units in the vicinity, or to remote sites where the chances of their being found were slight and the consequence less troublesome for the rest of the SRT Force. Both types of deployment were tried during the exercises, the lack of radio communication with the SRT tasking authority while the aircraft was on the ground (no HF radio was fitted) being the main disadvantage. In fact the No 38 Group tasking agency (FATOC) at the SRT base found the lack of communication so unsatisfactory that the idea of tactical discreet deployment of the SRT was not supported in principle, and thus almost the only significant and radical development of SRT doctrine during this period (1960–63) failed on that account.**

A suggestion had been made by the Belvedere Trials Unit that the Belvedere might be used with minimal modification to provide a refuelling service in the field for Whirlwinds which were being employed in shuttling troops and equipment between two points in the forward area, and then having to return up to 30 miles to the SRT Base for fuel.(8) The fuel for this return journey represented a payload penalty for each of the shuttle sorties undertaken; thus the number of shuttle sorties was increased, and each flight contained a non-productive period. For these reasons it also prolonged significantly the time taken to complete a troop redeployment. The Bristol Aeroplane Company, who in 1959 were still the Belvedere manufacturers, produced a brochure showing a Belvedere refuelling a helicopter and a tank directly from its internal overload tanks, and supplying fresh water to a patrol. It was calculated that one Belvedere could refuel six Whirlwinds with one hour's fuel at a

*Camouflage finish was only later decided upon (1964) and then only for the FEAF Belvederes.(7)

**The principle of making small groups of up to four helicopters self-supporting in tactical locations away from a main SRT base was revived later with the arrival of Wessex and Puma helicopters.

range of 50 miles from its own refuelling point, the choice of place for the transfer being practically without limit.*

The proposal to use the Belvedere as a refuelling vehicle for Whirlwinds in a European tactical environment was not enthusiastically received at a time when the Belvedere was a contentious subject at Ministry level (see Chapter 9) and was officially destined as part of the Light Cargo Force for Aden and FEAF exclusively.**

These arguments against new roles for the Belvedere still applied in July 1962 when the Belvedere, during Exercise 'Blind Mouse 4' in Germany, demonstrated, at the request of the Army, its ability to carry (and therefore deploy in time of war) the nuclear warhead of the 'Honest John' tactical missile. A case for the retention of the Belvedere in Germany for this purpose was prepared but not agreed.

An unexpected role which the Belvedere did acquire, and one which it retained throughout its life, was the recovery of crashed aircraft or helicopters unserviceable in inaccessible places. Altogether, between 1960 and 1968, Belvederes recovered 31 crashed aircraft or parts of wreckage including 23 complete helicopters, two Austers, two Chipmunks and a hovercraft. Twenty of the helicopters lifted were in FEAF, one in Aden, one in Germany and one in England.(9)

No 72 Squadron started to re-form at Odiham in November 1961, as a Belvedere training cell, the Squadron Commander of No 66 Squadron and three crews being transferred for the purpose, and became established in December with 15 pilots, 97 groundcrew, one navigator and one adjutant.(10)

*In 1962, when the possibility of buying the Chinook had been raised and the Wessex was seen as the future SRT vehicle, it was pointed out that the Belvedere/Whirlwind relationship was comparable with the Chinook/Wessex one, but the Chinook was not to be purchased.

**The problem was later mitigated (Phase 4) by the use of air portable 500 gallon flexible cylinders (Seal Drums) and 20000 gallon bags (Pillow Tanks) to be positioned at forward refuelling points, although this less flexible arrangement also added further to the unreality of exercise conditions, especially when gaily painted civilian fuel bowsers had to be employed to fill the Pillow Tanks, as in Exercise Sky Warrior at Otterburn in 1971. The subject would not be raised again until 1981 when the Chinook eventually appeared.



Belvedere recovering a forced landed Whirlwind Mk 10 in Germany during a 38 Group Exercise—1962.



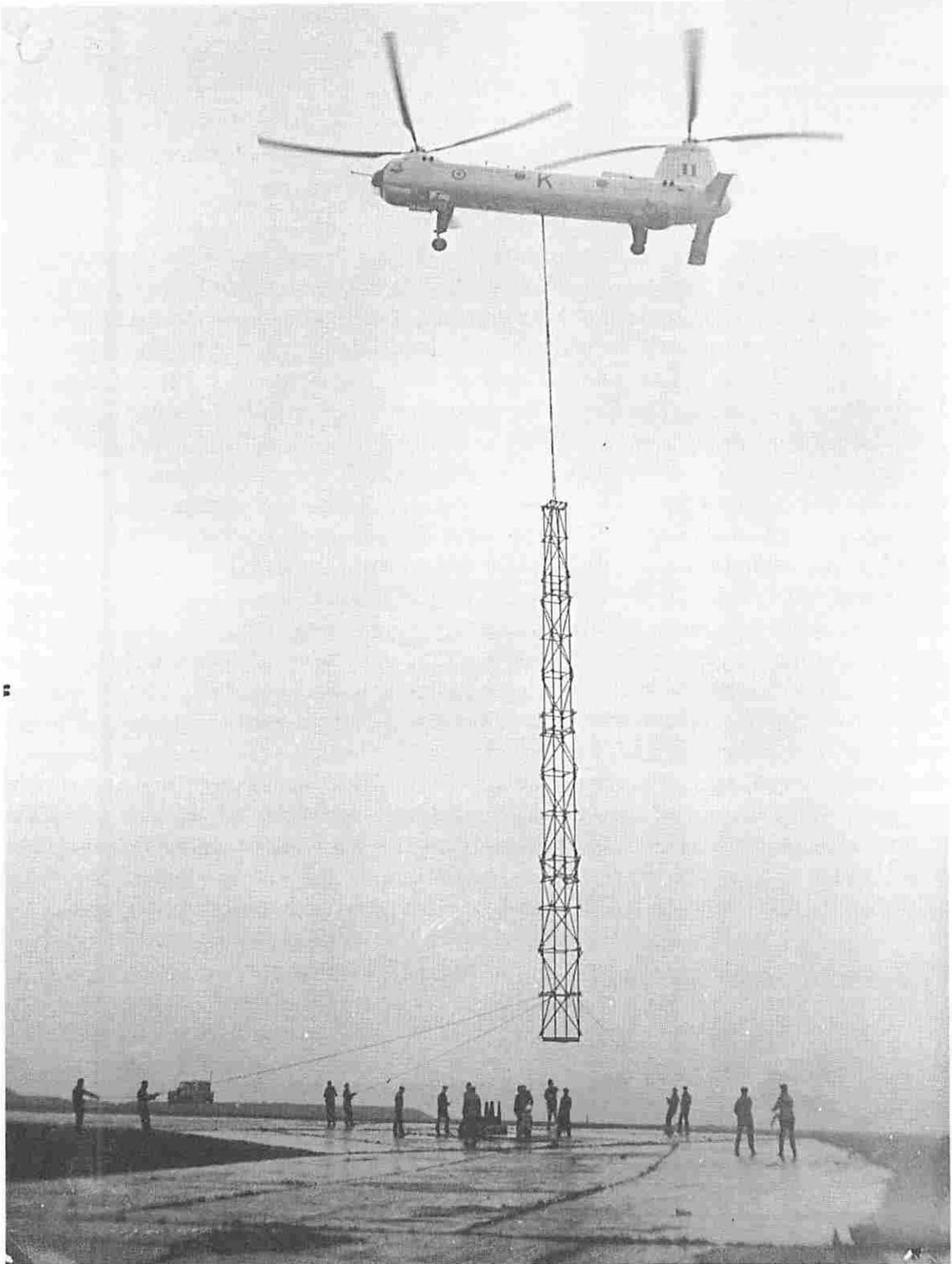
Refuelling a Sycamore of 225 Squadron detached to Kenya from Odiham for flood relief duties—November 1961.

Diversions from the SRT Exercise Task

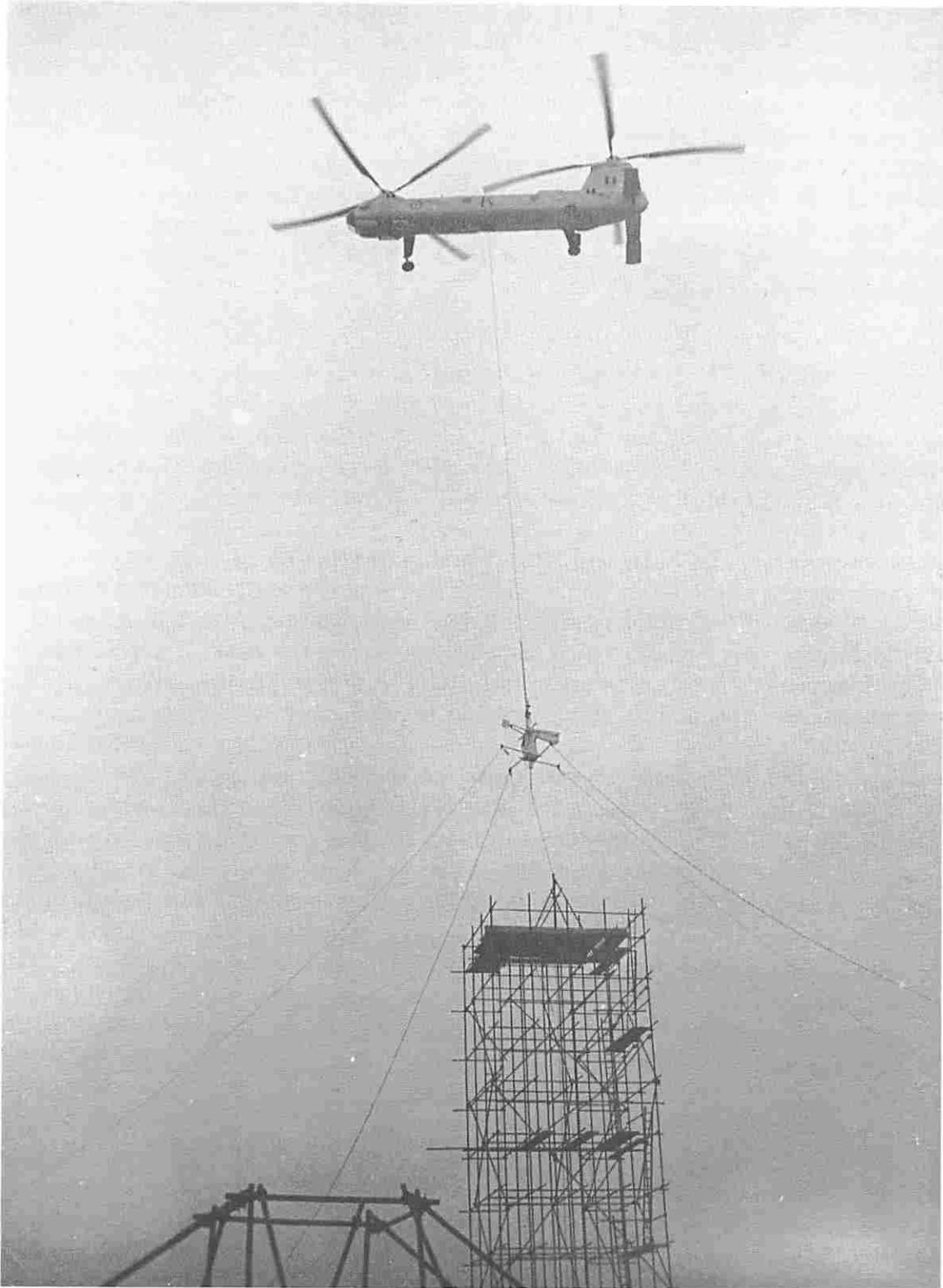
Apart from the various demonstrations, VIP communication flights, and occasional ambulance sorties (MEDEVAC) which formed part of the continuing secondary activity of the SRT Force during the first three years of its life at Odiham, there were three major diversions of note, one for the Sycamores and one for the Whirlwinds of No 225 Squadron, and one for the Belvederes of No 72 Squadron.

In November 1961, the month when the first four brand new Whirlwinds Mk 10 arrived for intensive flying trials with No 225 Squadron, severe flooding in Kenya threatened disaster for several populated areas. On 18 November No 225 Squadron was given six hours notice to prepare and despatch to Nairobi by Beverley, four Sycamores with six pilots and ground crews. The Beverleys left on time for Eastleigh via El Adem. The Royal Navy was assisting with Whirlwinds Mk 7, but these lacked the performance to offer a reasonable payload at 5000 feet in the Nairobi area so they were confined to the coastal area and Somalia while the Sycamores flew from Eastleigh. Doctors, engineers, food and medical supplies were delivered to the stricken areas where isolated settlements were cut off by the floods. Beverley and Dakota supply drops were concurrent. On 24 November, two of the Sycamores with three pilots moved to Mogadishu and continued food delivery, medical supplies and casualty evacuation operations, responding to tasking by the District Commissioners. In early December the Sycamores moved their base first to Kisimayu and then Gelib, withdrawing to Mogadishu between 20 and 22 December. Assistance in these deployments was provided by RAF Valettas and helped by an American H-19 helicopter and an Ethiopian C-47. On 22 December the detachment was withdrawn to the UK by Beverley, having flown 97 hours on rescue and supply sorties.(11) The success of this unexpected detachment and its efficient operation in limiting conditions of altitude and temperature with piston engined helicopters says a great deal about the expertise of the pilots and the wisdom of the RAF insistence on MCT and the maintenance of pure flying standards.

Meanwhile, the first four Whirlwinds Mk 10 were undergoing intensive flying trials with No 225 Squadron, each one completing 100 hours between 4 November and 11 December 1961—a feat which attracted praise in both 'Flight' and 'Aeroplane'. On 27 December CA release was given to permit up to 1500 lbs to be carried underslung, and in April 1962 a Whirlwind Mk 10 was used to position an extremely awkwardly shaped HF aerial on an 80 foot tower. It was not very heavy—only about 200 lbs—but it consisted of a dipole with 8 reflectors varying in length from 28 to 40 feet, and a very high degree of precision was needed for its emplacement. The ability to perform feats of this nature was still in the nature of a startling revelation at that time, although this particular success was almost eclipsed by the massive national publicity surrounding the placing by a Belvedere of the spire on Coventry Cathedral which was taking place at the same time.



Rehearsals at Odiham for Coventry Cathedral operation using a mock up of the flèche.



Coventry Cathedral operation rehearsal using a mock up of the sculpture.

256-B

The possibility of lifting the spire (in the form of a *flèche*) and its surmounting sculpture on to the roof of the newly built Coventry Cathedral by helicopter was first mentioned by No 38 Group to No 72 Squadron at Odiham in November 1961. After a reconnaissance of the Cathedral site and discussion with the builders about the requirements and restraints associated with the task, a possible method of tackling it was worked out. The task seemed at first sight to bear little relationship to the role for which the Belvedere was intended, but the techniques which had to be developed to meet a number of highly specialised requirements had several applications in later operational tasks in the Far East. Some of the details therefore have relevance in this account.

When consultations began in November 1961 with the Consulting Engineers (Ove Arup and Partners) and the builders (John Laing & Sons Ltd) neither the *flèche* nor its surmounting sculpture had actually been constructed. The *flèche* was to be a pylon 80 feet high with a base area of three feet square made of welded manganese bronze rods diminishing in thickness towards the top. The surmounting ornament was described as 'an abstract cruciform sculpture in aluminium which will pivot and serve as a weather vane'.⁽¹²⁾ At a planning meeting on 14 December 1961 the combined weight of the *flèche* and sculpture was assessed at 3700 lbs plus or minus 100 lbs. Weight of the complete assembly had previously been assessed at 4500 lbs and the figures were regarded with some scepticism by the RAF, who preferred to lift each element separately in order to be sure of preserving the ability, with the load suspended, to maintain hover outside ground effect with one engine failed. The Consulting Engineers were nervous about side loads being accidentally applied to the top of the *flèche* while attempting to put the sculpture in place by helicopter. By 1 March the weight calculation was as follows: *flèche* 3188 lbs, sculpture 1310 lbs, strop 100 lbs, aerodynamic loading 100 lbs—total 4698 lbs. To this the weight of a protective frame for the sculpture, made necessary by what was described as its abstract nature and numerous protrusions, had to be added. In all, this load exceeded by about 600 lbs the weight with which the Belvedere could have maintained a hover outside ground effect with adequate reserve power for the manoeuvring likely to be required. Fortunately the RAF plan to lift each element separately was agreed since the *flèche* itself could not be physically weighed in advance, could not be returned to its stowage once lifted out, and was calculated by reference to the Belvedere's torquemeters when the lift was made, to be well in excess of 3500 lbs weight. It was within the Belvedere's ability to carry this weight with one engine failed at an air temperature of +8°C, but would have been exceeded by the sculpture being carried at the same time.

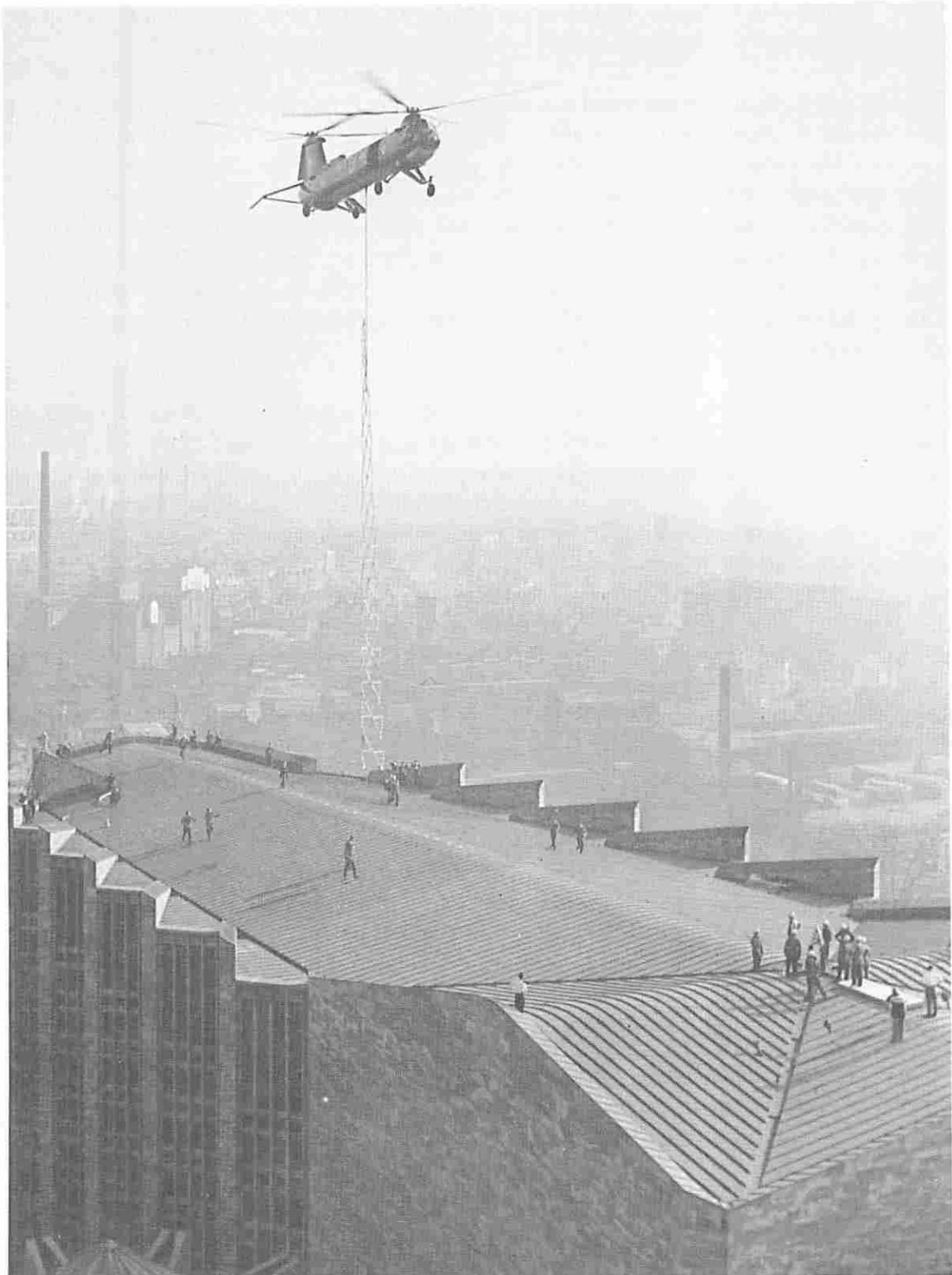
The structure of the Cathedral itself complicated the task considerably the roof consisting of a concrete shell supported only by the outer walls being very delicate. The inner roof, a mesh of concrete beams carried on pillars down either side of the

Nave, contributes nothing to the support of the outer roof which was said to be only a few inches thick at the centre where the flèche was to be placed.*

The experts were also concerned about the danger of the roof being punctured; not only would it crack along the entire length, but if one or more of the concrete beams of the inner roof were broken, the geometric integrity would be lost and the structure might collapse along the whole length of the Nave. There was also a risk that significant vibration of the roof near the point at which the suspension cables carrying the engraved glass panelled window forming the entire West Wall were pegged, (only some 15 feet from where the flèche was to be placed) would cause some or all of the glass panels to fall out. The Cathedral was due to be inaugurated by Her Majesty The Queen in May.

Special techniques had to be designed for controlling the aircraft as a result of these strictures, two main considerations arising from the fact that the aircraft would be required to hover with great accuracy at a height of about 200 feet above ground for placing the flèche, and up to 300 feet when inserting the sculpture. Firstly, use of the collective lever to guarantee the very small rates of descent demanded would clearly be impractical, so it was decided to achieve a state of equilibrium with the loads about six feet above their intended places, and accomplish the descent by human muscle power applied to the loads themselves, (four men for the flèche and eight men for the sculpture). This in turn demanded an absence of turbulence and therefore restricted the operation to wind speeds of 5 knots or less. Secondly, because the Belvedere rotor speed was at all times manually controlled via the twist grip on the collective lever, very frequent reference to the RPM gauge was essential. The accuracy of hover required, so far distant from points of visual reference, practically prevented frequent reference to cockpit instruments. For these reasons, a second pilot was employed to handle the collective lever and throttle, thus performing the automatic rotor RPM governing feature provided mechanically in all later turbine-engined helicopters. (He handled the collective lever only because it incorporated the throttle.) This procedure was particularly suitable for the twin rotor helicopter since, there being no fuselage torque variations with power changes,

*This was the main reason for requesting helicopter assistance in the first place. The flèche with its sculpture was expected to be too delicate to be lifted from its horizontal assembly position to the vertical without support at several points, and this would have required several winches to be positioned on the roof which was not stressed to carry them. The largest crane in the country (in a Scottish shipyard) could not be erected close enough to the Nave for its 'reach' to be sufficient, while a scaffold bridge would have needed to be some 300 feet high to cross the roof diagonally and would probably have involved the removal of some ancient 'listed' buildings nearby.



Carrying the flèche along the Coventry Cathedral roof.

258-A



Securing the flèche on Coventry Cathedral.

258-B

the first pilot could be left with control of both cyclic stick and rudder pedals. The technique was described as 'Split Control' and used effectively in FEAF on a number of occasions, for example, when positioning ground radar equipment on hill top sites and for certain night flying developments.

A third major requirement was that the loads had at all times to be prevented from developing a swing, since there was no way in which the aircraft could have acted to dampen it. Accordingly, four ropes were attached to both loads, each handled by two airmen, purely to control any tendency for a swing to develop. These parties had to be duplicated in the car park from where the loads were lifted, as well as on the Cathedral roof, as the loads had to traverse the whole length of the Nave. Altogether, 24 airmen were directly involved in handling and placing the loads, with another translating into visual signals the orders coming by radio from the aircraft crewman via the control officer on the roof. The entire party was found from No 72 Squadron and RAF Odiham, the airmen being Squadron servicing crews.

Throughout March, 1962, these techniques were thoroughly tested at Odiham and the handling parties familiarised with their tasks. Models of the size and weight calculated by the experts were made of both the flèche and the sculpture plus a duplicate of the 70 feet scaffold tower in which the flèche was to be mounted prior to lifting. Both models and the strops and slings to carry both them and the real loads, were designed by Mr Wilding of Westlands Aircraft Ltd, Bristol Helicopter Division, who personally advised on all dynamic and aerodynamic considerations throughout the operation and its planning. The first model of the flèche was built by the Army, a more rigid and robust one, found to be required by the demands of the rehearsals, being constructed out of scaffold tubing by John Laings under the direction of Mr Wilding. The practice model of the sculpture was built in station workshops as directed by the Squadron Engineering Officer—Fg Off R Bates. The essential part played by Mr Wilding, by kind permission of Westland Aircraft Ltd, was the only outside assistance given to No 72 Squadron and RAF Odiham in carrying out the task. The flèche was successfully placed in position shortly after dawn on 26 April 1962 and was followed by a trial run with a dummy load representing the sculpture, partly to exercise the handling parties but mainly to identify appropriate hover reference. The sculpture was carried on an 80 feet strop in order to minimise side loads on the flèche in case of aircraft lateral movement while the three foot spike on which the sculpture was mounted was entering the tube at the top of the flèche. The clearance between the spike and the tube was about an eighth of an inch. The hover reference selected was an industrial building about two miles distant. After waiting for the wind to subside, an attempt to place the sculpture was made in late evening, but failed when the attachment of the lead rope to the end of the spike was broken as the point of the spike struck the edge of the tube. The lead rope was useful to guide the spike, but essential for pulling the load (and the aircraft) down to put the sculpture in place. It was attached to

the spike by a short length of cargo lashing chain welded to the tip of the spike. The sculpture was successfully returned to its cradle in the car park, and after rewelding the chain to the spike and rethreading the rope through the flèche, a successful attempt was made to place the sculpture in the flèche shortly after dawn on 28 April, 1962.

Quite apart from the very favourable publicity resulting from the Coventry Cathedral operation, much was learnt about the technique for handling unusual loads by helicopters with a high degree of precision; this was to be of considerable value later in certain operations.*

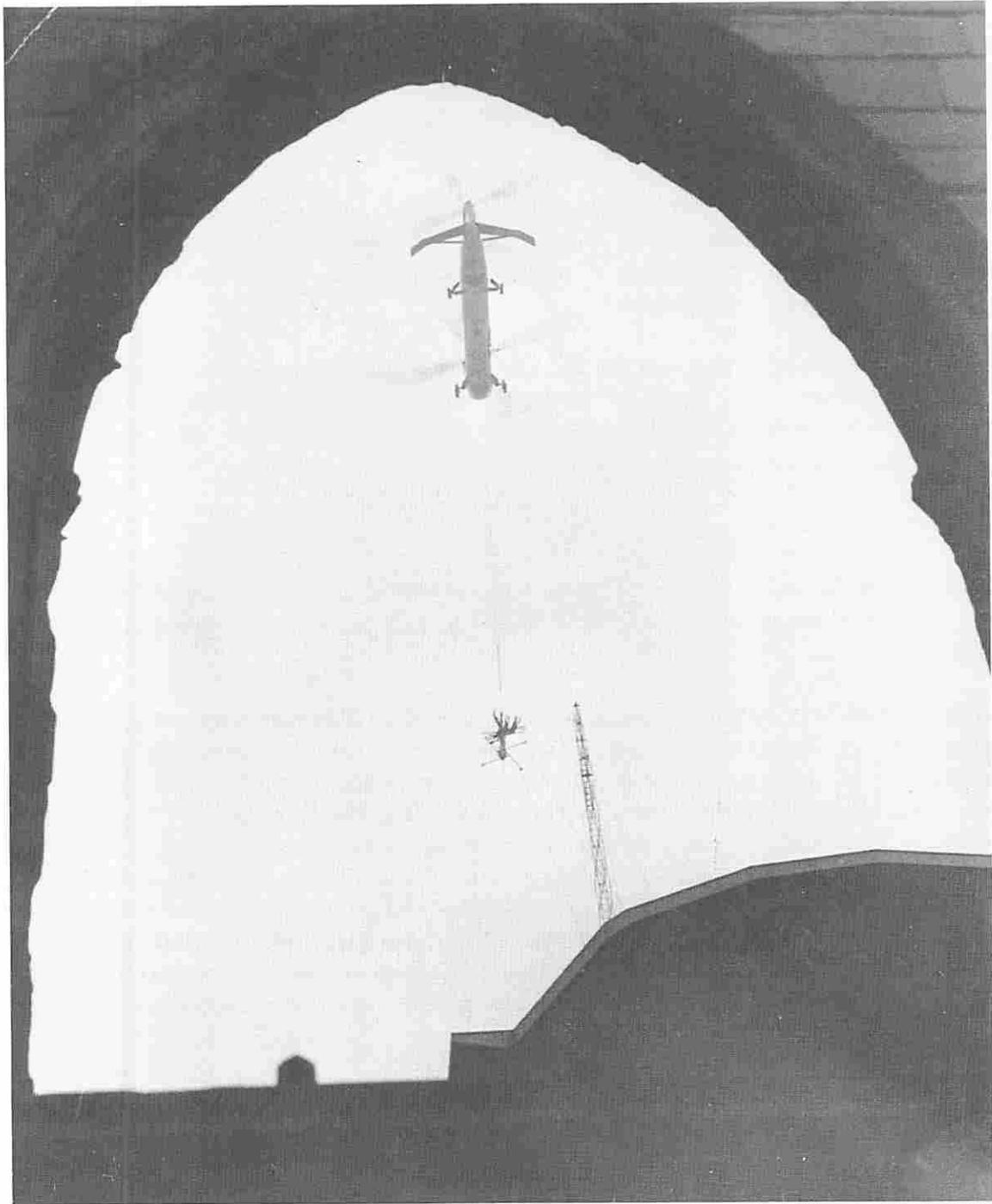
Although trials and rehearsals for the Coventry Cathedral operation had proceeded throughout March and April 1962, the flying time involved, including transit to and from Coventry, and the two lifts which together required only 45 minutes airborne time, totalled only 16 hours.

Helicopter Crewmen

In both the Coventry Cathedral operation and simultaneous HF aerial lift carried out by a Whirlwind of No 225 Squadron, the helicopter crew consisted of three pilots.

In 1962 there was still no establishment of helicopter crewmen except for the SAR units, NCO technicians normally being used in the role, following the procedure established in the first operational helicopters in Malaya in 1950 (see Chapter 2). For special tasks however, such as those involving valuable loads or those likely to prove hazardous to the aircraft, other people or property, the practice was to use a pilot to perform the crewman's task since instructions to the pilot flying the aircraft were likely to be mandatory and in certain circumstances could have dramatic consequences. In the case of Coventry Cathedral, the pilot acting as crewman needed to have the ability for instantaneous release of the cargo hook to obviate risk of damaging the flèche by introducing side loads after the base of the

*The identical technique was used for a similar task when, towards the end of 1966, a problem arose in the mounting of a 30 foot high metal cross in the top of a tall slender tower of the Hakka Methodist Church in Newton Road, Singapore. The problem had been mentioned conversationally to the Air Commander Far East, Air Marshal Sir Peter Wykeham who, having been AOC No 38 Group at the time of the Coventry operation, was able to pass the task to the same pilot, Wg Cdr Dowling, then commanding the Helicopter Wing at Seletar. The success of the operation is commemorated by a metal plaque near the base of the tower ascribing the task to No 66 (Belvedere) Squadron.



Preparing to insert the sculpture into the fèche.



Completion of the Coventry Cathedral operation.

260-B

flèche was secured, or after the sculpture had been placed in the flèche. There was objection in principle to allowing such a facility to be provided for other than the pilot flying the aircraft. The pilot had to insist on a cargo hook release button being provided at the crewman's station which was in fact used, but was removed as soon as the operation was complete. Eighteen years later, the Sea King crewman was to be given the facility to manoeuvre the helicopter itself.

There was no room for a crewman in the SRT Sycamores and inadequate performance in the Mk 2 or 4 SRT Whirlwinds to warrant one. Consequently, the early Whirlwind SRT Squadrons had become accustomed to operating without a crewman, and the advent of the Mk 10 Whirlwind did not change this situation. It was the Belvedere, with its rear undercarriage and cargo hook so far behind the pilot, and the absence of any easy access between the cockpit and passenger compartment which highlighted the need for a crewman. Even so, no formal Belvedere crewman establishment was provided, the selection and training of volunteer servicing NCOs to perform the role being left to the units concerned.

Operationally this proved quite satisfactory as it had been and still was in FEAF, the airmen concerned becoming fully proficient in the role, and providing advisory assistance to the pilot in low level navigation. This 'ad hoc' arrangement however eventually came up against the administrative problem of status and remuneration. These technicians were not technically aircrew, and could not be rewarded with the sum allotted for 'crewman pay'—a phrase invented long before helicopters came into the picture—amounting to two shillings and threepence (12p) per day.

It was the Belvedere units therefore which led the way in 1961 and 1962 in proposing a new aircrew category of 'helicopter crewmen' for all helicopters, recognising that there was no existing aircrew category properly suited to the role. There was strong opposition to this proposal but two fatal accidents in which the crewmen were killed, one in Germany in 1962 and one in Borneo in 1963, highlighted the anomaly of permanently carrying crew members who had no aircrew status. In 1963, Headquarters Transport Command sponsored a FEAF suggestion that the anomaly should be removed and at a meeting held at the Ministry of Defence on 7 August 1963, it was decided that in view of the servicing requirements of the helicopter, Air Engineers should be used in the role of Belvedere helicopter crewman. Subsequently a similar case was made and approved for Wessex and Whirlwind helicopters also.(13)

By March, 1965, the distortions thus generated in the Air Engineer trade, coupled with the distaste of the Air Engineers for this new role, (the old ones found it too rough and strenuous and the young ones felt it inappropriate to their engineering status) caused a new appraisal to be made. The Director of Flying Training, making a strong case against continuing to use Air Engineers in the helicopter crewman

role, and a less strong one against using Air Signallers and Air Quartermasters because of their lack of engineering qualifications, said their continued use could only be justified if surpluses existed in those trades. He firmly recommended a return to Squadron servicing personnel volunteers, to be allowed for in engineering establishments, and granted appropriate status and flying pay.(14)

There were however still strong objections to creating a new aircrew trade and in any case there existed a surplus of Air Signallers. Air Engineers as crewmen had first reached No 66 Squadron in FEAF, in 1965. Air Signallers arrived as helicopter crewmen in No 110 (Sycamore/Whirlwind) Squadron in Butterworth in the same year. When those sources were no longer available, Air Quartermasters started to appear in the crewman role, reaching No 66 Squadron in 1968.

Second Two Years SRT Development at Odiham—1962/63

1962 and 1963 saw the first fruits of the policy decisions described in Chapter 9. It also saw the end of the first era of SRT development as most of the original squadrons at Odiham disappeared overseas never to return. The No 72 Squadron number plate was however transferred to the newly forming Wessex Squadron in 1964, and No 230 Squadron re-appeared briefly in 1967/68 before re-forming with Pumas in 1972 (Phase 4).

No 230 Squadron was a busy Single and Twin Pioneer SRT unit incorporating a Conversion Flight which amounted to an Operational Conversion Unit (OCU) in early 1962. It performed the unique feat of converting gradually to a helicopter unit over a period of eight months while operating all three types of aircraft with OCU services for both Pioneers and Whirlwinds Mk 10. In May 1962 the Operation Record Book records the arrival of the first two Whirlwinds on this Pioneer Squadron and 'looks forward to receiving pilots trained on helicopters (by the CFS Helicopter Training Wing) to fly them'. A QHI from No 225 Squadron started work on operational conversion for the new helicopter pilots in June. For the next five months, Pioneer operations continued but reduced as helicopters increased although the Pioneer OCU activities continued unabated. In October the Squadron received its Standard from the HRH The Duke of Gloucester, and in December a helicopter-trained Squadron Commander (Sqn Ldr Thomas) took over from Sqn Ldr West. In December 1962, Pioneer operations ceased for No 230 Squadron and the Pioneer Conversion Flight became a separate unit at Odiham. The helicopter training continued in preparation for a planned move to Gutersloh Germany which took place in January 1963.

For the next two years, No 230 Squadron operated from Gutersloh in support of the Army in exactly the same way as No 225 Squadron had done at Odiham. Major exercises in the field were interspersed with numerous short detachments with three

or four aircraft and the usual activities of casualty evacuations, VIP communication flights and occasional diversions on behalf of the local population. For example in June 1963 considerable kudos was acquired when a farmer's cow was rescued from a peat bog as an underslung load.⁽¹⁵⁾ There were no major technical difficulties, the Squadron achieving between 200 and 350 hours monthly and generally providing a reliable service.

The No 225 Squadron habit of operating without crewmen was automatically adopted by No 230 Squadron but early in 1964 the latter Squadron voiced the opinion that the absence of communication between the pilot and his passengers should be resolved. This echoed the conclusion of No 848 RN Squadron in Malaya after their first troop carrying operation in 1953—see Chapter 3—but nothing was done about it.

When the need to provide helicopter transport for the United Nation Forces in Cyprus (UNFICYP) arose in February 1964, the task inevitably fell to No 230 Squadron since No 225 Squadron together with the Belvedere Squadrons (except the training rump of No 72 Squadron) had departed to Aden and Borneo. Four Whirlwinds of No 230 Squadron, together with air and ground crews, were detached to Cyprus to join 1563 Flight, (see Chapter 8), briefly called 'Nicosia Helicopter Squadron', but settling down a month later as the 'UNFICYP Flight'. This detachment, rotated by No 230 Squadron every four weeks, formed the first of a series of Squadron detachments for the UNFICYP task which continued well beyond the end of Phase 4 of this account. It temporarily came to an end for No 230 Squadron when the whole unit was withdrawn to UK at the end of 1964 immediately prior to its departure to the Far East for the Borneo operations in January 1965. The UNFICYP task was carried on by the SAR helicopters of Coastal Command until the newly formed No 18 Squadron Wessex were in position in February 1965. (No 230 Squadron was destined for two further UNFICYP detachments after its withdrawal from FEAF, one in 1968 the other in 1970/71).

Back at Odiham, No 225 Squadron, re-equipped with Whirlwinds Mk 10 in the first quarter of 1962, and in conjunction with the Belvederes, continued throughout 1962 and 1963 to carry out the repetitive task of participating in numerous small scale Army exercises with occasional full scale major training operations. In June 1962, No 66 (Belvedere) Squadron departed for Singapore, only a little later than planned, and was immediately replaced by No 26 Squadron which started as a composite unit with No 72 Squadron which had existed since November 1961. No 66 Squadron aircraft had already been shipped direct to the Far East so the effect at Odiham was no more than a change of titles and personnel. No 72 Squadron functioned during this period mainly as a Belvedere OCU, using the Army exercises as part of their own training scenario, whilst giving birth to No 26 Squadron. Comments on some of the salient features of five major exercises will serve to describe the most noticeable events in this period.

The conversion of No 225 Squadron crews on the turbine-engined Mk 10 Whirlwind took place in January and February 1962, although due to delays in production the full complement of 14 aircraft was not achieved until June. So important were the Army Support exercises considered that for part of this time numbers were made up by temporary diversion of six Mk 10 Whirlwinds destined for No 22 (SAR) Squadron. The pilot conversion presented no problem since the Mk 10 Whirlwind was basically the same aircraft as the Mk 2 with its two major difficulties—manual control of rotor speed and a critical shortage of power—removed. From this moment, the ability of helicopter pilots to control rotor speed manually started to decline. By November of that year, owing to an engine computer failure which required investigation, Whirlwinds were temporarily restricted to operating without using the engine-governing computer, and as a result only previously experienced pilots could be used on Exercise 'Winged Coachman' in Northern Ireland, and even they were limited to lifting supplies of fuel and food essential to allow the exercise to proceed on the ground.

Offensive Armament. In accordance with the policy to allow limited offensive armour to be fitted to SRT Helicopters (see Chapter 9), it was announced in January 1962 that the Nord SS-11 wire guided missile (optically guided from the cockpit) was to be available for optional fitting to the Mk 10 Whirlwind. Four pilots attended a course on the weapon in Paris in January.

Exercise Blind Mouse 4. Exercise Blind Mouse 4 in July 1962 was the first major exercise in Germany in which the Whirlwinds of No 225 Squadron were joined by fully operational Belvederes. The whole of No 225 Squadron was involved, together with five Belvederes provided by a mix of Nos 26 and 72 Squadrons' crews. The exercise itself was a great success from the SRT Force point of view although it ended tragically. The Whirlwinds as usual acquitted themselves admirably, as did the Belvederes which not only demonstrated the deployment of the Honest John Tactical Rocket nuclear warhead, but recovered a Whirlwind, slightly damaged in an engine failure forced landing, minus only its fuel and main rotor blades, 25 miles to Gutersloh as an underslung load. By a cruel irony the pilot of this Whirlwind, who had suffered but survived a wire strike by a power cable over the Dortmund Ems Canal during the deployment phase of the exercise, and later carried out this successful engine-off landing without injury to himself, navigator and six troops, was returning to England on 30 July as a passenger in one of the Belvederes, having been delayed at Gutersloh for the consequent Board of Inquiry. This aircraft crashed a few minutes after take off killing all on board, including Squadron leader Watson, the CO designate of the new No 26 Squadron, who was one of the pilots. The rotor transmission was immediately suspect and all Belvederes were grounded including the three remaining at Gutersloh and one en route to the UK which had landed to refuel at Coxyde. The grounding also halted No 66 Squadron, now in Singapore and engaged in assembling and air testing their newly arrived aircraft.

This catastrophe so early in the life of this controversial aircraft caused considerable concern in Whitehall, especially as it seemed to throw doubt on the basic integrity of the twin rotor transmission. The rotors had evidently either hit each other or the fuselage, and the wreckage had burnt on impact. It was soon discovered however that the sequence had been a loss of rotor speed (from 250 to an estimated 140 RPM) allowing the rear rotor to strike the fuselage, and that the front engine was serviceable but had already stopped at the time of the crash. The conclusion was that the rear engine had failed, that the pilot had mistakenly shut down the front engine and had then failed to enter auto-rotation, presumably in the confident expectation that double power from the supposedly remaining engine would be comfortably sufficient to continue the flight. The fears expressed by the BTU after their engine failure and forced landing in 1960, that confusion was likely due to the laterally disposed switches for the longitudinally disposed engines, were now tragically justified. It was too late to re-design the cockpit, so the unsatisfactory palliative consisted of painting prominent white lines round each group of engine controls, marking them boldly No 1 and No 2 and warning the pilots to be careful. After so many years with only single engined helicopters, it is significant that it was also found prudent to issue a general instruction reminding pilots of the primary and overriding concern which should be applied to the maintenance of adequate rotor speed in all circumstances.(16) The Belvederes were ungrounded at the end of September 1962. Fifteen months after this accident, in October 1963, a similar mistake was made with happier consequences during Exercise 'Triplex West' in Libya.

In this case, the pilot was a very experienced QHI. He was flying at 300 feet with 13 RAF Regiment passengers when a malfunction of the rear engine caused him to order the co-pilot to stop that engine. At the same time he instinctively entered a steep turn into wind and lowered the collective lever in preparation for a possible forced landing, although the remaining engine should easily have permitted the flight to continue. The co-pilot, mindful of the accident in Germany just described, delayed taking any action while trying to determine whether the first pilot had correctly identified the engine to be stopped. However he was overridden by the first pilot who himself stopped No 2 engine and was then astonished to find himself with no engine power at all. However, due to his previous precautionary steps he was then able to carry out a fully controlled engine-off landing straight ahead with only slight forward motion. There were no injuries. The ground was soft and the front undercarriage collapsed in shear when the wheels sank through the surface. The deceleration was sufficient to operate the crash switches thus isolating the electrics and enabling the subsequent investigation to prove positively that the front engine (No 1) had been switched off in flight. Thus, the first pilot had correctly stopped the No 2 engine and the co-pilot although incredulous afterwards, was shown to have simultaneously stopped the No 1 engine in error. This confusion under stress, exacerbated by the fact that in the Belvedere the pilots flew alternately from the left and right seats, was due in part to the cockpit design so that even

when pilots were fully alert to the possibility of error, the wrong engine switches were likely to be selected. All that could be done was once more to warn the pilots to be careful.

As a footnote to this accident it is interesting to record that unknown to the pilots the rear end of the aircraft was on fire, as a result of a fuel leak which had caused the initial malfunction. Had the No 1 engine not been stopped in error, the pilot would have climbed to 1000 feet and set course for base and there would have been a catastrophic failure in which all the evidence would probably have been destroyed.

It was the practice during this learning phase of the Belvedere to fly with two pilots, although the aircraft specification required it to be operable by only one. It was after Exercise Blind Mouse 4 that No 72 Squadron made the recommendation that two-pilot operation should be normal (split control as used in the Coventry Cathedral operation was used for accurate emplacement of the Honest John nuclear warhead). The death of the crewman in the Belvedere accident in Germany previously mentioned revived the case for establishing an aircrew trade of 'helicopter crewman'.(17)

Exercise Falltrap. Falltrap was the name given to an exercise involving paratroops in Greece in September 1962. Whirlwinds were used to provide casualty evacuation services for the paratroops. Although only three Whirlwinds were involved, the exercise is mentioned because it shows the rate of effort which was sometimes demanded. The whole of No 225 Squadron had been deployed in Germany for Exercise Blind Mouse 4 in July. In the following September No 225 Squadron again deployed six Whirlwinds to Germany for training for 1 BR Corps and a further six for the October exercises (Desert Rat and Canada Cup) as well as three for Falltrap. This amounted to one more than the total Unit Establishment (UE). Some aircraft were borrowed from the newly forming No 230 Squadron, and two pilots (previously with No 225 Squadron) from the recently formed No 26 (Belvedere) Squadron. There were three major parachute drops during 'Falltrap' and several minor ones. The Whirlwinds lifted 110 casualties, (including some carried more than once). The three aircraft and personnel (four pilots, ten technicians, two RAF Regiment gunners and one cook) were carried to and from Greece by Beverleys of the MRT Force—once again a highly successful form of deployment.(18)

Exercise Winged Coachman. From an exercise point of view, 'Winged Coachman' was a failure but it highlighted several deficiencies in the SRT Force which were normally concealed by unrepresentative circumstances, natural or contrived, in the interests of giving the Army what it wanted. The scene was Northern Ireland in November 1962 and was to have involved six Belvederes and eight Whirlwinds. Only five of the Whirlwinds arrived, three becoming unserviceable during transit

through Valley. The Belvederes were delayed for two days at Odiham by the 5°C temperature limitation for start up described in Chapter 8. When they did set off they encountered such fierce headwinds and low cloud that they were forced to divert to Tern Hill. They reached Valley to find that gales up to 58 knots prevented start up (maximum wind speed for starting rotors was 50 knots). An attempt to reach Aldergrove made two days later on 17 November was frustrated by low cloud (lack of instrument flying clearance and navigation equipment) and the Belvederes were recalled to Odiham on 20 November. The five Whirlwinds, as previously mentioned, were restricted to use of manual throttle owing to a computer defect investigation and so could only be flown deliberately in manual by experienced pilots for vital food and fuel supply sorties.(19)

Exercise Cross Channel. Exercise 'Cross Channel' was an ambitious and highly successful British/French operation in which the British troops were delivered to Toulouse in Britannias of the Long Range Transport Force, and deployed from there by Belvedere into the exercise area near Caylus, about 50 miles North East of Toulouse. Seven Belvederes drawn from Nos 72 and 26 Squadrons were used, and demonstrated convincingly what was to become a noticeable feature of the aircraft—its ability to deploy successfully over much greater distances than had previously been possible. The Belvederes flew tactically at low level the whole length of France. The operation was controlled by a No 38 Group FATOC at Caylus and the landing sites by MAOT from Odiham, the latter being found by using the Belvedere's only on-board navigation aid apart from the compass—a VHF homer. The aircraft was still quite new, and apart from the now usual first aid measures to persuade the engine starters to keep functioning, there were no major unserviceabilities and all seven aircraft returned in good order.(20)

Deployment to Aden. In January 1963, the time had come for No 26 Squadron to start deploying to Aden. The bold decision was taken to fly two Belvederes to El Adem to take part in an Army exercise ('Sandstorm') and then to continue to Aden round the South West corner of Egypt since flight across that country was politically inappropriate. The two aircraft flew by easy stages from Odiham on 17 January 1963 via Manston, Reims, Dijon, Orange, Nice, Pisa, Naples, Brindisi, Araxos, and Souda Bay, and reached Al Adem on 25 January. The exercise was carried out successfully and, apart from the inevitable starter motor change, without trouble.

On 22 February 1963, the Squadron Commander (Sqn Ldr Hart) arrived with three pilots to take the two Belvederes to Aden where they were due on 1 March. Accompanied by a Beverley carrying spares and servicing personnel they left El Adem on 26 February via S3 (an oilfield airstrip) to Djebel Uwainat, proceeded to Wadi Halfa on 27 February, and to Port Sudan and Massua on 28 February, arriving on schedule at Aden on 1 March 1963. Both Belvederes were serviceable

on arrival and immediately commenced demonstrations and trials. The aircraft performance was found to be even better than expected, and first operations commenced in May.(21) The remainder of No 26 Squadron at Odiham was merged with No 72 Squadron pending piecemeal deployment to Aden.

Exercise Triplex West. 'Triplex West'—a full scale tri-Service exercise in Libya—was in a sense a 'good finale' for the SRT Force as first constituted and it was fitting that it should be mounted in the same area as the first one in which the Force participated in 'Starlight' in 1960. Once again El Adem was the mounting base, the forward Airhead on this occasion being Bomba, an airstrip on the coast about 50 miles west. The exercise took place during the first week of October 1963, and was to require nine Whirlwinds and two Belvederes.

The Belvederes deployed themselves to El Adem without trouble, and four of the Whirlwinds were delivered by Beverley. The decision to fly the remaining five Whirlwinds to El Adem turned out to be an unfortunate one due to a combination of bad weather and unserviceability. The route was Manston-Chaumont-Orange-Genoa-Rome-Naples-Brindisi-Andravadi-Souda Bay-El Adem, the journey starting on 21 September. The first unserviceability delayed the whole party for three days at an unscheduled stop at Nice, and by the end of the month four out of the five were unserviceable. It was clear they would not arrive in time for the start of the exercise. From 1 to 3 March the party was held up at Naples, and with more unserviceability remained at Brindisi until 6 March. They arrived at Bomba on 7 March, one day before the end of the exercise, the brunt of the work having been borne by the Whirlwinds delivered by Beverley. There were other vicissitudes; the Whirlwind detachment Commander at Bomba broke his ankle on 3 October and his replacement had to be evacuated as a casualty on the 7 October; and one of the Belvederes had crashed. It was against this less than happy background that the news was received on the 10 October that, instead of returning to Odiham, the whole force would be increased by the addition of one Whirlwind and two Belvederes and would continue eastwards to Singapore for deployment to Sarawak in Borneo.

The aircraft carrier HMS Albion was to be used to convey this group to Singapore, inaugurating a method of transferring SRT helicopters between theatres of operation which was to be used with increasing frequency in the Far East. The opportunity was taken to add two further Belvederes from No 26 Squadron Odiham for delivery to Aden en route, and these were also flown to join HMS Albion at Tobruk. The extra Whirlwind was delivered by Beverley to El Adem for embarkation with the rest of the No 225 Squadron aircraft. The resident Flight at El Adem, No 1564 (Sycamore), assisted with the embarkation as reported in Chapter 5.

Odiham had thus dispersed to the Far East all but four of the No 225 Squadron Whirlwinds, and they, fitted with Nord SS-11 missiles, followed two months later

in December 1963. This marked the end of the first period of the SRT Force at Odiham. Six Belvederes had been sent to El Adem, none of which would return, and only three were left at Odiham. Three remained to be delivered from the contractors. In March, the last two Belvederes for Aden were flown to the aircraft carrier HMS Bulwark at Portsmouth for transit to Aden and regular tasking at Odiham then ceased. No 72 Squadron activity reduced to Belvedere conversion courses only, and this residue was retitled the 'Belvedere Conversion Unit' in August 1964.

In January 1964, only weeks after the departure of No 225 Squadron to the Far East, the Wessex Trials Unit, which had worked at Odiham since the middle of 1963, formed into No 18 Squadron to be joined in August 1964 by No 72 Squadron as the second Wessex Squadron. No 18 Squadron took up residence in Gutersloh at the end of that year, in order to release No 230 Squadron which was now urgently needed as further reinforcement of the FEAF helicopter forces in Borneo.

Nine of the No 230 Squadron Whirlwinds were embarked on the aircraft carrier HMS Triumph on 29 January 1965, collecting in passing their four remaining aircraft from the UNFICYP in Cyprus and replacing them with three Wessex of No 18 Squadron, also making use of the carrier transit. The Squadron air and ground crews were flown to Singapore on the 19 February ready to meet the carrier and fly their aircraft to Seletar on the 22 February. After only a few days local training, the entire unit embarked on the aircraft carrier HMS Bulwark, arrived at Labuan on 10 March and commenced operations immediately. Like the personnel of No 225 Squadron their predecessors in FEAF reinforcement the No 230 Squadron personnel were not posted for a full tour in the Far East, but for a one year period unaccompanied by families. Odiham carried a heavy administrative load on behalf of the families left behind from 1964 to 1966.

No 1310 Flight

Not quite all of Odiham's Whirlwinds went Eastward to Borneo. In 1964 the Army was dealing with an internal security problem in British Guiana during preparations for a General Election leading to Independence in 1966. Army Air Corps Alouettes were being used in support, but, as in Malaya in 1950-52 and in not dissimilar topography and climate, some troop and passenger carrying capability was needed. Two Royal Navy Wessex from HMS Devonshire had been co-opted to help but they needed replacing to allow them to return to their naval duties.

No 1310 Flight, consisting of three Whirlwinds Mk 10, three pilots, one Warrant Officer, six Senior NCOs and 32 airmen was formed at Odiham on 23 July 1964. After a brief period of training and trials with a cluster grenade discharger to launch grenades from 200 feet at 35 knots and intended to deliver tear gas or smoke to break up illegal demonstrations, the Flight deployed to British Guiana in the

latter part of August. The only other special equipment consisted of arrangements for mounting a Bren Gun in the cabin doorway. SARBE was by now a standard fit in all Whirlwinds for search and rescue homings.

Two of the three Whirlwinds arrived by sea in crates at Georgetown on 24 August and had to be assembled in the harbour area so that they could be flown to their base—Atkinson Field—some 25 miles away. This task was accomplished by great effort on the part of the ground crews, most of whom were new to helicopters and unaccustomed to the tropical climate, so that the first aircraft was able to take part in a planned operation—'White horse'—on 29 August. This was a typical internal security military operation to capture known criminals with illegal arms and ammunition in the relatively inaccessible jungle hinterland. The second aircraft was ready by the following day and the third arrived in October.(22)

The Flight quickly settled down to a pattern of operations practically indistinguishable, except in scale, from that in Malaya—troop lifts to deal with dissident factions in remote jungle areas, cordon and search operations similar to those carried out in Cyprus in the 1950s, reconnaissance, communications and supply tasks and the inevitable flow of both Service and civilian casualty evacuations.

British Guiana was not excessively violent and No 1310 Flight never had to use its grenade launchers or Bren Guns. As in Malaya, crewmen were trained from amongst the ground crew NCOs and carried as a matter of course. The personnel were rotated by Odiham every six months and, as was becoming typical of the small relatively independent helicopter detachment, were extremely efficient and reliable, flying between about 60 and 90 hours each month depending on the demands made upon them. There were no major accidents and morale was consistently high.

The General Election in December 1964 went off quietly, No 1310 Flight assisting in transporting ballot boxes. Towards the end of 1965, exercises were being carried out with the new Guyana Defence Force and internal security operations were dwindling. HM The Queen was able to pay a visit in February 1966 and for this event, No 1310 Flight had to be issued with special radio sets so they could contact the Guyana Police Force (part of the internal Security Forces). The state of SRT Communications capability has been mentioned previously.

26 May 1966 was Independence Day for the newly named Guyana and No 1310 Flight took part in the ceremonial fly past, and also flew the Duke and Duchess of Kent to visit Fort Wellington, New Amsterdam, Springlands and brought them back to Georgetown. The Army Air Corps helicopters withdrew in July and in September the three aircraft of No 130 Flight appeared at a ceremonial Beating of the Retreat. The Flight was disbanded two years after its formation, the Whirlwinds being returned to the UK by a Belfast of the Long Range Transport Force.(23)

Summary of Progress for the SRT Force, 1960-1964

The SRT Force of Whirlwinds and Belvederes grew rapidly at Odiham from the beginning of 1960, and disappeared equally quickly from Odiham to Aden and the Far East in 1963, preceded by No 66 (Belvedere) Squadron in 1961 and followed by No 230 (Whirlwind) Squadron from Germany in 1964. There was scarcely any measurable development in SRT techniques during that period, the method of operating being substantially the same throughout. HF radios were being fitted to the Belvederes previously scheduled for the Far East, an addition later made to the Whirlwinds, but this was more for RAF control reasons than for direct Army assistance. Communications with the Army in the field remained substantially undeveloped. The only navigation aid which was added was Decca fitted in the Whirlwinds, but there was no other technical improvement in ability to operate at night or in bad weather. Tasking of the inevitably inadequate SRT Force in the field remained a potential cause of dispute and there was no formal approved written 'Concept of Operation' for the whole Force, neither was there opportunity to construct one in the continuous hectic preparation and execution of an unending stream of so-called training exercises.

From a purely RAF point of view the efficiency of the aircrews was eminently satisfactory and the reliability of their performance, especially when required to carry out unusually difficult tasks or to take part in unexpected overseas operations in severe conditions, fully justified the efforts to maintain expertise in pure flying techniques within the full capabilities of the aircraft. In this, the influence of the CFS Helicopter Squadron and its control of individual pilot categories inevitably played an important part, as it undoubtedly did through QHI training in the numerous aircraft type conversions carried out at Odiham. Between 1960 and 1964, all operational training for both Whirlwind and Belvedere pilots during this period of maximum rate of growth of the SRT Force was carried out on the Squadrons at Odiham; as was the aircraft type conversion for Belvedere pilots.*

On two occasions during temporary grounding of the Belvederes, in September 1962 and April 1963, the ubiquitous Sycamore was recalled from retirement in the Maintenance Unit at Wroughton to provide continuation flying practice for the Belvedere pilots, and was relinquished afterwards 'with the regret of those who had had the pleasure of flying it'.(24)

*The Belvedere Conversion Flight which remained after No 72 Squadron re-formed with Wessex, was eventually merged with the Wessex Conversion Flight forming the 'Short Range Conversion Unit' in 1966, becoming the 'Helicopter Operational Conversion Flight' in 1967 and, with the arrival of Pumas in 1972, achieving Operational Conversion Unit status as No 240 OCU.

References to Chapter 10

- 1 No 38 Group ORB.
- 2 No 225 Group ORB.
- 3 ID9/94/10.
- 4 No 38 Group ORB.
- 5 Ibid.
- 6 BTU Trials Report.
- 7 ID9/94/10.
- 8 ID9/W2-60.
- 9 No 26, 72 & 66 Squadron ORBs.
- 10 No 72 Squadron ORB.
- 11 No 225 Squadron ORB.
- 12 Westland Report.
- 13 ID9/D4-35.
- 14 Ibid.
- 15 No 230 Squadron ORB.
- 16 ID9/94/10.
- 17 Nos 26 & 72 Squadron ORBS.
- 18 No 225 Squadron ORB.
- 19 Nos 225 & 26 Squadron ORBs.
- 20 Nos 72 & 26 Squadron ORBs.
- 21 No 26 Squadron ORB.
- 22 No 1310 Flight ORB.
- 23 Ibid.
- 24 No 26 Squadron ORB.

CHAPTER 11

THE ARABIAN PENINSULA IN PHASE 3 (1961-1971)

Background Summary

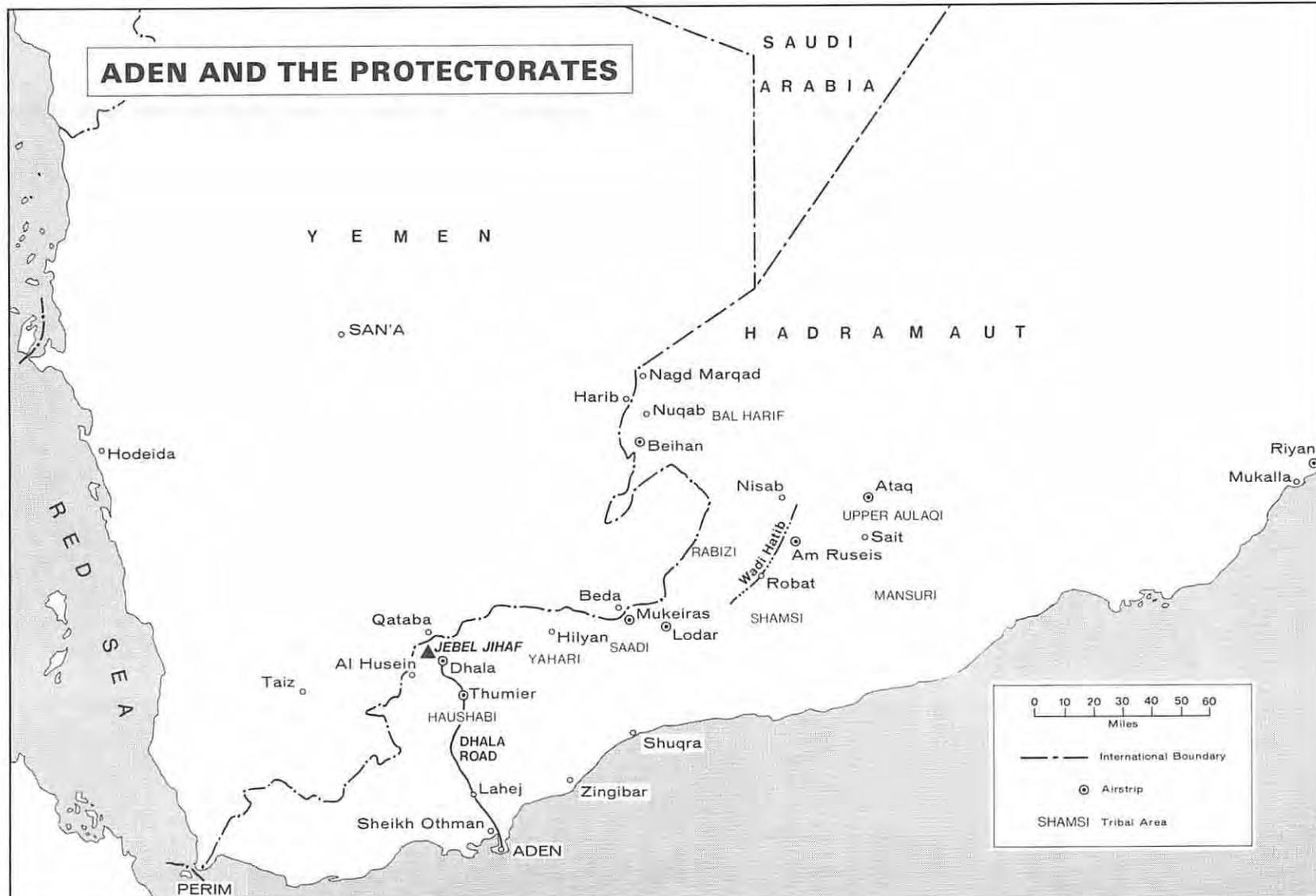
Helicopter operations in the Arabian Peninsula had been confined to the Sycamore SAR Flight at Khormaksar from 1955 (Phase 2) until the arrival of No 26 Squadron Belvederes in 1963, marking the start of Phase 3 in that Theatre.

The period between the end of the Kuwait crisis in August 1961 and the start of the large scale operations in the Radfan area of the Western Aden Protectorate two and a half years later (January 1964) is described by Sir David Lee in 'Flight from the Middle East' as a breathing space in the sense only that it constituted a brief interlude of relative calm between serious episodes which required the participation of all the forces available.

Apart from the SAR Flight in Aden and the single Sycamore in Nairobi described in Phase 2, there had been no helicopter support in the formal tactical support role in the Theatre during the activities preceding this breathing space. Helicopter tactical involvement in the final upsurge of activity in the Radfan and in Aden itself was to be crucial to the military operations eventually conducted, although the rising clamour for independence in South Arabia, coupled with the political pressures in the United Kingdom which foreshadowed the end of Middle East Command, was finally to frustrate the strategic aims of all these operations regardless of their temporary local success.

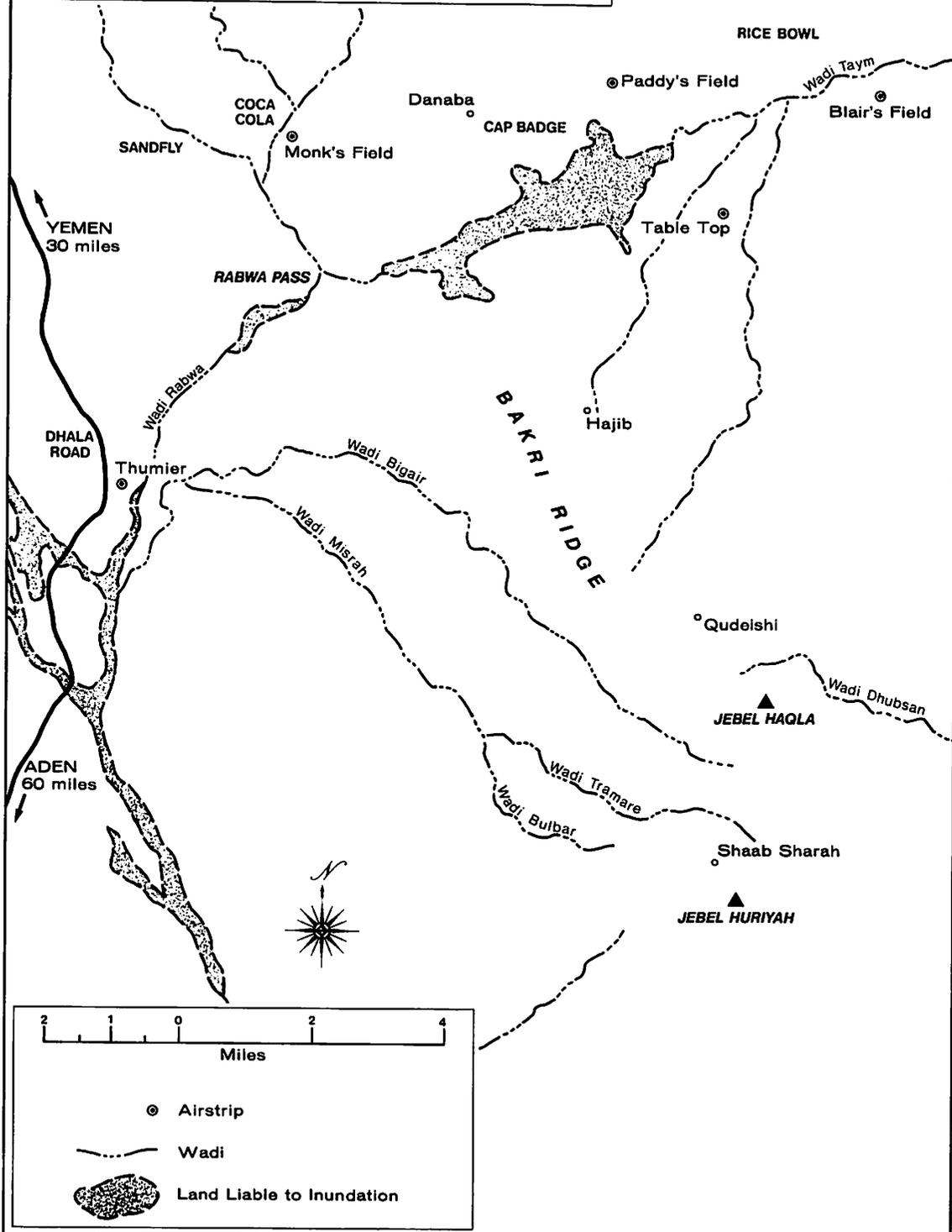
The six Belvederes of No 26 Squadron arrived in pairs over a period of more than a year starting in March 1963, a seventh being added from FEAF in mid-1964. It was not until December 1963 that the rising tide of trouble in the recently formed Federation of South Arabia, which then incorporated the Colony of Aden as Aden State, brought political and military matters to a head with a hand grenade attack on the British High Commissioner and his party whilst they were waiting to board an aircraft on that part of the tarmac used for civil aircraft at Khormaksar. Reaction was immediate, a state of emergency was declared throughout South Arabia, the frontier with the Yemen was closed, and offensive military operations by land and air on a considerable scale were decided upon. The dissident elements among the Radfan tribes, being the greatest trouble-makers and receiving most encouragement from their masters across the Yemen Frontier, were selected as the main targets for a three battalion operation planned for January 1964. This operation, titled 'Nutcracker', relied for transport and logistic support on two

273-A



Air Staff Drawing Office (RAF) October 1986

AREA OF RADFAN OPERATIONS



Air Staff Drawing Office (RAF) October 1966



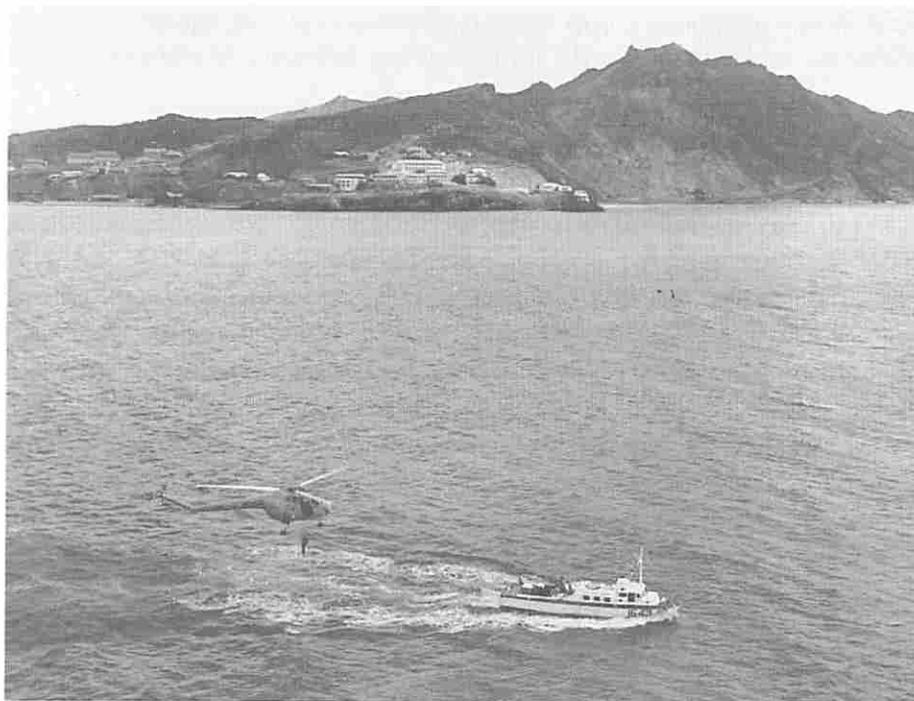
26 Squadron detachment on HMS Albion during the Mombasa/Tanganyika operation in January 1964.



26 Sqn Belvederes on HMS Centaur bound for Dar-es-Salaam during the Mombasa/Tanganyika operation in January 1964.



Casualty Evacuation to Thumier by Sycamore of Khormaksar SAR Flight.



Sycamore of Khormaksar SAR Flt training with RAF Marine Craft near Steamer Point—Aden.

Belvederes and two Sycamores of the Khormaksar SAR Flight and four Royal Navy Wessex Mk 1 from HMS Centaur which happened to be available at the time. The operation lasted about three weeks.

By March 1964 it was evident that the FRA (Federal Regular Army—previously Aden Protectorate Levies) was strained beyond its resources in trying to garrison the newly controlled areas of the Radfan while manning the frontier against Yemeni incursions. It was decided to withdraw these units in the Radfan to a base at the edge of the area (Thumier), whereupon the dissidents reoccupied the area vacated and a victory was declared by Egypt and Yemen. Incursions over the border then increased as did attacks on the convoys on the Dahla Road, while the resident tribesmen joined the dissidents in increasing numbers. It was decided that still further military action involving British troops would be essential to quell the insurgency before it got out of hand. Thus in May 1964 the second and main operation commenced in the Radfan—'Operation Flamingo'.

Before this happened, however, there was a temporary diversion in the form of unrest in the newly independent East African States, and a Marine Commando force was despatched from Aden in February 1964 to deal with the military mutiny of Dar-es-Salaam. The aircraft carrier HMS Centaur, whose Wessex Mk 1 helicopters had so recently helped the Belvederes in Operation Nutcracker, were this time helped in return by two Belvederes which were embarked on HMS Centaur at Aden and used first in the seaborne troop assault and heavy lift of equipment and vehicles at Dar-es-Salaam, and subsequently on patrolling between Mombasa and Zanzibar.

The first plan for Operation Flamingo in the Radfan involved flying the whole of 45 Commando by helicopter to seize high ground and, by controlling the Danaba Basin and Wadi Taym, cut off retreats to the Yemen. No 26 Squadron then had four Belvederes, increasing to six in May. These, together with the Kormaksar SAR Flight—which had at last exchanged its Sycamores for four Whirlwinds Mk 10—and two Army Air Corps Scouts, constituted the entire helicopter force available, there being no Royal Navy aircraft carrier present at the time. This force was insufficient for the helicopter-borne troop assault required and recourse had to be made to an advance on foot with the helicopters in the support and supply role. The dominating feature named Cap Badge was eventually captured after much difficulty, and the Wadi Taym satisfactorily controlled. This experience showed that settling the Radfan was going to be a long and arduous business in which the availability of an adequate helicopter force was a major consideration.

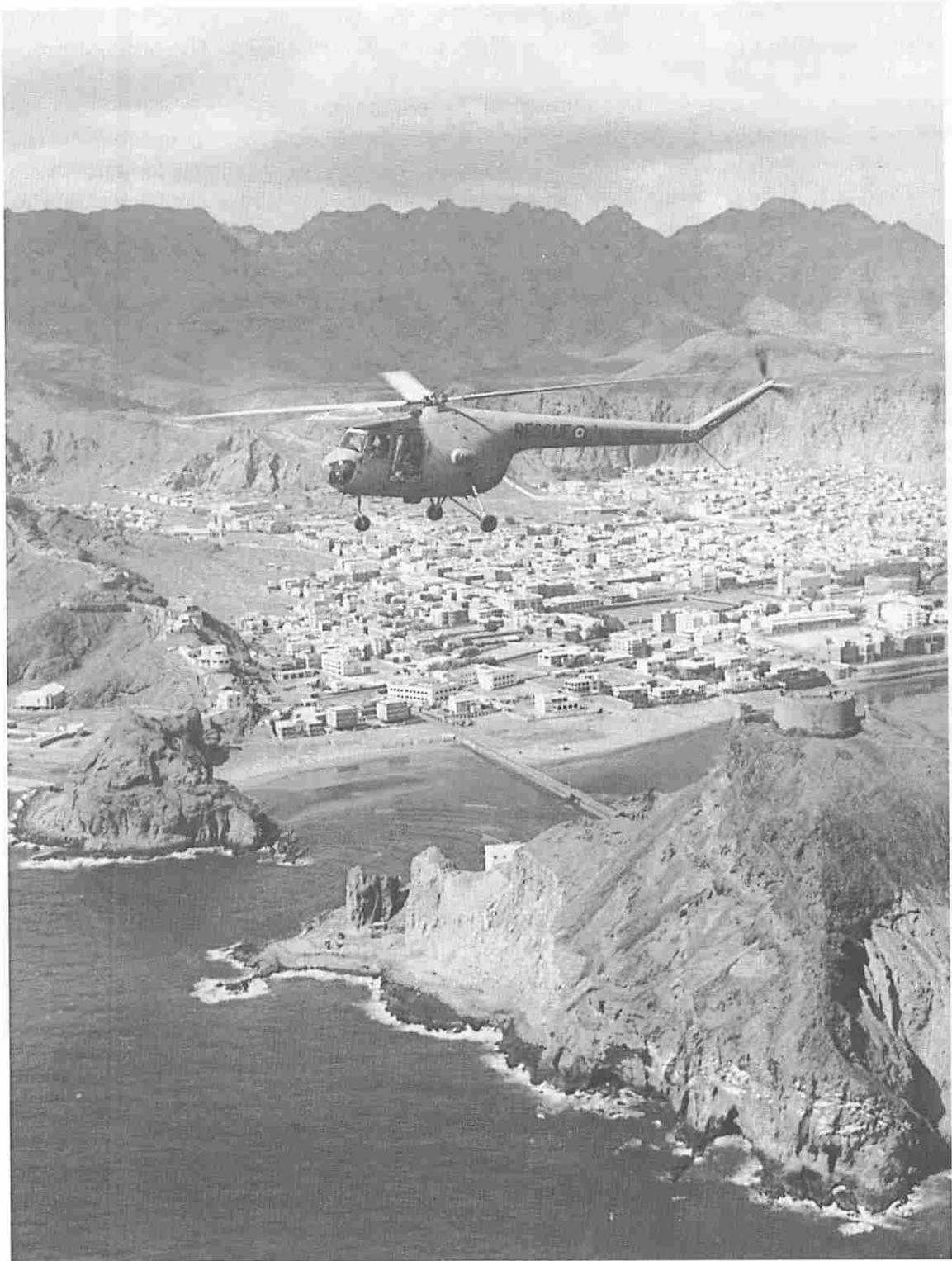
Aggressive patrolling by the ground troops with helicopter support and re-supply continued while the return of HMS Centaur which was due later in May was awaited. Extra helicopter support including a further Belvedere and pilot from

FEAF would then be available for the next phase, the primary objective of which was the capture of Bakri Ridge. This culminated victoriously in the occupation of the formidable Jebel Huriyah, a 5500 foot peak which dominated the whole of the Radfan. This was the decisive climax of the campaign although it did not signal the end of operations in the Radfan as Government Forces, and consequently the helicopters, continued to be active at varying degrees of intensity for the whole two and a half years remaining before the final British withdrawal from Aden in 1967.

The gradual reduction of operational tempo towards the end of 1964 provided a much needed respite for Khormaksar where the Belvederes were beginning to succumb to technical problems. Yemen and Egyptian pressure was switched to the urban areas and a mounting wave of subversion and terrorism swept through Aden State itself leading directly to the withdrawal of all British Forces in 1967. Assistance was provided from time to time by Royal Navy Wessex helicopters temporarily detached from passing aircraft carriers, but the main helicopter task of maintaining the FRA and British troops in the Radfan during this period fell on the Wessex Mk II of No 78 Squadron which arrived in mid-1965 just as the Belvederes were finally collapsing and they, together with the Whirlwinds and later the Wessex of the Kormaksar SAR Flight, became progressively more involved with internal security tasks arising from the increasing subversion and terrorist activities in Aden itself in the final days before withdrawal. No 78 Squadron was the last RAF unit to leave Aden, flying a final sortie with freight and passengers from Khormaksar to HMS Intrepid at 1345 hours on Independence Day—29 November 1967.

Khormaksar SAR Flight

By 1963 the Sycamores of the SAR Flight had been an established feature at Khormaksar for over seven years. After a slow start, initially having been regarded with some suspicion, they had become practically indispensable both in providing a rescue capability for the fighter pilots operating in areas dramatically inhospitable in terms of topography as well as population, and in enabling VIPs and various political personages to appear at places otherwise difficult or impossible for them to reach. Such was the eventual operational reliance on this SAR Flight that there were occasions when Hunter strike operations were postponed, pending the return to standby of a SAR helicopter temporarily converted to the VIP role. This Flight was 'Khormaksar's own' and although the No 26 Squadron Belvederes and later the Wessex of No 78 Squadron borrowed crews at times it was not, despite proposals to the contrary,(1) allowed to be absorbed into the tactical helicopter squadrons until just before the final withdrawal in 1967. By contrast, in both Cyprus and FEAF the SAR function became a secondary task for the Tactical Helicopter Force. This is not to say that the Aden SAR Flight was excluded from the tactical role,



Kohrmaksar SAR Flt Sycamore over Aden.



Khormaksar SAR Flt Whirlwinds over Aden.



Gulf SAR Flt Whirlwind Casualty Evacuation to Bahrein (1967—shortly before replacement by Wessex in Comsar Bahrein).

especially when the Whirlwinds with their enhanced cabin space replaced the Sycamores. Even the Sycamores were called in to help, for example, in the first Radfan operations of January 1964,(2) while a Whirlwind, 'misemployed' for an operational reconnaissance in June 1964 was hit four times by ground fire in the Wadi Misrah two miles from Thumier.(3)

In fact the Sycamores, which had originally arrived in June 1955, had been closely associated with transport support during air operations by Shackletons and Venoms from late 1956 onwards when there was much dissident tribal activity and gunfire especially on the Yemen border,(4) but their restricted cabin size, small numbers and limited power automatically prevented them from being used in a main tactical helicopter role until the arrival of the Belvederes in 1963 made such operations possible. Nevertheless, even the SAR role throughout consisted almost exclusively of dealing with the results of ground or air activity inland from Aden and in these circumstances there was for the helicopter pilots little difference between SAR and a more formal tactical role. Frequently the Sycamores on rescue missions would themselves be supported by Venom and even Shackleton escorts to provide defence from hostile ground forces. The sea SAR role, however, was still regularly practised and full standby maintained. In May 1963, for example, the pilot of a Royal Navy Scimitar from the aircraft carrier HMS Ark Royal ejected and was rescued by Sycamore ten minutes later.(5)

Except for No 1564 Flight at El Adem, the Khormaksar SAR Flight was the last operational unit to have its Sycamores replaced by Whirlwind Mk 10s. The change took place slowly, the first two Whirlwinds arriving in January and February 1964, but requiring some role modification on arrival. The four Sycamores were flown to the aircraft carrier HMS Albion for return to the UK on 28 March but delays in modification and in the arrival of a second pair of Whirlwinds (intended ultimately to form a new SAR Flight at Muharraq) until July created a problem in Aden which was felt sufficiently keenly to cause temporary detachment in June of a Sycamore from Cyprus from where the El Adem Flight was supported.(6)

In November 1966 the SAR Flight received its first two Wessex Mk 2s, painted yellow and equipped for SAR work. The Whirlwinds, however, were retained as the internal security situation in Aden deteriorated and did not leave until May 1967. One of the Wessex was used to relieve No 78 Squadron from the increasing task of VIP transport as the internal security situation worsened (7), but once the SAR Flight had aircraft identical to the tactical force and crew borrowing between the two units became a regular and automatic procedure, the 'de facto' absorption of the SAR Flight into No 78 Squadron became inevitable, although it did not happen officially until the last few months before withdrawal when the rest of the Khormaksar establishment was being drastically reduced.

Belvederes in Aden

The arrival on 1 March 1963 of the two Belvederes constituting the first element of No 26 Squadron in Aden, as described in Chapter 10, which had flown all the way from Odiham and taken part in an Army exercise at El Adem en route (Operation Sandflight), should have been seen as a milestone in helicopter capability. The 2200 mile journey from El Adem was accomplished easily in four days, requiring 25 flying hours per aircraft (see Chapter 10). It passed almost unnoticed, in spite of the fact that Transport Command tried to generate some publicity, both to counteract general disbelief in the Belvedere itself, and to recognise that both aircraft duly arrived fully serviceable on the predicted date.

The authorities in Aden may also have had mixed feelings on the subject. Belvederes were not arriving, as it might seem in retrospect, specifically to fill a long felt need for powerful helicopter assistance in the fight against dissident tribesmen which, after several years, had become a way of life a comfortable distance away from Aden itself. Rather they were deployed in accordance with the previously planned worldwide five company lift capability of the new Short Range Transport Force as described in Chapter 9. Indeed redeployment had been delayed at the request of Headquarters, Air Forces Middle East the year before because of the shortage of accommodation, hangar space and technical facilities at Khormaksar (8)—hardly the response of a Command feeling dire need of tactical helicopter support.

For the Army, however, there can have been no such cautious ambivalence. During March and April 1963 the Belvederes carried out trials and training, and demonstrated beyond doubt that their performance capabilities were at least as good, and in many respects better, than predicted. All at once the ability to insert, resupply and recover whole patrols by air in places in the Jebel and Wadis north of Aden otherwise appallingly difficult to reach had become a reality, where previously the somewhat doubtful recovery of single casualties by the SAR Sycamores had been the only regular facility. Of at least equal importance was the capability to deploy and supply the 105 mm artillery guns to advantageous positions which could never have been reached otherwise.

In May 1963, three months after their arrival, the Belvederes were committed to their first formal operation (Operation Pennant) which involved four nights away from base. The engine starter troubles which became progressively worse soon forced the decision to avoid overnight stops away from Khormaksar. Anxiety on the Squadron to receive more aircraft from Odiham to build up the unit to its full size became intense, but there was no plan to repeat the self-delivery from the United Kingdom by air used for Operation Sandflight, and it is doubtful whether Khormaksar itself was enthusiastic to add to its accommodation problems. No 26 Squadron was operating from four non-air conditioned offices and two aircraft



105 mm gun having been positioned by Belvedere, being re-supplied with ammunition by a Whirlwind of the Khormaksar SAR Flight in the Gebel North of Aden.



Troops being deployed by knotted rope to defensive position near Thumier.



Beverley and Belvederes on the Strip at Thumier.



Machine gun mounting in rear hatch of Belvedere in Aden.

packing cases.(9) It was November before the aircraft carrier HMS Albion came past with two more of No 26 Squadron's Belvederes on board.

Khormaksar, having housed only No 8 Fighter Squadron, possessed less than 100 married quarters when the Sycamores arrived in 1955, but by 1962 had acquired its 1000th married quarter and a strength exceeding 3000 officers and airmen. At the end of 1963 it housed nine squadrons and two independent flights with a total establishment of 84 aircraft, so that although a vast building programme had been in progress for some time, accommodation needs of all kinds still presented a considerable problem.

In the meantime Belvedere operations continued on an opportunity basis—two Austers were recovered as underslung loads in June, but by July the behaviour of the starter motors which had caused prohibition of night stops away from Khormaksar were the cause of a further limitation restricting the Belvederes to an 80 nm radius of action from Aden. The Squadron Commander sought, but failed to obtain, permission to visit FEAF to see how they dealt, apparently successfully, with this and other Belvedere problems; and he also failed in an attempt to obtain field camping equipment to enable aircraft and crews to night stop away from base—already a well established No 38 Group practice at Odiham where No 26 Squadron had spent the formative months of its re-birth as a helicopter unit. To add to his frustration he was unsuccessful in his attempts to secure more suitable Squadron accommodation. All these factors doubtless enhanced the feeling on the unit that the No 26 Squadron Belvederes seemed to be regarded almost as much of a nuisance as an operational asset on the very busy and overcrowded multi-role fixed-wing operational airfield of Khormaksar,(10) described by the Commander-in-Chief in March 1964 as the largest and most complex station in the RAF.(11)

This attitude on the part of the Squadron may in retrospect seem to be somewhat paranoid, but it must be remembered that a very similar feeling of local scepticism initially prevailed in FEAF in 1950, Cyprus in 1956 and Khormaksar itself during the first years of the SAR Sycamores in 1955/56. Khormaksar in 1963 came late into the full scale tactical helicopter business, and No 26 Squadron, having grown in the enthusiastic highly mobile tactical helicopter environment of No 38 Group, was yet to make its way in what seemed by contrast to be an excessively cautious atmosphere. This factor helped to cause the sharp contrast between the development of the large tactical helicopter in Aden and that in FEAF.

In the first nine months of the Belvedere's presence in Aden—March to December 1963—not much had happened. Operational trials and training of pilots, Corporal crewmen volunteers from amongst the ground crew, and soldiers of the Federal Regular Army (FRA) in roping techniques proceeded. Operation Pennant in May served mainly to convince the authorities that the Belvedere was too difficult to

maintain away from Khormaksar, especially in respect of engine starters, and by July the infant No 26 Squadron with only two aircraft was actually feeling frustrated by lack of tasking, the 80-mile radius limitation placed on their operations and the long delay in receiving more of their aircraft from Odiham. In 1963 operations in Borneo had priority and Odiham was more concerned with providing aircraft and trained Belvedere crews for that theatre. In October two pilots went back from Aden to Odiham to collect the next two Belvederes and ferry them to El Adem for embarkation on the aircraft carrier HMS Albion from which they were delivered in Aden in November. During this period the Squadron, thus reduced to three pilots, felt some dismay when another was removed for his turn in the full-time administrative post of Sergeants' Mess Treasurer, leaving only the Squadron Commander, Flight Commander and the single Squadron Navigator as the operational element. This seemed to confirm their impression that they were scarcely regarded as a vital operational asset to the Station.

The arrival of the second two Belvederes from Odiham in November 1963 occurred just as the severe conditions of the theatre were beginning to show their serious impact on the first two. Rotor blade erosion due to abrasive dust had grounded one aircraft and the second was developing a similar condition. There were insufficient rotor blade replacements. In the following month a troop deployment to a 6200 foot ridge had to be abandoned due to excessive turbulence, a most unusual but nevertheless revealing incident. Elsewhere a few successful placings of 105 mm artillery guns and crews were carried out. The following year was to be very different.

1964 was to be the year of the Belvedere in Aden, seeing both its valuable contribution to the Radfan operations as well as the beginning of its demise in this theatre.

Method of Operating in the Radfan

The pattern of bases was very close to the ideal taught by the Joint Warfare Establishment. Khormaksar was the MRT Air Head into which the long range Comets and Britannias could operate without restriction. About 40 miles north across desert at the edge of the Jebel lay the SRT Air Head at Thumier (later known as Habilayn). It consisted simply of a dusty airstrip originally 350 yards long, well suited to operations by the Twin Pioneer aircraft of No 78 Squadron. Later in the operation it was lengthened to permit use by Beverley transport aircraft. The distances from Thumier to the scenes of operation were very satisfactorily short, being only about 15 miles from the semi-permanent landing and delivery sites eventually established for the helicopters in the forward areas, and in some instances considerably less. Sortie lengths varied from five to twenty-five minutes. Indeed, from a security point of view Thumier was uncomfortably close



Belvedere positioning 105 mm guns North of Aden.



'One ton containers' ready for re-supply in forward area. Dust problem very evident in the prolonged hover required.



Belvedere landing near a Beverley at Beihan.



Belvedere at Thumier attempting to land ahead of its dust cloud.

to the enemy in the mountains and was frequently subject to rocket and rifle fire especially at night. For this reason, as well as because of total absence of servicing facilities of any sort, every effort was made to get helicopters back to Khormaksar at or soon after last light. This ferry flight was sometimes done after dark but night landings at Thumier were not practicable because airfield lighting was almost certain to attract enemy fire. This was the only operational night flying required of the Belvederes and occasionally it would have to be made on one engine when the second one defied all attempts in the field to start it. During Radfan operations, engines were never stopped away from Thumier. Refuelling there was for some time carried out by the time-consuming and exhausting use of hand pumps from 44 gallon drums; much later a bowser was provided, but it seems that initially there was little expectation of the comparatively long term continuous use of Thumier which was to become the pattern. It was over a year after the first Radfan operation before any serious attempt was made to provide restful conditions (tents and chairs) for the air and ground crews doing their daily stint in the heat and choking dust of Thumier.

Such toleration by the crews was not matched by the aircraft engines. The Belvedere with its downward pointing air intakes suffered a good deal of compressor blade erosion resulting from the self-generated sandstorm in which, in addition to take-offs and landings, it was obliged for the majority of its tasks to hover while hooking on the external loads. Adhesion of fine grit to the engine compressor blades and inlet guide vanes exacerbated the already difficult starting problems by causing engine surging. Engines with an intended life of 400 hours at that stage were on average achieving only 110 hours. At the end of May 1964 an oil and PSP landing site had been constructed at Thumier by No 5000 Airfield Construction Squadron and this helped considerably. Nevertheless, by 15 July 1964 15 'out of phase' engine changes had been carried out.

Later it was found that a further great improvement could be achieved by sealing off the whole wire cage covering the engine intake for a surprisingly small loss of only 5% of engine power of which the Belvedere had a comfortable surplus.

The further effect of this pattern of operating was that amongst the equipment which the Belvedere had to carry on leaving Khormaksar was its own spare supply of the noxious avpin starter fluid—highly toxic, explosive and virtually unextinguishable if ignited. It would not be found at Thumier or anywhere else away from Khormaksar.

Command and Control

Thumier housed the Brigade Headquarters conducting the Radfan operations and exercised operational control over the helicopters allotted daily for the task by

Headquarters AFME in Aden. Tasking was by the Brigade Air Support Officer (BASO) who lived at the Brigade Headquarters. In the later stages there was a small Air Traffic Control Organisation and an indispensable Mobile Air Movement team for assembling the freight loads in the correct size and order.

Operation Nutcracker

To return to the beginning of the Radfan operations, 'Nutcracker' in January 1964 was an assault by the 3rd Battalion of the FRA with helicopter support consisting of two Belvederes, four Naval Wessex Mk 1 of No 815 Squadron and the Sycamores of the Khormaksar SAR Flight. It was a demonstration of power aimed at the tribal stronghold in the Wadi Misrah, and aimed to convert the track in the Wadi Rabwa to one usable by jeep in order to gain access to the Wadi Taym for future use.

The four carrier borne Naval Wessex of No 815 Squadron were used to reinforce the troop and supply movements, the Sycamores of the Khormaksar SAR Flight being used mainly in the casualty evacuation role.

Between 3 and 15 January the Belvederes carried out numerous troop and resupply sorties and 105 mm gun deployments. Hunter cover was provided but right at the outset a Belvedere received 5 hits from ground fire, and the wearing of protective flak vests and carriage of light machine guns for suppressive fire was authorised. The aircraft was plagued throughout by engine starting problems, so introducing a disturbing element of unreliability into planned operations.

Shipborne Assault in East Africa

On 20 January, only five days after the Belvederes completed their task in Operation Nutcracker, two Belvederes with five pilots and six technical crewmen were embarked on the commando carrier HMS Centaur to join the Wessex of No 815 Squadron for operations with the Royal Marine Commandos in East Africa following a mutiny by the 1st Battalion of the Tanganyika Rifles. A dawn assault on Colito Barracks, Dar-es-Salaam, was carried out successfully using four Wessex and both Belvederes. The first Belvedere took 20 minutes to get started, the second one hour and 25 minutes.(12) Fortunately there was only light opposition on shore, and that was quickly suppressed. The Belvederes carried troops, Land Rovers and other heavy equipment. Later the same morning, a similar helicopter-borne commando assault was made on Dar-es-Salaam Airport where no opposition was encountered. This was also followed by much ship to shore shuttling of troops and equipment, the Belvedere engine starters continuing to cause a good deal of trouble. Although this was the second time a ship-mounted helicopter assault was made on land, the first being on the Suez Canal area in 1956, it was the first time that helicopters



Belvedere refuelling at Thumier using 44 gallon drums and a mechanical pump. Note the proximity of the front engine jet pipers.



Belvedere re-supply at Obad—6000 ft above sea level and 15 miles West of Beihan. The tail stabiliser constituted a considerable problem amongst the rocks.



Re-supply in the Radfan 2 miles East of Thumier. Note the front wheels 'castored' to prevent movement down the slope.



Belvedere in the Radfan 4 miles East of Thumier.

had led the landing and were the sole aircraft involved. Vehicles and heavy equipment were included in the helicopter lift.

Although the Dar-es-Salaam operation had been successfully completed there was still unrest in the area and the Belvederes were transferred to HMS Victorious when it arrived on 29 January to replace HMS Centaur. The original detachment starting on 20 January had been expected to last seven days, but on 10 February another ship change took place and the Belvederes appeared on HMS Albion which continued to cruise between Dar-es-Salaam, Mombasa and Zanzibar. Several exercises with the Marine Commando and the RN helicopters were arranged and were inevitably characterised by the usual struggle with the Belvedere engine starters. Much help was given by the RN helicopter technicians who were accustomed to the same starter arrangement for their Mk 1 Wessex, but for some reason the Belvederes seemed even more troublesome. Some conclusions about both the appropriateness of the rectification procedures and the nature of the problem itself may be drawn from the fact that when operational pressure was high the Royal Navy's first remedy for a failure to start often consisted of hitting the Avpin Injector a smart blow with a hide faced hammer, and this sometimes worked.(13)

On 19 February preparations were made against the possibility of having to evacuate British nationals from Zanzibar and next day HMS Albion appeared off-shore with three escort vessels. Night flying briefing was carried out for the helicopter crews, but operations were not required. HMS Albion disembarked the Belvederes at Aden on 26 February, five weeks after they had started on a seven-day detachment. Starter troubles were the only technical problems recorded by No 26 Squadron during that period but they were described as endemic. They were hardly likely to improve the Belvedere's reputations with the Royal Navy and Royal Marines. Such technical support as could be provided at long range was supplied from Khormaksar throughout the period.

Appendix No 10 to the Middle East Command ORB described the AFME operations in East Africa, mainly concerned with troop movements by Hastings and Beverley aircraft in Kenya and Somalia, without mentioning the Belvedere maritime operation at all.

Aden Operations Continued

Back in Aden, Operation Nutcracker had been described as a success in that the road through the Jebel Radfan was completed, although a further limited operation (Rustum) was arranged to maintain law and order on the doubtful assumption that such had been established. FRA patrols were, however, still being attacked and in February a Belvedere was used to ferry a Forward Air Control Post to a suitable position to control further air strikes. It returned with a dead Company Commander and two wounded FRA soldiers.

Elsewhere across-border enemy activity also continued and in March a remote Federal Guard post north of the fertile area around Beihan was attacked by an enemy helicopter escorted by two MIG fighters. The response was an attack by eight Hunters using cannons and rockets, which destroyed an enemy fort over the Yemen border. The Belvederes, still carrying only VHF radio were unable to speak to the Hunters, and this lent urgency to the belated fitting of UHF radios and homers.

The Belvederes had demonstrated some of their capability and were being regarded with new respect on the station. In April 1964, 14 months after their arrival, they acquired a single office, 15 feet × 9 feet, for use by the complement which now consisted of six pilots, including the Squadron Commander and Flight Commander, one navigator and three crewmen. There was no air conditioning. March and April represented a breathing space after Operation Nutcracker and the East African operations which was useful for new pilot training and catching up on continuation training including night and simulated instrument flying which, although not likely to be needed in this theatre, was maintained as far as possible in accordance with standard RAF practice. Even so, ad hoc tasking, eg for Army exercises, visiting the scene of a Hunter crash at 7000 feet altitude, carriage of No 13 (RE) Field Survey Team and practise firing of bren guns by crewmen in the new mountings provided in the doorways, resulted in the monthly task hours actually being exceeded.

Main Radfan Operation—Flamingo

The main Radfan operation lasted from 1 May to mid-June 1964. During the first five days the chief objective was capturing the precipitous 'Cap Badge' feature which dominated both the Danaba Basin and the Wadi Taym into which the troops were then able to penetrate in the face of considerable opposition.

Cap Badge, only 15 miles North East of Thumier, was such a dominant feature in the Wadi Taym area that it was to be permanently held by the Army throughout the whole period from its capture in May 1964 until final cessation of operations in 1967. Being a steep sided rocky outcrop rising abruptly from a flat desert area and usually surrounded by enemy, it relied heavily on helicopter support and maintenance. The usable space at the top was so small that explosives had to be used to create even a minimum sized landing site for the helicopters. Belvederes delivering under-slung loads on the only area available would often have insufficient room remaining to land in order to recover the lifting strop which was dropped with the load, and would have to recover it by means of a rope previously attached and hauled into the door by the crewman. These restrictions often applied at other landing sites where the length of the aircraft could be an embarrassment, often placing the pilot over the edge of a precipice and the cargo hook over the landing

site, while the rear end of the Belvedere was projecting over another valley.(14) A constant problem was a tendency to suffer minor damage to the low slung and downward sloping tail stabilizers amongst the rocks.

The second part of the two-phase operation was delayed a few days to await the arrival from Singapore of the aircraft carrier HMS Centaur with the Royal Navy Wessex helicopters, an extra Belvedere on loan from FEAF bringing the Squadron strength up to seven, and two 5.5 inch guns from Singapore which would greatly extend the range of the available artillery. It was aimed south of the Wadi Taym at the Wadi Misrah and the Bakri Ridge and started on 24 May, culminating in occupation of the Jebel Huriyah which was successfully achieved on 11 June. For the helicopters, however, the rate of operation throughout Operation Flamingo was more or less constant, the daily supply of food, water and ammunition being a never-ending task interspersed with troop redeployment, casualty evacuation and the re-siting of artillery in commanding positions as the troops moved towards their objectives.

The following extract from the No 26 Squadron Operations Record Book for May 1964 gives a good idea of the character of the Belvedere operations during Operation Flamingo, which was also the high point of Belvedere activity in the theatre:

26 SQUADRON—MAY 1964

The entire Squadron effort this month has been devoted to Operation Flamingo in the Radfan area, Western Aden, in co-operation with the Army and Royal Marines. During this period 613 operational sorties were flown in 225 hours. The loads totalled 1083974 lbs freight, 1254 troops and passengers and 47 casualties.

Radfan

- 1 May The opening moves of the operation required the support of 3 of the squadron's Belvederes; XG 467 (Sqn Ldr Hart), XG 458 (Flt Lt Woodcock) and XG 468 (Flt Lt Martin). Supplies of water, food and ammunition were carried to 3 sites on the tops of 2 ridges east of the Thumair—Dhala road and 3 miles north of the airstrip.
- 2 May Further sorties were made to the same sites as yesterday: 2 aircraft were used. The greatest problems were caused by turbulence on the ridges at midday and early afternoon. Flying

was suspended during this period and re-started at 1700 hours. This is an unsatisfactory state of affairs as the crews have a 14 hour working day.

3 May 36000 lbs of freight and 25 passengers were carried to the ridges by 3 aircraft during the day. We are getting used to these 3 landing sites now; the beads of perspiration on the captain's brow are much smaller than they used to be. Our loading operations at Thumier are running quite smoothly as the Mobile Air Movements Section (Fg Off Bannister) now have the preparation of loads down to a fine art.

4 May Belvederes XG 467 (Sqn Ldr Hart) and XG 468 (Flt Lt Smith) were able to complete all Operation Flamingo tasks by 12.30 hours today, by which time they had lifted 21430 lbs freight and 58 passengers and troops.

5 May By making a 'first light' take-off from Khormaksar, 4 aircraft (XG 467, Sqn Ldr Hart, XG 463, Flt Lt Woodcock, XG 458, M Plt Bousher, XG 461, Flt Lt Smith) were able, in 18.20 hrs flying to carry 31000 lbs freight, and 179 passengers, troops and casualties. At the urgent request of the Army, Flt Lt Smith landed in the Wadi Taym under fire, with the armed escort of Sqn Ldr Hart in XG 467, to collect 9 wounded soldiers, 8 of whom were stretcher cases. Only 3 stretchers could be carried in the proper racks, the remainder being put on the floor. With 8 stretchers, 1 sitting patient, doctor, gunner and crewman on board 'standing room only' was the order of the day.

The Squadron strength was increased to-day by the arrival of Flight Sergeant Wheatley, attached from the Khormaksar Search and Rescue Flight.

- 6 May In 12 hrs, 55 mins flying time, 3 aircraft carried 42300 lbs of freight and 40 people. All of our doings at Thumier recently seem to have been recorded by the various press representatives who have come in ever increasing numbers to spend a day 'up country'. Alas! As far as the accuracy of the published reports go, most of them could have stayed at home. To-day's 'Daily Telegraph', for example, paid a glowing tribute to the work being done by the 'Beverley helicopters'.
- Thumair
- 7 May 3 aircraft (XG 468, Flt Lt Smith; XG 458, M Plt Nisbet; XG 458 later in the day M Plt Bousher) operated from Thumier to-day. Almost all of the freight carried went to 2 mountain peak landing sites known to us as November One (Cap Badge) and November Two. These vantage points overlook the Wadi Taym. The business of releasing the external load, landing alongside it to recover the strop, taking off and clearing back to Thumier for a further load now goes quickly and involves being on the ground at the site for only a little over a minute. The Army Scout helicopters are gradually learning that we become embarrassed, to say the least, if they land in the middle of the only available landing site and switch off their engines just as we start our approach—a situation which has occurred a number of times.
- 8 May Amongst the passengers carried to-day was a prisoner of war, from November One to Thumier. He appeared to enjoy every minute of his flight, in marked contrast to his Marine guard! Our operations were marred by the necessity of flying XG 458 (Sqn Ldr Hart) back to Khormaksar on one engine, due to a starter failure on the other engine. Thumier airstrip is not considered secure and night stops there are avoided whenever possible. The coffins containing the bodies of 2 soldiers killed at Al

Nagnil were flown from the village to Thumier by Sqn Ldr Hart (XG 468).

- 9 May Pilot fatigue is becoming a very real problem to us as the long working days in an unfavourable climate take their toll. Similarly our aircraft are beginning to suffer. The 'Hours to Minor Inspection' figure for several of our Belvederes is reducing at an alarming rate. To-day's figures for work done were 56100 lbs freight, and 82 passengers in 11.20 hours flying time.
- 10 May In a day of intensive flying, a record amount was to-day carried by Belvedere XG 458 (Sqn Ldr Hart). In 6 hours 50 mins operational flying time, no less than 45190 lbs of freight and 64 passengers, troops and casualties were flown from Thumier to the surrounding landing sites. Included in the freight were 6 Land Rovers and 2 105 mm Howitzers flown to Al Naquil: the road into the Wadi Taym is still under construction and helicopter lift was the only feasible method of getting them to the Army unit in the village.
- 11 May XG 458 (Flt Lt Martin) was the only aircraft required to fly in the Radfan operation to-day. Fg Off Bannister, Mobile Air Movements Officer at Thumier, who has done much to ensure the smooth movement of loads from Thumier, was to-day relieved by Flt Lt Clelland.
- 12 May Mr Duncan Sandys, Commonwealth Secretary, to-day visited the Radfan. The Squadron carried members of the South Arabian Federal Government and the Press to various Army units, including the village of Al Naquil, scene of our casualty evacuation sortie of the 5th May. Our serviceability problems eased to-day by the extending of the Belvedere servicing cycle from 100 to 150 hours between Minor

inspections. This measure has given a new lease of life to 2 of our aircraft, XG 467 and XG 458.

- 13 May Flt Lt Smith (XG 458) brought back to Khor-maksar from Thumier the bodies of two members of the Special Air Service who were killed on the night of the 30th April. The Command Medical Officer (Flying) flew to-day in one of our aircraft on operations. An immediate result was the imposition of an upper limit of 3 hours operational flying per pilot per day.
- 14 May To cope with the amount of urgent supplies needed by troops at places which could not be supplied by means other than helicopter, yesterday's limit of 3 hours was raised to 4. This enabled Flt Lt Martin (XG 468) and Flt Lt Woodcock (XG 467) to move a total of 48070 lbs freight and 25 passengers.
- 15 May The situation in the Radfan improved sufficiently for us to send only one aircraft (XG 468—Sqn Ldr Hart). The number of landing sites in use has increased, but we are now able to fly direct to most of them, avoiding the long detours which were needed in the early days of the operation. The immediate result was more freight uplifted per hour, with a consequent saving of pilot and aircraft hours.
- 16 May Mr Hugh Fraser, Under Secretary of State for Air, to-day visited the Radfan and his party and members of the press flew by Belvedere to meet the troops.
- 17 May One aircraft (XG 468) flew in the Radfan operations to-day delivering a total of 20000 lbs of freight and 9 passengers.
- 18 May XG 467 (Flt Lt Woodcock) was the only aircraft tasked to-day. After navigational difficulties caused by low cloud and poor visibility

the aircraft landed at Thumier, to be promptly enveloped in fog! When this cleared, one engine refused to start and it was necessary to return to Khormaksar without lifting any loads.

- 19 May The movements team at Thumier changed to-day, with unfortunate results. Due doubtless to inexperience in this theatre, there were a number of delays which, with an upper limit placed on the amount of operational flying which can be done, we could ill afford.
- 20 May Flt Lt Woodcock (XG 467) to-day moved 14000 lbs freight and 22 passengers in the Radfan operation.
- 21 May More infuriating delays caused by not having loads ready for the aircraft were experienced to-day. Notwithstanding this, 25840 lbs freight and 6 passengers were carried in 6 hrs 30 mins flying time, but this effort required the use of 3 aircraft.
- 22 May Flt Lt Martin (XG 467) carried out a casualty evacuation from the Wadi Behab, some 30 miles North East of Mukeiras, where men of 2 villages had been keeping alive their age old tradition of fighting one another. The Brigadier of the Federal National Guard and 2 Arab representatives were taken as intermediaries. Our reception was cordial, and 4 stretcher cases and 4 sitting patients were brought back to Khormaksar.
In the Radfan Sqn Ldr Hart (XG 461) moved 20300 lbs of freight in 2 hrs 45 minutes flying time.
- 23 May The entire helicopter effort in the Radfan to-day was the movement to and from the November One and Two positions. The Army have now moved across the Wadi Taym into the mountains on the south side of the Wadi, but supply of these older positions is still entirely dependent on the helicopter force.

- 24 May The new Army positions to the South of the Wadi Taym presented some problems to-day. They are approached by a considerable detour and are situated about 5000 feet above Sea Level. Landing at the new sites is not feasible with a Belvedere because of the steep slopes and the length of the fuselage. It is advisable for the Army Scout helicopter to land to pick up our cargo strops after we have released our external loads. The alternative is to wait at the hover and use the second rope to pull the strop up. This makes us a tempting target.
- As evidence that opposition still exists close to Thumier, Belvedere XG 463 (Sqn Ldr Hart) was fired on by 2 Arabs who hid in a cave before their fire could be returned. The aircraft was undamaged. The crew were fuming with rage at not being quick enough to fire back.
- 25 May Flight Sergeant Wheatley, who was loaned to the Squadron from the Search and Rescue Flight at a time when we were hard pressed was to-day replaced permanently by Master Pilot Watts, also from Search and Rescue.
- To-days operations in the Radfan area with 2 aircraft resulted in the unlifting of 37600 lbs freight and 7 passengers.
- 26 May XG 461 flown by Flt Lt Woodcock was to-day hit by fire from Arab dissidents near the Echo Four landing site at Hajib in the Radfan. The rear gunner, Flt Lt Chittenden (who is attached to the unit from No 37 Squadron) returned the fire, but his Bren gun suffered a stoppage after firing 4 rounds. His comments on this situation may safely be left to the imagination.
- The Belvedere was hit 6 times and suffered damage to the rear fuelage.
- 27 May Master Pilot Bousher (XG 457) lifted 16700 lbs freight and 25 passengers to-day. He later ferried back to Khormaksar XG 461.

Thumier/Khormaksar 28 May The squadron maintained a 1 hour standby with one aircraft which was not, however required.

29 May Once again a standby aircraft was available but was not used. The squadron stood down after duty to-day for the remainder of the month.

Part II Training

Our commitments in 'Operation Flamingo' resulted in the virtual suspension of continuation training during May. The operations in the Radfan, however, provided an excess of practice in external load carrying, mountain flying and, on occasion, night and single engine flying!

Flying Times

Operational Day	222.05
Operational Night	3.35
Training Day	3.40
Training Night	Nil
Other Flying Day	6.30
Other Flying Night	Nil

Part III Administration

The Squadron received its seventh aircraft on 22nd May, 1964. This aircraft arrived from Far East on Board HMS Centaur. (XG 474) Flt Lt Spreadbury—GD Pilot together with three airmen groundcrew arrived with the aircraft and are attached for duty with the Squadron for 2 months.

Seven Bevedere H C Mk 1 on strength of the squadron as at the end of the month.

Personnel

525752 F S Duffield, L—Aircraft fitter was promoted to the rank of Warrant Officer and posted to RAF Khormaksar.

574814 F S Ireland, E H—Airframe fitter was posted in to fill this post.

1600430 M Plt Watts, G F was posted to the Squadron from SAR Flight.

Part IV Honours and Awards

Nil

General

Squadron Commander's Remarks A good flying month indeed. The pilots flew between 60 and 68 hours exceeding the task by more than 50 hours. But, this effort, with only 3½ crews at the start of the operation was too much to sustain. The arrival of Flt Lt Spreadbury from FEAF eased the situation and the two new pilots from the UK will give us 5 crews when they are trained. The posting in of M Pilot Watts needing Belvedere conversion does not help as the training load is already high.

The groundcrew have done an excellent job. During the preparation for the operation very long hours were worked, which combined with the start of the Aden 'Hot Season' caused a lot of concern, but it enabled the Squadron to meet the tasks. The written congratulations of the C-in-C and GOC have been passed on to the airmen with pleasure.

All aircraft have been fired at, usually the only indication is a Radio message. The damage to XG 461, by six bullets was an unfortunate combination of cloud, which governed the approach with the external load; ground activity which had not been reported and the airspeed being low as the final run in had been commenced. It is a coincidence that the same aircraft received 5 bullets in Radfan during January, this year.

(P F HART)
Squadron Leader
Officer Commanding
No 26 Squadron

At the beginning of June 1964 No 26 Squadron felt sufficiently enthusiastic and confident to demonstrate in the time honoured way with a Squadron mass fly-past. A formation of five Belvederes was flown over Aden. Meanwhile Radfan operations continued, another rotor blade was damaged by a bullet and a Royal Navy Wessex which had toppled over into a Wadi after suffering ground resonance due to an over-loaded condition was recovered as an under-slung load by the Belvedere.

Between 30 April and 30 June the Belvederes had flown over 1000 sorties, carried nearly 1800 passengers, 48 casualties and 1111 thousand pounds of freight. In the same period the SAR Whirlwinds in 57 sorties carried 95 passengers, 26 casualties and 41.1 thousand pounds of freight. The four Royal Navy Wessex which operated in the Radfan between 24 May and 26 June only, flew 409 sorties carrying 2096 passengers and 192.7 thousand pounds of freight.

The first events presaging the collapse of the Aden Belvederes also occurred in June, starting with two Avpin fires. The first one was actually an explosion, causing the pilot to exit precipitately through the starboard hatch, breaking a wrist and ankle in his fall. It was the practice to remove the access ladder before starting engines because otherwise the rocking motions sometimes felt during rotor acceleration were liable to crumple the ladder. The front of the aircraft was severely damaged by fire. The second Avpin fire did not cause that amount of damage, being a small one occurring due to self-ignition of a small quantity of Avpin in one of the discharge tubes. It was noticed about two hours after the aircraft landed. (The Belvedere had the awkward habit of discharging Avpin unused after the starting cycle directly on to the ground, as well as Avtur fuel from the Fuel Metering Unit when the engines were shut down—both being the subject of adverse comment by the Belvedere Trials Unit, but for which no remedial action had been taken. (See Chapter 9).

The pace of operations in Operation Flamingo had also taken its toll and by 24 June all the Belvederes were unserviceable. Engine surging was being experienced both on starting and shutting down, radios were causing problems and uncured vibration in flight was getting worse.

Until July 1964 the method of correcting rotor blade tracking errors in Aden consisted of the crude system of striking the blades on a spring tension flag. It could only compare the blade flight paths while at minimum pitch when standing on the ground. There was no way of identifying errors occurring in individual blades at high lift angles, especially those required at high level landing sites. Transit cruising height in excess of 8000 feet exacerbated the problem. An optical system which permitted offending blades to be identified in flight marked a great improvement although it was a far from perfect solution. It was difficult to use when the sun was low and produced unreliable results in turbulence. This 'In Flight Tracker' was not available in Aden until July 1964 and even then the only set available was

found to be unserviceable on arrival and had to be returned to the United Kingdom. The consequences was that the crews had become accustomed to accepting progressively higher levels of vibration as the rotors aged, while the errors caused by sand erosion of the long, largely unprotected, control runs were to some extent masked by the excessive rotor-generated vibrations. It was also in July 1964 that the blanking off of the wire cage over the engine intakes previously mentioned took place, but nothing could be done to protect the transmission and control run bearings. Nevertheless, in July 1964, 526 sorties were flown carrying 700 passengers and 407 thousand pounds of freight. In August 745 sorties, 2827 passengers, 24 casualties and 386 thousand pounds of freight were lifted.

The successful completion of the assault phase of Operation Flamingo made little difference to the helicopters except to reduce the rate of resupply of ammunition and casualty evacuation flights, and especially the likelihood of damage by small arms fire. Hunter attacks by day and Shackleton bombing by night finally forced the last tribes still defying the Government to surrender. Official offensive action ended on 18 November 1964. The task of resupply by helicopter remained, however, as the FRA, strengthened by British troops, continued to hold the key positions in the Radfan to counter the active subversion by Egypt and infiltration from the Yemen which continued unabated until final British withdrawal. The really critical period, however, had been during the assault phases from 1 May to mid-June 1964.

In September, two Belvederes were flown to Riyan in preparation for an expected rebellion at Mukulla, which the mere appearance of the aircraft may have done much to prevent occurring.⁽¹⁵⁾ In other words, for this brief period the Belvedere was being used successfully in the numerous roles and in the manner which had become usual for helicopters in other theatres.

By October 1964 the support for Operation Flamingo was becoming more sporadic, which was fortunate because it was then that the Belvedere suffered the blows which were to finish it eventually in Aden. On 5 October, Flt Lt W S Smith, flying between Khormaksar and Thumier, experienced a yaw cable control failure—a similar defect to that which had caused the fatal crash in Borneo in May 1963 described in the next chapter. On this occasion, however, there was no crash, much to the later astonishment of the chief designer and others at the manufacturers at Weston-super-Mare. Smith was fortunately in a flight condition in which the total loss of yaw control and a large part of lateral cyclic control did not prove immediately fatal. Wallowing almost out of control, he managed to flop the aircraft on to the ground at Monks Field (an airstrip used by the Twin Pioneers) with no further damage—a feat for which he received an immediate AFC.

A little over three weeks later, on 30 October, while on a night cross-country flight, the same pilot, undergoing a check by the Squadron QHI, Flt Lt K W Woodcock, and with crewman Sgt G A Whitehead, was killed, together with the others, when

the aircraft crashed near Lahej, some few miles north of Aden. The wreckage was destroyed by fire after a violent impact and, apart from finding the front engine to have been almost stopped and the rear one running at high power at the time of the crash, no conclusion could be drawn as to the original cause of the accident.(16) The aircraft had been approaching Aden at 1500 feet when there was a high pitched and heavily broken 'May-Day' call from the aircraft on UHF radio as though the operator was being violently shaken. It lasted six seconds. There were other visual reports suggesting a fire had occurred in the air. A second Belvedere in the vicinity, although not hearing the original May-Day call as he was using VHF radio, was informed by Khormaksar and then saw what he thought was a flare or small fire on the ground. He landed 100 yds away to investigate and found the remains of the crashed Belvedere burning. The cockpit was not found until the next day. The event seems to have been consistent with an explosion or fire or both in or near the front engine or its Avpin tank, but this could not be determined with certainty.

The Belvederes, grounded since the fatal crash at the end of October, started flying again on 17 November, and were at once employed in collecting the litter consisting of parachutes, containers, jerricans etc scattered over the Army posts in the Radfan following the resupply activities of the Twin Pioneers, Beverleys and Argosys of Nos 78, 84 and 105 Squadrons respectively which had been forced to carry out this essential part of the helicopter's role during the Belvedere's absence. Morale, however, had been badly shaken and there was some fear of the aircraft.(17) Added to the two deaths and one pilot with a broken wrist and ankle following the starter explosion in June, four pilots had been lost to the Squadron and only five remained including the Commanding Officer. Then on the last day of December 1964 a Belvedere carrying out underslung load training at Khormaksar had a control failure due to a servicing error, crashed on the airfield and was a total loss although without crew injury. Three Belvederes had now been lost since June leaving four remaining. All were grounded.

In December 1964 the Squadron Commander, due to be replaced at the end of his tour in March 1965, summed up the year as an excellent operational one in which the Belvedere was well proved as a work horse and in which the crews had matched all operational demands.(18) Ever hopeful, he looked forward to a new starter system and appropriate modification for the Yaw cable problem, but this was not to be. What did appear was a Command modification to introduce an armoured bulkhead to protect the first pilot from the starter turbine. Ungrounded on 8 January 1965 for air tests and training only, achieving seven hours ten minutes total for the month, complaints were made about poor spares backing. There were no spare engine starters or Avpin injectors.

At this point it is useful to compare the situation with that in FEAF where corresponding difficulties were being steadily overcome, as will be described in the next chapter. The reasons for this difference are arguable and difficult to apportion

in relative importance. Certainly the morale of No 26 Squadron was at a very low ebb and the official AFME view seemed to be that the solution would consist of replacing the Belvederes with the expected Mark II Wessex as soon as possible. The flow of spares certainly seemed inadequate, notably of starters and injectors; however, control of servicing practices clearly left much to be desired and does seem to have been a significant factor. Much comment has been made concerning the severe operating conditions—sand and gypsum dust etc—but the fact is that, following Ministerial pressure in early 1964 for the manufacturers of engines and airframes to provide more immediate help in the overseas theatres as described in Chapter 9, Mr Banks of Westland Aircraft Co visited Aden in February 1965 to advise on the servicing practices—mainly vibration rectification—and achieved remarkable results. The seven-hour flying achievement in January had been followed by only four-and-a-half operational hours in February although much air testing had been done with the in-flight tracking equipment. The complication of this procedure may be judged from the fact that to solve its vibration problems one aircraft carried out no less than 23 air tests in February. It was then due for a double engine change.(19) The very next month, following the ministrations of Mr Banks, the Belvederes were back in business, flying 146 hours of which 90 were operational in the Radfan. Mr Banks, who personally had much to do with training RAF ground crews on the Belvedere at the manufacturer's establishment at Weston-super-Mare, commented that he had spent much of his time in Aden instructing tradesmen inadequately prepared before arrival. It seemed to him that many of the airmen he had trained at Westlands appeared to have gone to FEAF where the priority was higher at the time when No 26 Squadron was deploying piecemeal to Aden.

This resurgence of the Belvederes coincided with the arrival of the new Squadron Commander, Squadron Leader P D M Moore, who replaced Squadron Leader P Hart in March 1965. Unhappily for him the recovery lasted only two months although they were not without interest. The Sharif of Beihan (Ruler) requested air support following enemy attacks and two Belvederes, surprisingly, were detached for two weeks to this relatively distant place but retained there indefinitely. The crews, including the new Squadron Commander, lived under canvas with the FRA on the airstrip and operated intensively in the support role throughout April and early May. It was an active operational situation, landing sites were subject to mortar fire, three shells landed near a Belvedere delivering a load, and the redoubtable XG 474 (the RAF Museum aircraft) received a further bullet through a rotor blade. There was much fine sand—no oiled patch preparation—and XG 474 required a double engine change in the field. This was carried out successfully although the rear engine change required a hole to be dug into which the engine could be lowered. There were four minor Avpin fires, vibration was getting worse again and the task was reduced to one aircraft in late April. The Brigadier commanding the FRA forces was restricted in the reaction he was allowed to make to enemy activity, being allowed only to fire two artillery shells for each one received.(20) Squadron



Engine change at Beihan (XG474 is the RAF Museum Belvedere).



Arab village used as an army defensive position with the Wadi Taym in the background.

Leader Moore formed the opinion that the Belvedere was used on occasion to draw enemy fire deliberately so as to allow reply by the FRA 105 mm guns.(21)

This was the last operational use of the Belvedere in Aden. No operational flying had been done from Khormaksar in April and in Beihan only mapping survey teams were supported in the first half of May before returning to Khormaksar. The ground crew were absorbed into a fully centralised helicopter servicing flight formed at Khormaksar and with attention now focussing enthusiastically on the newly arriving Wessex Mk II there was no longer any hope of producing a serviceable operational Belvedere. Three pilots returned to the UK and were not replaced. The remnants of No 26 Squadron struggled miserably on through June and July doing the occasional short training flight, two of which were abandoned in July due to excessive vibration. A forthcoming visit by the Inspector General of the RAF was looked forward to in anticipation of a policy decision on the future of No 26 Squadron to end the speculation, of which there was a good deal.(22) The Squadron Commander paid a visit to FEAF, spent five days at Kuching and was greatly impressed by the contrast with conditions in AFME, commenting that operations in FEAF were rarely above 1000 feet, there was little turbulence and hardly any sand. He noted with surprise that No 66 Squadron had a shed full of spares—there were virtually none at Khormaksar.(23)

August, September and October saw a final spurt of energy to make the four Belvederes at least partially serviceable, the news having been received that provided they could be made sufficiently serviceable to fly on to the Carrier in time, they were to be delivered in November by HMS Albion to FEAF where they were eagerly awaited. Two pilots had been sent to FEAF in September for refresher continuation training on the Belvederes in order to be fit to carry out this task. The opportunity for Khormaksar to get rid of these last Belvederes evidently provided the necessary impetus and they were duly landed on the Carrier on 23 and 24 November 1965, although on arrival in Singapore (described in the next chapter) they were found to be in a condition which could not by any stretch of the imagination be described as serviceable. All except one were, however, eventually recovered to full operational standard in FEAF.

So ended the year of the Belvedere in Aden, in circumstances which gave the aircraft an indelible reputation of technical unreliability in the memory of those who happened to be in that theatre at the time and who, in the normal course of overseas postings, would see nothing of its behaviour in FEAF. The Squadron Commander of some eight months tenure recorded that it was a matter of regret that No 26 Squadron was unable to offer any help in the sharply deteriorating internal security situation developing in Aden itself. No 26 Squadron's 50th anniversary passed in October 1965 without celebration and on the 28th it was announced that the squadron was to disband a month later. There was no publicity because of the redeployment of operational aircraft involved. Nevertheless the British and

Federal Regular Armies acknowledged that without the Squadron support, the successful Radfan campaign could never have been envisaged.(24) Its disappearance was regretted by both British and Arab troops.(25)

Wessex Mk II in Aden

The commitment to continued tactical helicopter support for ground troops now evidently permanently required in the Radfan had transformed the picture in Aden. Although offensive operations had officially ceased when the last tribes in the area sought peace in November 1964,(26) infiltration by dissidents from the Yemen was increasing and maintenance of ground forces in the Radfan was clearly to become a long term task. The operational organisation at Khormaksar, previously divided into Tactical and Transport Wings was, in December 1964, redivided into Strike Wing, Medium Range Transport Wing and Short Range Transport Wing, the latter comprising the Helicopters, Twin Pioneers and the Communications Squadron. Although not an exclusively Helicopter Wing, it was commanded by an experienced helicopter pilot—initially Wing Commander K Fry (previously Flight Commander of the original Casualty Evacuation Flight in FEAF in 1950–52). He was succeeded by Wing Commander C Symons in October 1966.

The addition of Wessex to the Belvedere force in accordance with the planned one-company lift in Aden (part of the worldwide four-company lift deployment—see Chapter 9) had been noted by AFME in October 1964 as expected to occur in mid-1965.(28) That was the month that ended with the fatal Belvedere crash already reported, which must have planted the thought in many minds that the Wessex could well be the substitute for the Belvedere in Aden, which in fact turned out to be the case.

The position of the engine air intakes of the Wessex was no improvement on the Belvedere, rather the reverse, and engine deterioration due to sand erosion was an even greater problem. Even when the aircraft were new an alarming rate of engine changes seemed to be needed, but this was traced partly to the fact that a number of loose rivet heads embedded in grease in the nose doors during manufacture were being released into the engine intakes as the grease melted.(29) Unlike the Belvedere, however, the engines when serviceable could always be started and the Wessex had a lesser, but still useful, single engine capability.

A further advantage of the Wessex in Aden, particularly noticeable in retrospect, was that whilst on several occasions the Belvedere had to cease operations at high altitudes in the middle of the day and early afternoon due to turbulence, the Wessex appears to have had little trouble in this respect.(30) There was nothing to complain about in the control response of the Belvedere compared with the Wessex; on the

contrary, it was rather better. The difference must be accounted for by the auto-stabilisation and automatic rotor speed control, both of which were lacking in the Belvedere.

In terms of general shape the Wessex benefited in Aden because of the shorter fuselage length, single tail wheel and narrowness of the rear fuselage which, being completely devoid of the low slung tail surfaces which had been added to the Belvedere in a largely unsuccessful and scarcely necessary attempt to improve stability in forward flight, had caused some difficulty in positioning the aircraft without damage in the rocky terrain of most hilltop landing sites.

As far as performance was concerned, the Wessex in Aden was well suited to the very short ranges required in the Radfan resupply operations and was able to replace the Belvedere, albeit with rather more sorties per task. There was however a sufficient number of aircraft provided. Even the 105 mm Howitzer, stripped of much of its armour and without crew and ammunition, could be lifted by the Wessex over very short ranges even at high altitude, and as the full scale offensive operations had ceased in the Radfan before the Wessex arrived, such operations could be carried out at a slower tempo without embarrassment.

In the closing days, as the internal security situation in Aden itself deteriorated sharply, the Wessex turned out to be almost ideally suited to the very localised rapid response operations demanded.

No 78 Squadron

No 78 (Twin Pioneer) Squadron was disbanded and re-formed with nine Wessex Mk II on 7 June 1965, the aircraft being delivered by the LSL 'Sir Launcelot'. The aircrew arrived together—one Squadron Leader, nine of the twelve pilots established and, a new feature, eight trained crewmen including one officer crewman leader. The ground crew were posted to the Khormaksar Helicopter Servicing Flight which, although under the command of the OC SRT Wing, removed them from the direct control of the new Squadron Commander—Squadron Leader F Braybrook. He initially attributed a rather poor serviceability rate to this and the fact that the Wessex Mk II was still new; but local conditions prevented a higher rate ever being achieved. For the first six months the Wessex had an average monthly serviceability of 21.2 per cent, in 1966 30.8 per cent and in 1967, 46.6 per cent.(31) However, the establishment of nine aircraft, rising to 14 in 1967, ensured that there were enough aircraft for tasking and sufficient operational hours available for the tasks required, even though by December 1965 continuous 24 hours per day servicing work was required at Khormaksar to achieve it.(32)

The Squadron was declared operational on 18 June 1965—11 days after arrival—and in the following month exceeded the task hours of 240 with 275 hours, of which



One of the key positions overlooking the Wadi Taym—named 'Cap Badge' (also known as 'November One').



Defensive position South of Wadi Taym (Foxtrot 3) showing the typically limited space for re-supply operations.

43 were training. An indication of what was going on in the Radfan is given by the loads lifted in July which, in addition to 2591 troops, 49 Arab and 29 British soldiers casualty evacuated, included 545000 lbs of freight,(33) much of it cement, timber and nails.(34) The anxiety to acquire new helicopter lift to replace the now almost defunct Belvederes must have been keen in AFME where the resupply of the operational areas by Twin Pioneers, Beverleys, Whirlwinds (of the SAR Flight) and Army Air Corps Scouts, was described as 'a gigantic task'.(35)

Radfan support—passenger/troop lifts, casualty evacuations, food/water/ammunition supply—formed a continuous daily task amounting to 80 per cent of operational effort in 1965,(36) two Wessex being detached daily at dawn to Habilayn (previously called Thumier) and recovered to Khormaksar at or after dusk. Night flying was starting to be developed. Not only were the Wessex crews all trained for helicopter night operations at their Central Flying School Conversion Course, unlike the Belvedere crews whose aircraft were scarcely cleared for night flying before departure from the UK, but the auto-stabilised rotor-speed governed Wessex presented much less of an adventure for night flying than had the Belvedere. A night casualty evacuation in August 1965 encouraged this development and by the end of the year, bullet and blast proof bays (Sangars) were being prepared at Habilayn to permit overnight stops by Wessex for urgent casualty evacuations. Patients could be extracted from the Radfan by night, even from such small and precipitous sites as 'Cap Badge', and often within two hours find themselves on board a long range transport aircraft en route from Khormaksar to the United Kingdom.(37)

There was much co-operation with the Royal Navy in the two-and-a-half years of the Wessex operation in Aden and not only in the Radfan. In August 1965, three Wessex of No 78 Squadron were temporarily exchanged with three Royal Navy Wessex Mk Is on the Commando Carrier HMS Bulwark for Exercise 'Mixed Crop'—a helicopter assault on the Wahidi Coast in which vehicles and guns were carried ashore by the RAF Wessex and troops by the Royal Navy Wessex Mk Is, covered by Hunters operating from Khormaksar. Several joint Service operations were mounted as the Aircraft Carriers HMS Bulwark, Albion, Eagle and Hermes passed in transit to and from the Far East.

In September 1965, support for the FRA in Dhofar was provided. During this operation the only RAF aircrew injury from the several bullet strikes received by helicopters throughout the period in Aden occurred when a pilot was wounded in the thigh.(38)

Occasional operations were mounted elsewhere in the area; for example, three Wessex were deployed in support of the FRA at Amitfa, some 60 nm east of Mukeiras in December 1965, a month of high activity for No 78 Squadron which also included a four-day deployment in the eastern extremity of the Wadi Taym.(39) Since usually only three, though occasionally four, Wessex were available out

of nine, complaints of spares inadequacy were being made by No 78 Squadron. Nevertheless, the Squadron was much encouraged by the interest being shown by the upper levels of the Command in what the helicopter pilots still felt was the 'Cinderella' of the Service.(40) The new AOC, Air Vice Marshal Humphrey, had made his interest plain and frequently flew in helicopters whilst the Commander-in-Chief, Admiral Le Fanu, actually chose to operate as a Wessex crewman during a two-hour ammunition resupply operation.(41)

In early 1966 the deterioration in the internal security situation in Aden was extending the helicopter working day to the point where the effect of crew shortages due to fatigue was beginning to be felt. Eighty hours flying per week was not unusual, a typical day consisted of rising at 03.30 hours, collecting weapons, ammunition and detachment gear and being briefed to be ready before dawn to fly to the Army Establishment at Little Aden to collect troops and freight for delivery at Habilayn at or before dawn; then to be available for operational tasking throughout the day for eight or nine hours. Enjoyable though such a life may have been for most pilots, to return to Khormaksar at dusk to find Squadron or formal Station duties still having prior importance and the social round continuing, made life in Aden itself seem unrealistic compared to the harsh realities so closely experienced by the helicopter crews such a short distance away.(42) By the end of 1966 that situation was to be rudely reversed.

Extra standby aircraft were being provided at Habilayn whenever the SAS were operating—mostly along the Yemen border. The Army Air Corps Scouts were the main support for the SAS but were frequently getting hit by ground fire. In March, two Wessex with three crews and a servicing party, together with two Army Air Corps Scouts, were detached to Ataq, staging through Mukeiras, for seven days' support of a party probing nearby Wadis in some strength. In the course of this operation, 50 troops and two 150 mm Howitzers were lifted to the tip of a Jebel at a height of 7200 feet.(43)

By April 1966, 24-hour detachments at Habilayn had become standard. A tenth Wessex was delivered equipped with Infra-Red Linescan equipment intended to detect from the air mines laid in the ground, in particular on the road to Dhala. The trials with this equipment were described as successful although it was never used afterwards in that theatre.(44) A modification previously made to the Wessex nose doors to reduce sand ingestion was not found to be successful. Thirteen Gnome engines had failed due to sand damage in May and a 150 hour strip inspection was instituted. A new design for the nose doors was being considered.(45) By June the internal security situation in Aden was beginning to build up towards the chaotic scenes which characterised the final debacle in 1967. Mortar fire and mine laying were starting in Aden and there were eight killed and 52 injured that month. At the end of the first year of operations, No 78 Squadron Wessex had flown 2353

operational hours carrying 5.4 million lbs of freight, 28000 troops and 424 casualty or medical evacuations.

Wessex operations in the Radfan had become almost routine by mid-1966. Two new tactical features had been added during that year. Firstly, cordon and search operations as practised originally in Operation Wellington II in Malaya in 1953 and quite extensively in Cyprus in 1957 (see Chapter 5) were becoming standard. The helicopters were used to position troops around an area thought to contain dissident insurgents, and the place thoroughly searched while escape was prevented. Secondly, and shortly after the arrival of Wing Commander C Symons as Officer Commanding the Short Range Transport Wing in October 1966, it became the practice for offensive operations of this sort to be led by up to three Army Air Corps Scout helicopters armed with machine guns, and carrying an Air Commander for the operation—usually Officer Commanding SRT Wing himself.

One such cordon and search operation was mounted in October 1966 (Operation Fate) in conjunction with the Royal Navy. Five Wessex and one Army Air Corps Scout were embarked on a small helicopter carrier—HMS Fearless—and transported some 600 miles just over the eastern edge of the Protectorate beyond the Oman border. At dawn, troops of the First Battalion Irish Guards were positioned by Wessex at the perimeter of the village of Hauf and search troops were then landed from the ship to investigate. Surprise was complete and there was no opposition. Twenty two dissidents were captured. No 78 Squadron felt that the various commando ship and assault training exercises carried out over the past year was well vindicated. In the same month there were 84 terrorist attacks in Aden itself, 61 of them with grenades. There were four killed and 66 injured.

By the end of 1966 the Wessex of No 78 Squadron had been used to recover five Sioux and two Scouts of the Army Air Corps damaged or unserviceable in forward areas. One of the Scouts had to be jettisoned (May 1966) when the Wessex suffered an engine failure, of which there were many. In December 1966, for example, there were 13, and one engine failed a compressor check on the ground. In that month the task hours were 230, and 275 were flown including 43 on training.

Last Year in Aden

The dramatic events of the last months in Aden are chronicled in detail elsewhere, notably in 'Flight from the Middle East' by Sir David Lee. For the helicopter crews, however, the Radfan resupply and other operations continued unabated as the enormously complicated rundown of the huge Aden complex proceeded.

This was a period of very rapid development of operational techniques and modifications to the aircraft to meet the challenge of providing security by day and night

in and around Aden base itself, as the various Nationalist factions infiltrated from the north and mounted terrorist rifle, grenade and mortar attacks in and around the town and airfield.

The first requirement, apart from adding an additional machine gun in the portside rear window—one was already mounted in the doorway on the starboard side—was to make a satisfactory arrangement for launching illuminating flares. The Wessex was already equipped with the Schermuly flares, attached to the undercarriage as in the Whirlwinds, for emergency landing by night, but what was required was an internal fuselage-mounted dispenser able to launch a whole series of much larger flares. Some work in this direction had already been done with the intention of illuminating targets in the Radfan for Hunter strike action but the existence over the target of flares which failed to ignite but whose parachute opened correctly created something of a hazard. Nevertheless, much success was achieved with a Shackleton Flare Chute fitted in the Wessex doorway. Up to 20 flares were carried.

Starting with a mobile searchlight as used on fire engines, a succession of different types of searchlight configurations fixed to the aircraft were tried to enable the Wessex to be used for regular patrols around and within the perimeter fence built along the boundary of Aden State; this fence was known as the Scrubber Line. The effect was mainly deterrent but if there was Intelligence warning of incursion at a particular point, the aircraft could proceed to it guided by Khormaksar radar and then illuminate it. The machine guns were loaded with tracer ammunition to enhance the effect, and if vehicles or other activities were seen, the aircraft could land and disembark a patrol to deal with them.

By February 1967 the Wessex was being used regularly for day and night internal security patrols in Aden where there were 140 terrorist attacks during that month resulting in 38 killed and 144 wounded. In the following three months both flares and searchlights were being used to assist ground troops in the Radfan operations, while the use of flame floats for target marking was also investigated. In April there were 403 terrorist attacks in Aden, 165 by grenades causing 25 deaths and 97 injured.

May 1967 was a notable month in that No 78 Squadron activity in Aden reached its peak. With task hours of 420 the Squadron flew 541. A demonstration was carried out showing the following roles:—

- a. General purpose machine gun firing in the desert edge surrounding Aden State.
- b. Lifting troops into night ambush positions just outside the Aden State boundary.

- c. Lifting SAS troops to forward bases from Habilayn.
- d. Ammunition resupply to ground troops.
- e. Airlift for political affairs officers visiting sensitive area.
- f. Cordon and search operations.
- g. Searchlight illumination of check points around Aden State boundary.
- h. Flare dropping for night Hunter strikes with rockets and cannon.

As the military and political situation deteriorated, the flexible potentialities of the helicopter were being fully and enthusiastically developed. Two Wessex were deployed to Riyan where rioting and terrorism was breaking out in the eastern part of the Protectorate. They remained there for nearly four months.

From now onwards the preparations for final withdrawal and the rising tide of violence in Aden accelerated. Large scale evacuation of families and civilians started in earnest. In June, a shortage of aviation fuel occasioned by the Arab/Israeli war complicated matters further while a mutiny by National Guard armed police in Aden led to firing inside Khormaksar itself and something like open war in Crater where the crew of an Army Air Corps Sioux, shot down by the rebels, was rescued under fire by Wessex. Troop resupply and movement continued in the Radfan culminating in withdrawal of the main body of British troops at the end of June. South Arabian Army operations were mounted with the SAS—a technique now being relied upon to ensure Habilayn was kept clear of enemy infiltration up to the last minute. Cordon and search operations were also mounted on the islands near Little Aden. Of the 61 dead and 113 wounded in June in Aden, 40 per cent were British.

No 78 Squadron had, by July, been two years in the theatre, and consequently a significant amount of crew replacement had occurred. About half the crews were now in their first helicopter tour, many of the more experienced pilots with which the squadron started having become tour-expired. Their standard was considered high, operational training in Aden averaging 50 hours, most of it on operations as co-pilot. Two pilots were always carried for night flying, and by day when opposition was considered likely, which was most of the time in the last months. Nevertheless, it was found necessary in May to attach three experienced pilots from No 72 Squadron at Odiham for three months to cover a period when the No 78 Squadron operational experience level dropped sharply while training time was hard to find. The operational standard was not allowed to fall and training and full categorization of crews in all the techniques in use continued right up to October—the month before the final withdrawal.

In July, the tactical role of the SAR flight was recognized by its inclusion in the task hours for No 78 Squadron and yet another new capability was added to the Wessex when trials showed that practice grenades could be dropped from the helicopter with sufficient accuracy to make 20 lb fragmentation bombs an effective weapon. Bomb racks holding four bombs on each side of the aircraft were quickly designed and in only two months approved as a Command modification although the bombs were never used in anger. A & AEE clearance followed in September. Crew categorization actually included clearance for use of cluster searchlights, flare dropping, machine gunnery and bombing. Engine changes continued at up to 12 per month and in the continuing search for means of reducing sand damage, the practice was developed of delivering, together with assault troops, a membrane which they could spread on the ground for the helicopter to land on when recovering them. The Riyani detachment recovered a UPS1 ground radar from Lodar at an altitude of 7000 feet, the Wessex requiring to be stripped of all possible items to enable this lift to be made. Radfan operations were beginning to reduce but aircraft were still supplied for four days a week at Habilayn for tasking by the BASO. In Aden there was a daily troop deployment from Waterloo Lines to Temple Cliff overlooking Crater.

In August the two-aircraft Riyani detachment had a busy month with political officers conducting negotiations with local officials; some parachute dropping training was also carried out. These helicopters finally evacuated the remaining British officials from Mukeiras and Lodar and withdrew to Aden at the end of the month. The provision of Sangars to protect the parked aircraft at Khormaksar from rifle and mortar fire, as had been done at Habilayn earlier, was clearly well justified. An 81 mm mortar attack on Khormaksar was abruptly terminated when one of the day internal security patrol Wessex found the culprits in a rubbish dump at Sheik Othman. The aircraft suffered nine bullet hits in the following hour. Armour plate was fitted to protect the first pilot on the starboard side and flak vests were issued. Preparations to move No 78 Squadron to Sharjah were started.

Together with the SAR flight, which since July had been included with No 78 Squadron for tasking purposes, there were now 14 Wessex with a monthly serviceability rate of around 50 per cent. The average in 1966 had been 35 per cent. By September terrorist activity was dwindling as the dissidents could see the end coming and were busy dividing up into rival nationalistic parties to seize power when the time came, but day and night helicopter patrols were maintained. Up-country operations were not yet abandoned however and when an Army Air Corps Scout was shot down near Ataq, a detachment of two Wessex was mounted to support a fire power demonstration by Hunters in reply. All up-country flights by helicopter were now accorded Hunter cover.

In October 1967, the last South Arabian troops abandoned the Radfan and were withdrawn by helicopter to a position just north of Khormaksar. The last up-

country helicopter flight was to ferry their Commander—Brigadier Dyce—from Dhala on 28 October. On 17 October, eight Wessex were flown to the Commando Carrier HMS Fearless for transit to Sharjah and the remaining six performed a farewell fly past for the AOC, AVM Humphrey, on 29 October. Day and night internal security patrols continued with help from the Royal Navy by day, and the searchlight and flare equipment helicopters of No 78 Squadron by night. Training flying continued, including conversion instruction for the CinC, Admiral La Fanu. As the rest of the Khormaksar establishment disappeared around them, No 78 Squadron was happy to acquire integration of their second-line ground crew and expected, wrongly as it turned out, a similar arrangement to be made after their move to Sharjah. It was January 1971 before this reintegration was to happen, and then only for a similar reason—the rundown of establishments prior to withdrawal. It lasted for a year, that is until withdrawal from the Gulf and disbandment of the Squadron, but was recorded in May of that year as beneficial to serviceability.

November 1967, the last month of British presence in Aden, was given over to ferrying men and equipment to the ships for the evacuation. Day and night helicopter internal security patrols continued as before, No 848 RN Squadron by day and No 78 Squadron by night. The No 78 Squadron base was transferred from Khormaksar to HMS Intrepid on 25 November, a formation of three Wessex escorted the High Commissioner from HMS Eagle to Khormaksar en route to the UK by air on 28 November, and the final sortie with freight and passengers was flown by No 78 Squadron from Khormaksar to HMS Intrepid at 1345 hours on Independence Day—29 November 1967—the last RAF Unit in Aden as the ship left territorial waters at 2330 hours.

After their experiences of the past two years, there was little regret at leaving for the helicopter crews, unlike their usual reaction in similar circumstances elsewhere in the world. Independence was not being gained by the up-country tribesmen who were generally much admired, but rather by a murderous rabble in Aden well mixed with dissident Egyptian and Yemeni infiltrators. For this reason, the spectators' view accorded to the helicopter crews of the carnage in Sheik Othman as the rival Nationalist parties attempted to annihilate each other, afforded a certain ironic satisfaction, and the destructive fires started in Aden by celebratory firing of mortars on Independence Day evening provided an unexpectedly cheerful spectacle for the departing ships.

Although it was a No 78 Squadron responsibility, it was probably the members of the SAR Flight who instigated the plan to paint RAF roundels on two large spherical marine marker buoys, welded to each other by a length of chain, and to hoist them by helicopter to the summit of the rocky crag in Aden known as Shamsam where the chain was securely fixed in a hole filled with concrete. The ex-Army Air Corps Sioux helicopters left behind in Aden and intended for the new State forces, lacked the power to lift them down, and they could scarcely be cut

free without risking much damage to dwellings further down the mountain. The message from the RAF was unmistakable if slightly obscene, and was felt by the Squadron to be a satisfactorily appropriate expression of their feelings. Nobody was reprimanded.

Helicopters in the Persian Gulf

Following withdrawal from Aden, No 78 Squadron was based at Sharjah for the remaining four years of British presence in the Persian Gulf. The Search and Rescue Flight originally intended for Muharraq, but diverted to the more pressing needs in Aden, was now able to be deployed as originally planned. The SAR task was hardly an operationally onerous one and the absence of a helicopter element in the Gulf Communication Flight inevitably led to frequent demands on the SAR Flight for VIP and staff communication journeys. The position was regularised at the end of 1968 by retitling the unit a Communications and Search and Rescue Flight—COMSAR Bahrein.

The withdrawal from Aden was followed by a build-up of British forces in the Persian Gulf, and although there was little operational pressure in the absence of enemy activity, No 78 Squadron was as busy as ever supporting an intensive series of training exercises, introduced partly to publicise the presence of the two British battalions at Sharjah and Bahrein, and partly to foster closer co-operation between the three Services. These Army, as well as the RAF, personnel were by this time on short unaccompanied tours from nine to thirteen months duration so the turnover was quite rapid and generated a continuous training requirement for both soldiers and helicopter crews. For the helicopters, crew training now had priority over tasked hours, and the monthly totals showed a regular excess of training over operational hours flown. This situation was directly opposite to that which had existed in Aden, and became not unlike that at Odiham where a more or less continuous stream of Army exercises required helicopter support (see Chapter 10). The nature of these Exercises and their locations varied from assault landings over beaches to parachute drops on the Jebel Akhdar in Oman and the occupation of the high altitude airstrip at Saiq. In the absence of an actual enemy, SAS troops were used to represent dissidents creating a realistic simulation of operations and providing the helicopters with a real task in support of these troops in the dramatically inhospitable mountains of Central and Eastern Oman. Real dissident activity was not entirely lacking but these frequent exercises doubtless provided an effective deterrent to any significant renewal of such activity in Central Oman and in the Trucial States.

The Wessex serviceability declined sharply after the excitement and stimulation of the last days in Aden, but there were three other factors which contributed greatly to this effect. Firstly, sand ingestion was an even bigger problem than it had been in the Radfan, leading to a higher rate of engine failure. Secondly, the ground crew



78 Squadron crew in Aden showing the 0.76 mm GP Machine Gun mounted in a Wessex. The crew are wearing Flak Vests and a 'Mae West' fitted with a Sarbe beacon.



78 Squadron Wessex operating near Sharjah in 1971.



78 Squadron Wessex operating near Sharjah in 1971.

turnover was now so rapid that the experience level lowered significantly—in July 1968 for example only the Squadron Engineer Officer and three of the 75 airmen ground crew had previous experience with helicopters, and only one of them with the Wessex. In July 1968 the first-line servicing was at 60 per cent of planned strength and the second-line at 70 per cent. In the same month, eight engine changes were required in six aircraft at the end of a single Army exercise. The pilots were reduced to an average of 9 hours 40 minutes flying each—well below the 15 hours considered the minimum monthly requirement for maintenance of standards. Lastly, the very high temperatures over the summer months were frequently referred to as the cause of poor serviceability rates, particularly in the first two years at Sharjah. In July, August and September 1968 for example, the hours flown by No 78 Squadron were 151, 159 and 159 respectively. In October and November they achieved 237 and 231 respectively, attributing the change to the cooler weather.⁽⁴⁶⁾ They celebrated the event with a seven-aircraft formation flight and the resumption of regular engine-off landing practise—the first exercise to be dropped when the flying hours were restricted. By 1969, May was being referred to as the end of the exercise 'season' and August the beginning of preparations for the start of the exercise 'season' in September.

The provision of HF radio for helicopters has already been mentioned (see Chapter 10) but it was not until December 1968 that this facility was provided for the Wessex in Sharjah. For the first time they had ground-to-ground communications away from base, and a safety radio network was able to be established. The very late provision of this type of radio, the need for which had been clearly demonstrated in FEAF more than ten years previously, gives some clue to the degree of priority afforded to helicopter ancillary equipment in the field of communications. The same applied to navigation equipment.

The sands of both Aden and especially Sharjah had had a serious effect on the aircraft, and not only the engines. A complete refurbishing scheme had to be arranged in the UK, the Wessex being returned by Belfast freighter in rotation, starting in November 1968. By April 1969 the aircraft strength had fallen from 14, including the two at Muharraq, to nine—that is seven at Sharjah. Nevertheless average monthly flying hours comfortably reached between 200 and 250 while 273 in July was described as 'very good for the hot season'. In this period the Squadron had two Squadron Leaders (including the Commanding Officer), two Flight Lieutenants, 12 Flying Officer pilots, one Flight Lieutenant Navigator and 12 crewmen. Record flying hours of 330 were achieved in October 1969 with only nine aircraft and the main technical problems seemed to be solved. The aircraft strength fluctuated between nine and twelve throughout 1970 due to the refurbishing programme and occasional poor serviceability was blamed on spares shortages and ground crew inexperience—circumstances which had been known to occur together in other theatres giving rise to the suspicion that the latter may sometimes cause the former.

In October 1970, No 78 Squadron completed an exercise in desert conditions and recorded the fact that no engine changes took place as a result. This, it was thought, was due to the use of new techniques. It would seem that taking off straight into forward flight and landing at constant power running forward slowly to minimise sand ingestion had only just been discovered, or else forgotten and rediscovered in No 78 Squadron at this late date.

The nearest thing to a real operation for the helicopters in this four-year period in Sharjah occurred in December 1970 when it was decided to disrupt some dissidents in the mountains of the Musandam Peninsula in Oman. For 12 days Operation Breakfast (also known as Operation Intragon) employed all seven of the Wessex then on the strength of No 78 Squadron in support of the Trucial Oman Scouts and SAS. Aircraft and crews were armed but there was no opposition. The only navigation aid then or even in that theatre for the helicopters was the 'Violet Picture' homer in the aircraft which could be used in conjunction with the SARBE used by the SAS.

1971 was the last year of the British presence in Sharjah, as well as in the whole of the Gulf. As in Aden, whilst all other units prepared for departure, the supposedly reduced helicopter tasking in fact continued at a high level because of a flood of late short notice bids for assistance. Much to their delight, the second-line servicing was returned to the control of the Squadron and serviceability continued satisfactorily. By March the unit was down to six aircraft but flew 226 hours. Limited night flying had been carried out in the previous year, but night transits were not uncommon and the occasional night casualty evacuation was now being done. There were no special aids apart from the searchlight clusters inherited from the last days in Aden. Exercises continued almost to the last minute, one actually taking place in October. As an operational training area for helicopters in desert and mountain terrain, Sharjah could scarcely have been excelled and its loss could not be made good elsewhere.

The No 78 Squadron disbandment parade took place on 26 November 1971, although the last operational flight was flown a few days later on 1 December. Sir Geoffrey Arthur (the Political Resident) and his Personal Assistant were taken by helicopter to three locations for formal abrogation of the Treaties of the Trucial States. The Ensign was lowered at Sharjah on 14 December 1971, and at Muharraq on the following day, leaving the Staging Post at Masirah Island as the last tenuous British presence in the Gulf area.

Since June 1965 when the Squadron was re-formed in Aden, No 78 Squadron Wessex had flown 18764 hours of which 6766 were operational. They carried over 12 million lbs of freight, 128156 passengers and 1176 medical evacuations.

References to Chapter 11

- 1 Squadron Leader Hart.
- 2 Middle East Command ORB.
- 3 No 26 Squadron ORB.
- 4 Khormaksar ORB.
- 5 Ibid.
- 6 Middle East Command ORB.
- 7 Squadron Leader Timbers.
- 8 Middle East Command ORB.
- 9 No 26 Squadron ORB.
- 10 Squadron Leader Hart.
- 11 Middle East Command ORB.
- 12 No 26 Squadron ORB.
- 13 Squadron Leader Hart.
- 14 No 26 Squadron ORB.
- 15 Squadron Leader Hart.
- 16 Accident Board of Inquiry.
- 17 Flight Lieutenant Perrott.
- 18 No 18 Squadron ORB.
- 19 No 26 Squadron ORB.
- 20 Air Commodore Moore.
- 21 Ibid.
- 22 No 26 Squadron ORB.
- 23 Air Commodore Moore.
- 24 No 26 Squadron ORB.
- 25 Khormaksar ORB.
- 26 Middle East Command ORB.
- 27 Khormaksar ORB.
- 28 Middle East Command ORB.
- 29 Squadron Leader Braybrook.

- 30 Wing Commander Symons and others.
- 31 Middle East Command ORB Appendices.
- 32 No 78 Squadron ORB.
- 33 Ibid.
- 34 Squadron Leader Braybrook.
- 35 Middle East Command ORB.
- 36 Squadron Leader Braybrook.
- 37 Ibid.
- 38 Middle East Command ORB.
- 39 No 78 Squadron.
- 40 Ibid.
- 41 Ibid.
- 42 Squadron Leader Braybrook.
- 43 No 78 Squadron ORB.
- 44 Middle East Command ORB.
- 45 Ibid.
- 46 No 78 Squadron ORB.

CHAPTER 12
THE FAR EAST IN PHASES 3 AND 4—1962-1972

Introduction

Phase 3 of the helicopter history started with the introduction of turbine-engined helicopters. In the Far East, Belvederes arrived in May 1962 followed by Whirlwinds Mk 10 in July 1963. Overlapping from Phase 2 and still in residence at Butterworth was No 110 Squadron with Sycamores, being the residue of the piston-engined helicopter force which operated in the Malayan Campaign of the 1950s, and which in 1962 was still busy with the remnants of the defeated, but never wholly destroyed, Communist terrorist forces lurking mainly in the vicinity of the Thai border (see Chapter 3).

The dominant feature in Phase 3 in the Far East was the Borneo Campaign, although the Belvederes had arrived in Singapore some seven months before the Brunei Revolt in accordance with the planned deployment of the Support Helicopter Force, to provide a simultaneous four-Company lift worldwide. They, together with the No 110 Squadron due to be re-equipped with Whirlwinds Mk 10, were to provide the light cargo element of the one-Company lift for the Far East (see Chapter 9). The Brunei Revolt was the start of what turned out to be four years of exciting and challenging helicopter flying in support of Army operations in the jungles of North Borneo as well as some in Malaya (West Malaysia).

The Borneo Campaign itself is fully described elsewhere, the account here being limited to a mere outline forming the background against which the helicopter operations can be seen to have relevance. Examples of the activities of individual helicopter squadrons in the Campaign serve to describe some of the less usual tasks demanded of them and the conditions they encountered.

The official ending of Indonesian hostilities in 1966, the disbandment of the Belvedere Squadron in 1969, the rundown of FEAF in 1970 and finally the replacement of the then remaining Whirlwinds by Wessex in 1972 constituted the change to Phase 4 which, with the exception of No 28 Squadron in Hong Kong, was short-lived in the Far East and is included here for the sake of continuity and later clarity, since Phase 4 belongs chiefly to the European theatre.

Period Preceding the Brunei Revolt

In Chapter 3, the ending of Phase 2 in the Far East was recorded as occurring when the Brunei Revolt of December 1962 resulted in three Sycamores of No 110 Squadron, then at Butterworth, being despatched by Beverley from Singapore to Labuan.(1) Phase 3 actually commenced seven months earlier with the arrival of

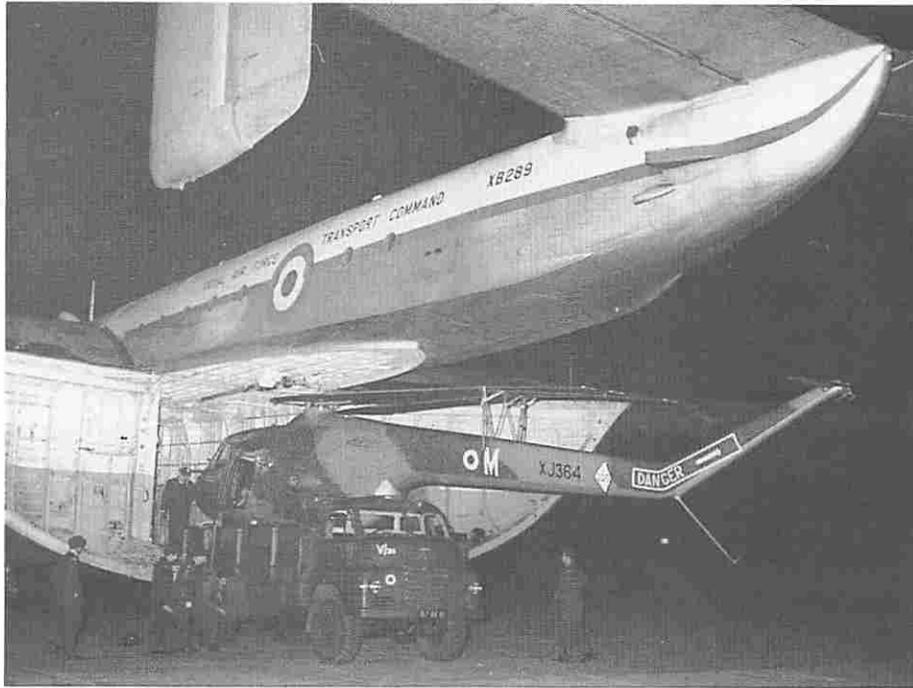
the Belvederes in the Far East and that short period constitutes the continuation of the Belvedere story from the point where it was left at Odiham in Chapter 8.

In April 1962, six Belvederes were crated for transfer by cargo ship to Singapore. This was an entirely new procedure and was supervised by the manufacturer's representatives amongst whom was Mr J Banks, who subsequently had much to do with the Belvedere in both the Far East and Aden, some of whose later comments are quoted in due course. The shipment produced no problems and, surprisingly, nor did the reassembly in Singapore, which was supervised by Flt Lt Munro, the first Belvedere Squadron Engineer Officer whose later comments are also quoted since they provide informed opinion on the sharply contrasting difference between the fortunes of the aircraft in FEAF and Aden respectively. As reported in Chapter 8, this first Belvedere Squadron, No 66 was formed out of the Belvedere Trials Unit, including both air and ground crews and the Trials Unit Engineer Officer.

The aircraft were not unloaded on the Seletar slipway and re-erected under the aegis of No 390 Maintenance Unit as might have been expected. The crates were handled at the Naval Base and the aircraft were towed by road on their own wheels (without rotor blades) travelling at night the few miles to the Royal Navy Air Station Sembawang—a grass airfield between the Naval Base and Seletar. Here, some 15 miles and therefore comparatively remote from the nearest FEAF engineering complex at Seletar where the air and ground crews were posted and residing, the aircraft were rapidly made ready for flight by their own Squadron ground crew, a facility regarded as most helpful by the Squadron Engineering Officer.(2) Shipped in April, the first two aircraft were flying from Sembawang by May, and able to participate in a FEAF exercise in June.(3)

These first six months were extremely valuable in providing a working-up period for the Belvederes in view of what was to come later in Borneo. Apart from a few weeks in August and September when all Belvederes were grounded pending investigation of the fatal crash in Germany reported in Chapter 10, during which time the last two of the six Belvederes arrived in crates and were reassembled at Sembawang, trooping and resupply operations were conducted with comparatively little trouble. The engine starter systems were still new and the ex-BTU ground crew knew well how to persuade them to function, so even they produced no serious problems at this stage. Two foreseen difficulties however became immediately apparent—shortage of crewmen and the total absence of winches.(4)

There was still no formal policy for providing crewmen for helicopters and although the BTU and Belvedere Squadrons had made a strong case for an appropriate establishment in 1961 and 1962, it was not until August 1963 that the decision by the Air Ministry to establish crewmen in respect of helicopters was taken, the initial intention being to use air engineers for the role.(5) In mid-1962 therefore,



Unlike the Whirlwind, the Sycamore could be loaded into the Beverley without the need to interfere with the rotor hub and blades. This method of deployment was used as part of the immediate response to the Brunei revolt.



The first Belvederes in Malaya were shipped to the Singapore Naval Base and towed by road to Sembawang overnight for re-assembly.

because they could not function safely and effectively without them, the Belvedere Squadrons were still selecting and training their own crewmen from amongst their technical ground crew, thus following the procedure adopted by their predecessors in the Casualty Evacuation Flight of 1950. In order to obtain the maximum benefit from the engineering expertise available whilst the aircraft were deployed away from base, the tendency, as before, was to use senior NCO ground crew when possible, although Corporals and Junior Technicians were also employed. The result was a more or less chronic shortage of senior NCO technicians.(6)

The No 66 Squadron Unit Engineer Officer was himself awarded the Queen's Commendation for valuable services in the air at the end of his tour in August 1964, having flown well over 450 hours in Belvederes as a crewman and, occasionally, as co-pilot, mostly on operations in Borneo.(7) It was not until October 1963 that the first aircrew crewmen (Air Signallers because they happened to be in surplus at the time) arrived on No 66 Squadron.

The lack of winches in the Belvedere was felt almost immediately in Malaya in 1962. The electric winch designed for the aircraft, dependent for its control on variable electrical resistance, had been found during tropical trials at Idris in North Africa to be virtually uncontrollable and had simply been abandoned.(8) As an alternative, fit and practised persons could be expected to climb down reasonably short lengths of rope, but their recovery posed a more difficult problem especially in jungle sites. In December 1962 the pilot and navigator of a Javelin, having ejected and landed in the jungle (the former being suspended from a tree) had to be recovered by being hauled up manually by rope to the rescuing Belvedere. A block and tackle arrangement was rigged and very shortly afterwards the same procedure was used to rescue six survivors from a sinking launch.(9) It was a desperate remedy.

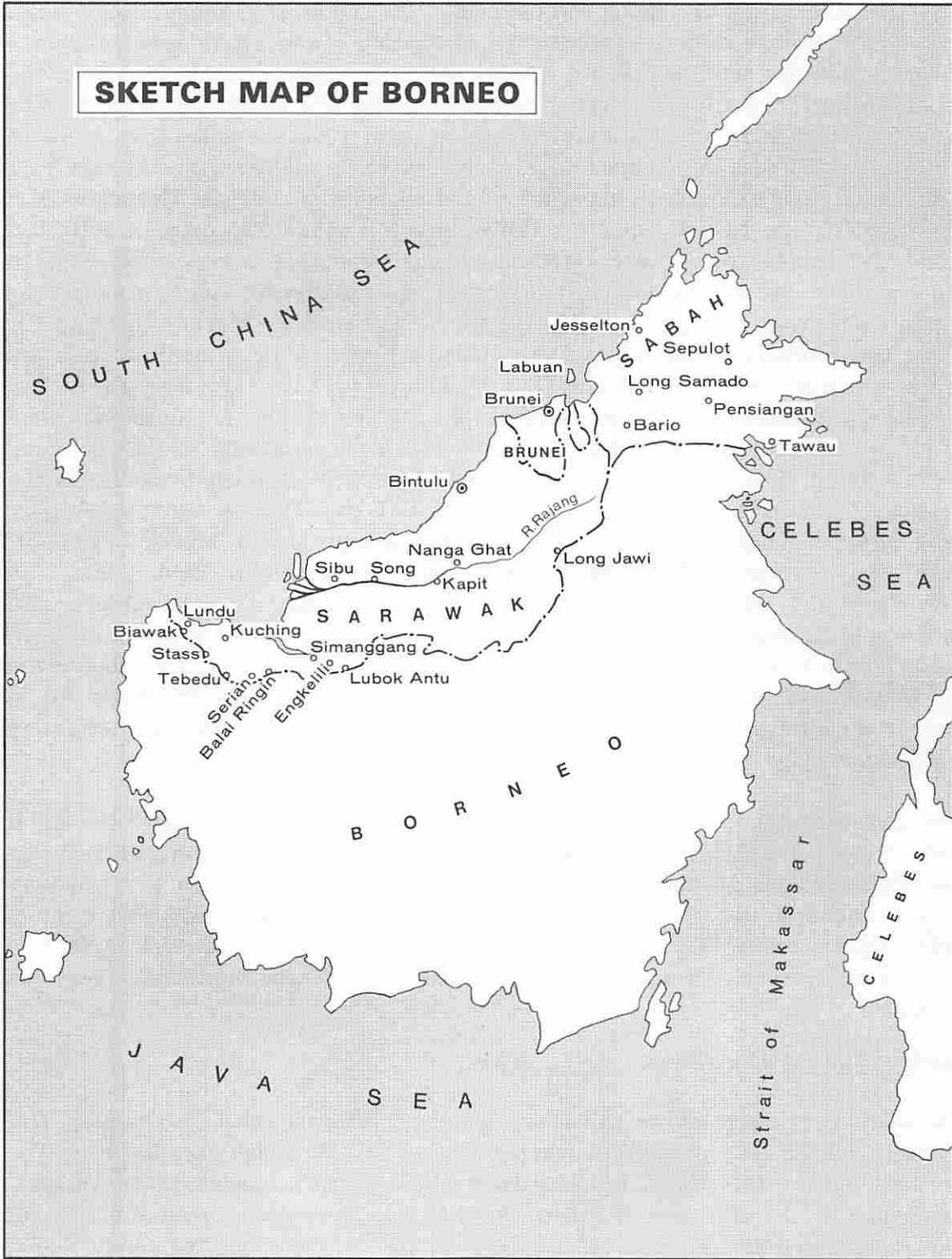
A much smaller difficulty is recorded because of the related dramatic events which followed. The control cables, known as the 'yaw cables', by which opposite lateral cyclic tilt was applied to the rotors by the pilot's foot pedals were unexpectedly reduced to a life of 100 hours in December 1962. This inevitably produced a temporary shortage of the item. Subsequently yaw cable failures in flight occurred in May 1963 in FEAF and October 1964 in AFME. In the FEAF case the result was a catastrophic crash in which the crew of three and six passengers were killed. The only possible conclusion was that the yaw cables constituted a feature requiring redesign, and the chief designer at the time, Mr McClements, confirmed this view.(10) Reducing the cable life to 100 hours was neither a satisfactory nor a reliable solution. That it had to be accepted is further evidence of the inherent disadvantages under which the Belvedere was labouring. Soon afterwards the yaw cable life was reduced to 50 hours, but a proposal by the manufacturer to replace the yaw cables by control rods was not implemented.

The Brunei Revolt of December 1962 signalled the end of anti-Communist terrorist activities in North Malaya as a main preoccupation of the FEAF helicopter force although military activity near the Thai border and communications flights for the jungle forts in North Malaya never actually ceased. The size of the task may be judged from the fact, for example, that in July 1962 the nine Sycamores at Butterworth carried 582 troops and 9300 lbs of freight, and by the end of the year had carried their thousandth aero-medical patient since arriving at Butterworth in mid-1959.(11) The No 110 Squadron Whirlwinds Mk 10 did not replace the Butterworth Sycamores except for SAR standby, but were used in September 1963 to replace those Sycamores detached for operations in Borneo. Assumption of the support helicopter role in North Malaya by Alouettes of the Royal Malaysian Air Force and Iroquois of the Royal Australian Air Force was a gradual process, and it was not until October 1964 that the Sycamores were formally withdrawn from operational tasking on the mainland of Malaya. Four then remained and were established to provide two for daily use by the Air Commander in the communications role in Singapore. Even that was not quite the end of the Sycamore in the SH role. Apart from the two brief detachments to Gan in October 1962 and August 1964 already mentioned in Chapter 3, the Sycamores, having moved to Seletar, were once more pressed into operational service in November 1964, joining the Belvederes and Whirlwinds Mk 10 in support of the ground forces opposing the Indonesian incursions then taking place in South Malaya. Two Sycamores continued in the VIP communications role for nearly four more years, and after having served for 13 years in Malaya, Borneo, Singapore and briefly in Gan and Hong Kong, their final retirement in FEAF in May 1967 was marked by a ceremonial formation flight escorted by Whirlwinds.

The SAR standby task on behalf of both the RAAF fighter units based there and also of visiting fighter and bomber exercise detachments from Tengah, required one Whirlwind Mk 10 detachment to Butterworth which continued to be met by No 110 Squadron until August 1965, and thereafter by the other Whirlwind Squadron, No 103, until March 1967. Apart from this continuing SAR task at Butterworth, major attention centred on Borneo and Singapore from the start of operations in Brunei in December 1962.

Borneo—Outline Description

The island previously known as Borneo lies about 400 miles east of Singapore and measures about 800 miles from north to south by 600 miles east to west. The southern and western three-quarters of the island, almost completely undeveloped, was ceded by the Dutch to Indonesia in 1949 and thereafter named Kalimantan. The remaining quarter consisted of Sarawak in the west (approximately 24000 square miles) and North Borneo (later Sabah) to the north east (approximately 24000 square miles), which together constituted British Borneo; and, sandwiched between them, the independent Sultanate of Brunei (a mere 2500 square miles



Air Staff Drawing Office (RAF) October 1986

approximately). Together they have an area comparable to that of England and Scotland, but their frontier with Kalimantan stretches for nearly 1000 miles, mostly along the top of the watershed in the east and north, with ground heights up to 8000 feet, often not easy to locate accurately in the hills but much more difficult to recognise topographically in the lower and flatter regions of Sarawak. The entire country is covered with primary jungle with extensive mangrove swamps in coastal areas. There are few roads near the coasts and none at all inland except in the vicinity of Kuching (capital of Sarawak), Sibiu in the central area and in Brunei. Sarawak is delineated in 'Divisions' numbered one to five reading from west to east, thus Kuching is in the First Division and Bario in the Fifth Division. The small but pleasant island of Labuan lies 20 miles off the Brunei coast and was part of British North Borneo (Sabah).

Hazards

The climate of Malaya was briefly described in Chapter 2. That in Borneo is of a similar pattern but more intense, that is to say, the morning mist and low cloud is more frequent and more tenacious, the afternoon thunderstorms start earlier and are more widespread and the overall rainfall is even higher. In addition operations, especially in North Borneo and the fourth and fifth divisions of Sarawak, involved moderately high altitudes amongst mountainous scenery at least as difficult as the worst Malaya had to offer and which, for most of the campaign, was so poorly mapped that quite large mountains were either wrongly placed by several miles or else omitted altogether. In these circumstances radio navigation aids would have been of limited use even if they had been available which they were not. Initially, the helicopters had no HF radios and VHF or UHF contact was non-existent beyond a few miles from base. It follows that the helicopter crews had a daunting task, and that many sorties had to be flown to find and redirect Army patrols who were geographically lost—a situation which occasionally affected the helicopter pilots themselves. Pensiangan in Sabah, for example, a bowl-shaped amphitheatre in a deep valley, was notoriously difficult to find by using the only maps that were initially provided. It was also one of the more topographically difficult sites for the MRT Beverleys to locate for the frequent supply drops required.(12)

Later in the campaign, as a result of urgent survey work which was aided both by helicopter transport for Army survey teams and extensive photographic reconnaissance by FEAF Canberras, more useful maps became available but even these were woefully short of accurate detail in many areas. Also, they virtually stopped dead at the Kalimantan Border, so the helicopter crews were presented with quite useful mapping detail which ended sharply with the line of the border and gave only the most vague indications of what lay beyond this invisible barrier up to the very edge of which they had to operate. In one particularly large blank area across the Kalimantan Border near Engkelili in the third division of Sarawak, the cartographer had indicated his total inability to provide significant information by inscribing the

message 'Here be dragons'. The absence of accurate maps was but one indication of the remoteness of the interior of the country from the fragmented ribbons of development near the coast. Only five months after starting operations, a Sycamore of No 110 Squadron discovered a 'new' village of about 300 people whose existence was previously unknown. A police superintendent was flown in by helicopter to establish control.(13)

There were a few unmanned airstrips suitable for light fixed wing aircraft, but no comprehensive pattern of such facilities.

Borneo—Political Background

Both North Borneo and Sarawak had originally been part of Brunei's empire until Sarawak was ceded by the Sultan to Sir James Brooke in 1841, thus founding the dynasty of the White Rajahs. It became a British colony after the Japanese occupation in 1945. Brunei became a British Protectorate in 1888, and North Borneo was ceded as a British colony in 1891. Thus, in 1962 we were dealing with a British Protectorate (Brunei) as an independent enclave between two British Crown Colonies—British North Borneo and Sarawak. The formation of the Federation of Malaysia in September 1963 incorporated North Borneo (now named Sabah and including Labuan) and Sarawak to constitute East Malaysia, an event which the Indonesians greatly resented and which was the chief reason for previous border attacks from Kalimantan escalating into what President Sukarno of Indonesia called 'Confrontation'.

The independent Sultanate of Brunei suffered an internal revolt in December 1962, shortly before the formation of Malaysia. Disaffected elements in the State objected to the plans to form Malaysia out of what used to be Brunei's empire as much as did the Indonesians, albeit for different reasons. There was in any case an element of social unrest in Brunei itself due partly to the maldistribution of the considerable wealth derived from the oil wells at Seria. At all events, it was in Brunei that the first trouble appeared but, although exacerbated by infiltrators from across the border, it broke out inside the country as well as taking the frontier incursion form of activity which was to characterise the Confrontation operations to which it was the curtain raiser.

As in Malaya in the 1950s, the native people took little or no direct part in the war, but in this case the indigenous population did not include the Malay presence—54% in Brunei but only 7% in Sabah and about 20% in Sarawak. There were, however, an estimated 30000 Indonesians living in Sabah—two thirds of them in the Tawau region. As in Malaya, the Chinese residents were the principal fertile field for the Communist influences which were active in supporting the Indonesian-organised incursions. The Chinese represented about 20% of the population of Sabah and about 30% of that of Sarawak and in the latter the local terrorist

sympathiser situation in the populated areas was not dissimilar to that in Malaya in the 1950s. The truly indigenous people are the Land Dyaks, Ibans and half a dozen other tribes—agricultural people living in Longhouse communities and generally supportive of the security forces. Borrowing a phrase from the days of General Templer in Malaya some 10 years previously, much attention was paid to obtaining the support of all types of local communities by influencing their 'hearts and minds', and in this activity the helicopters naturally played a major part.(14)

The Brunei revolt was crushed within ten days but mopping up operations continued for about four months, during which time numerous SAS patrols supported by helicopters operated in the border area engaged more in catching the escaping perpetrators than opposing further incursions.(15) Thereafter there was no further significant trouble in Brunei itself in the Confrontation period.

In April 1963, before the mopping up of the Brunei revolt had quite finished, the Confrontation war had begun with a cross border raid at Tebedu, and the build-up of British Forces in Borneo already in progress was accelerated, and with it the larger scale and long term commitment of RAF helicopters.

This period from the Brunei revolt in December 1962 leading up to the full-scale Confrontation activities following the declaration of the State of Malaysia in September 1963, constituted for the helicopter units a build-up period comparable to Phase 1 of the helicopter history (1950-52) when the Dragonflys of the Casualty Evacuation Flight in Malaya provided a very limited service in support of ground troops not yet able to conduct the full-scale effective operations which were soon to be needed. For the helicopter crews, many of whom had operated in the Malayan emergency of the 1950s, the similarity of the operating conditions at this early stage of the Borneo operations was heightened by the fact that there was often mutual personal recognition between the RAF helicopter pilots and the SAS troops who now met each other again in jungle clearings exactly like those in which they had last met in Malaya ten years before.(16)

The Start of Operations

On 8 December 1962, civil disturbance in Brunei was recognised as armed rebellion. The British response in Singapore was to implement the contingency plan prepared for this eventuality (Plan Ale), suitably updated by the addition of helicopters to the forces to be despatched by air—there was no doubt in this Theatre about the vital role of the helicopter. Troops were embarked in four Beverleys of the MRT force at Seletar for transit to Labuan and the aircraft carrier HMS Hermes was loaded to such an extent with motor transport, personnel and support equipment that there was no room for the three RAF Sycamores and Belvederes which had been added to the force. After some discussion the three Belvederes were cleared for take-off with overload fuel tanks at 19500 lbs all-up weight (1000 lbs over normal

limits) and flew direct the 400 odd miles to Kuching and thence to Labuan on the 17 December—a total of eight hours flying time—with no untoward effects apart from a heavier than usual vibration during the first hour or so of flight after each take-off. The aircraft were serviceable on arrival and went to work deploying and supplying a troop of the Royal Marines with 105 mm guns and ammunition.(17) The three Sycamores were flown by Beverley to Labuan with six pilots and twelve ground crew on 28 December and were flying by the following day.(18)

An opportunity to demonstrate the 'hearts and minds' philosophy with considerable effect was provided almost at the very outset of operations in Borneo when in January 1963, with the Brunei revolt barely suppressed, military follow-up action was briefly interrupted to help the civilian population to deal with the consequences of a period of rain which was excessive even by Borneo standards. Sixteen inches of rain fell in one week in Brunei and the fourth and fifth divisions of Sarawak and much flood relief and rescue work had to be done. The effect on the attitude of the local population was most beneficial for the security forces, particularly at this early stage of the campaign. The principle of helping the local population whenever possible, particularly with helicopter lifts and medical casualty evacuations, was followed throughout the whole ensuing period of military activity.

Development of the Campaign

In the immediate aftermath of the suppression of the Brunei revolt, most helicopter tactical activity was concerned with moving the SAS patrols to and fro in the border areas. The RAF had, at this stage, only three Belvederes and three Sycamores in Borneo, based on Brunei Town airfield. The commando carrier HMS Albion was in the Far East and Royal Navy Whirlwinds Mk 7 and Wessex Mk 1 were pressed into service to assist. A naval helicopter presence was maintained thereafter in various locations from the commando carriers continually in transit between Singapore, Borneo, Hong Kong and Australia for the remainder of the Borneo campaign. In addition to their work near the border, Belvederes were used in lifting heavy machinery for airstrip construction or improvement, for example at Long Seridan and Meligan, as well as in their new role of recovering disabled helicopters. In the first two months of 1963 they lifted two RN Whirlwinds from Brunei to HMS Albion and one RN Wessex onto a barge for return to HMS Albion. Other similar operations are described later.(19)

There was no large-scale military activity immediately following the suppression of the Brunei revolt, rather a steadily mounting threat as propaganda from Jakarta was matched by the gathering of Indonesian-trained raiding parties along the whole length of the Kalimantan border, and especially in the first and second divisions of Sarawak. A corresponding build-up of British troops took place and the RN helicopters were deployed to Kuching. In early 1963, FEAF was still awaiting the delayed arrival of the Mk 10 Whirlwinds, but in the meantime had only the three

Belvederes and Sycamores to deploy. In fact, the Sycamores were withdrawn to Butterworth in March but had to be returned to Brunei in the following month, where they were used mainly in Sabah and the fourth and fifth divisions of Sarawak. In July 1963, FEAF was at last able to deploy the first six Whirlwinds Mk 10 to Kuching, and No 224 Group in Singapore assumed from the Royal Navy responsibility for helicopter operations at the airfield. Two Belvederes were added, being transported by HMS Albion.⁽²⁰⁾ The Sycamores were finally withdrawn to Butterworth in September. The pressure to provide helicopters was now severe and it will be seen why the allotment of Mk 10 Whirlwinds to replace the Mk 2s for SAR in the United Kingdom was delayed at the end of Phase 2 as mentioned in Chapter 5. The fitting of H/F radios in the helicopters had now become so urgent that No 224 Group was demanding the quickest solution regardless of whether or not it was the best. The AOC was applying urgent personal pressure on the Vice Chief of the Air Staff to obtain priority for Borneo at the expense of other commitments if necessary.⁽²¹⁾ A hangar was to be built for the Belvederes at Kuching. By July, the Borneo helicopter deployment was one Belvedere and three Sycamores at Brunei, two Belvederes and six Whirlwinds at Kuching. On 1 August, No 103 Squadron, having disbanded in Cyprus (see Chapter 5) re-formed at Seletar with 10 Whirlwinds Mk 10 alongside No 110 Squadron. Air Ministry agreed H/F SSB radio for Borneo helicopters and the Collins 618-T3 set was approved for the purpose. The FEAF helicopter force of two Whirlwind and one Belvedere squadrons was now complete, and what may be described as the first of two phases of the Borneo operation ended in September 1963. Thereafter, there was a considerable further increase in helicopter strength and activity.

There may be a tendency to think of the Borneo campaign as the main reason for the existence of the FEAF helicopter operations, in which case the retention of the two Whirlwind and one Belvedere squadron bases in Singapore would be surprising. Similarly, there was no attempt to deploy No 224 Group HQ from Seletar to Borneo. Tasking agencies and local controller teams had to be created specifically for Borneo operations. The fact was that FEAF was a complete and virtually independent air force having front-line operational units in all the main specialisations—bomber, fighter, transport (long, medium and short range) and maritime, together with two large Maintenance Units—one engineering and one for all aspects of supply. Its primary task was to support the Commonwealth Strategic Reserve and, in the process, to provide air defence for Singapore and Malaya. The FEAF contingency plan for Borneo was but one of the many envisaging possible conflagrations throughout the Far East. The fact that it was the only one to require full implementation did not by any means exclude efforts in other directions and throughout the Borneo Confrontation period elaborate exercises with the Commonwealth Brigade in Thailand and elsewhere continued unabated, as did air defence exercises in Singapore.⁽²²⁾ Thus, when in September 1963 the declaration of the formation of the Federation of Malaysia resulted in Confrontation escalating to a state amounting to undeclared war, it was No 38 Group resources from the

United Kingdom which eventually had to be obtained to provide and maintain adequate helicopter support for the increased Army activity. Meanwhile the policy for the three FEAF helicopter squadrons remained as:

- a. Tactical support for the Far East Strategic Reserve.
- b. Support for civilian authorities including border security and Borneo territories.
- c. Internal security.
- d. Aero-medical evacuation.

Three Belvederes and six Whirlwinds—three from each of Nos 103 and 110 Squadrons—were retained at Singapore for training and seven days per week dawn to dusk standby for SRT support operations in West Malaysia (Malaya). No 110 Squadron had the additional task of a single aircraft standby at 15 minutes readiness for SAR at Butterworth, plus the Sycamore communications tasks for the Air Commander. The policy for the FEAF SRT helicopter squadrons therefore resulted in a deployment of 12 Whirlwinds and five Belvederes in Borneo, and six Whirlwinds, three Belvederes and two Sycamores at Seletar in Singapore (23) with one Whirlwind detached to Butterworth.

Confrontation

'Spine Force' was the name given to the No 38 Group elements added to the FEAF helicopter force in late 1963 for the second phase of the Borneo operations which consisted of ten aircraft of No 225 (Whirlwind) Squadron and three Belvederes of No 26 Squadron not yet delivered to join the first two No 26 Squadron aircraft in Aden—see Chapter 11. The personnel strength was 27 officers and 112 NCOs and airmen. The suddenness of this deployment may be deduced from the fact that Odiham had deployed to North Africa for Exercise Triplex West practically the whole of No 225 Squadron plus three of the Belvederes destined for No 26 Squadron and it was at the end of that Exercise that they were told they were to deploy to the Far East instead of returning to Odiham—see Chapter 10. The crews returned to the United Kingdom for embarkation leave, and preparation for a one-year unaccompanied tour in the Far East, all of which was to be spent in Borneo. The No 26 Squadron Flight Commander recalls that one result of this rapid preparation for a tour in an area with limited support establishment involved medical and dental checks resulting in the precautionary extraction of 146 teeth from the airmen selected.(24) A tenth Whirlwind was transported by Beverley to join the nine Exercise Triplex West aircraft at Bomba in North Africa ready to embark with the two Belvederes (one had crashed at Bomba during the exercise—See Chapter 10)

plus a replacement for the crashed aircraft already embarked on HMS Albion, which then delivered the entire No 38 Group task force to Singapore on 20 November. The air and ground crews were flown from UK to Singapore arriving on 13 November. After Theatre operational training at Seletar lasting about three weeks the entire Spine Force was transported by aircraft carrier to Borneo and became operational in December.(25)

Nos 103 and 110 Squadrons had deployed in Borneo on a rotational basis about two-thirds of their aircraft strength and the addition of the whole of No 225 Squadron virtually doubled the Whirlwind force in Borneo. Similarly, the three Spine Force Belvederes (making a total of ten in FEAF) plus one from Singapore went to increase the Borneo detachment from three to seven aircraft. The result was an almost instantaneous doubling of the helicopter force available in Borneo, one effect of which was to permit a more flexible and efficient deployment pattern to a larger number of forward bases, and thus to provide better and more immediate response to the more organised and widely dispersed Indonesian incursions which now developed under Confrontation policy. The Royal Navy helicopters of No 845 Squadron were moved from Labuan to Kuching with deployments at Sibu and Nanga Gaat thus assisting in the first, second and third divisions of Sarawak.(26) In January 1964 the RAF deployments were seven Whirlwinds at Labuan, six Belvederes and eight Whirlwinds at Kuching, with one, two or three Whirlwinds deployed further at Milegan, Tawau, Long Semado and Simanggang. Bullet-proof vests were issued, Whirlwind pilot seats were fitted with armour-plate and Bren gun fittings were provided in doorways. All helicopters were being fitted with H/F radios. The last four Whirlwinds of No 225 Squadron, fitted with the wire guided SS11 missile, were despatched from Odiham to Kuching. Phase 2 of the Borneo operations was now in full swing.

Army Deployments

The Army was strung out all along the Kalimantan border, having a chain of patrol bases from which about two-thirds of the occupants were out on patrol at any one time. Each battalion had a frontage of about 100 miles or more and an attempt was made to construct permanent helicopter landing points every 1000 yards or so for both tactical troop movements and casualty evacuation.(27) The troops were rotated from Singapore every four months (six months for the Gurkhas) and, in the absence of roads, relied completely on the helicopter force to accomplish the changeovers. In order to maintain constant operational readiness whole units had to be inserted and withdrawn in one day, while a similar two-way mass movement had to be conducted on the same day by the MRT force between Singapore and Labuan or Kuching, the latter having severe accommodation problems for troops in transit.(28) Whereas in Malaya during the 1950s operations had involved up to 24 battalions, not including the Police Field Force, with only limited troop lift capability by helicopter, in Borneo in 1964 there were only some six battalions plus

some local auxiliaries but with helicopter support the operational usefulness of this force was reckoned to be effectively tripled.(29) By the end of 1964 there were ten battalions.

In early 1964 with the Indonesian and internal threats increasing, the forward platoon patrol bases started to become Company bases and to look like jungle forts, complete with 105 mm gun emplacements in and out of which the Belvederes moved the guns as required. The Belvederes were also heavily involved in the construction of these forts which required comparatively large quantities of barbed wire and, especially, corrugated iron panels.(30) Some were very close to the Indonesian border, for example Stass and Biawak in the first division of Sarawak, and aircraft flying much above 50 feet were liable to be fired on by heavy machine guns from across the border. In these cases the MRT food, water and ammunition resupply air drops had to be replaced by tactically flying helicopters able to keep out of sight of the enemy by literally hiding behind the trees.(31) Navigation errors by the helicopters operating so close to the border were liable to be fatal, particularly in the first and second divisions where the border was not always defined by obvious topographical features such as mountain ridges and was often invisible. In November 1956 the pilot of a Whirlwind from Kuching flying from Bau to Stass—a flight of some 10 minutes—evidently mistook a small hill across the border for a similar one near Stass itself, overflew his target by a few seconds and was promptly shot down by machine gun fire with fatal results.(32) In December 1964, Wg Cdr Ross, an RAF chaplain, was killed by enemy fire from across the border whilst travelling as a passenger in an Army Air Corps Auster carrying out a mail drop at Biawak.

The regular standard helicopter tasks required by the Army in the operational circumstances of the second main phase of the Confrontation war consisted basically of the daily maintenance supply of food, water, kerosene and ammunition to the Company and patrol bases screening the Kalimantan border. Although the whole border had to be watched it had become clear that there was a large but not unlimited number of places where the Indonesians could organise border crossings. When these occurred, rapid troop redeployments were needed in the forward areas, and to meet these demands numerous small helicopter detachments were employed, maintained and changed with complete flexibility as the local situation demanded and the overall picture permitted—an example of centralised control of tactical air power.

Forward airheads used were initially Brunei in the east and later, as the activity increased, Labuan where facilities were easier to arrange, and Kuching in the west. Such few airstrips as there were became natural bases, able to accept the single and twin Pioneers and heavy supply drops by the Beverleys, Hastings and Argosys of the MRT force. The main strips used throughout were at Lundu in the first division, Simanggang in the second division, Sibu in the third division, Long



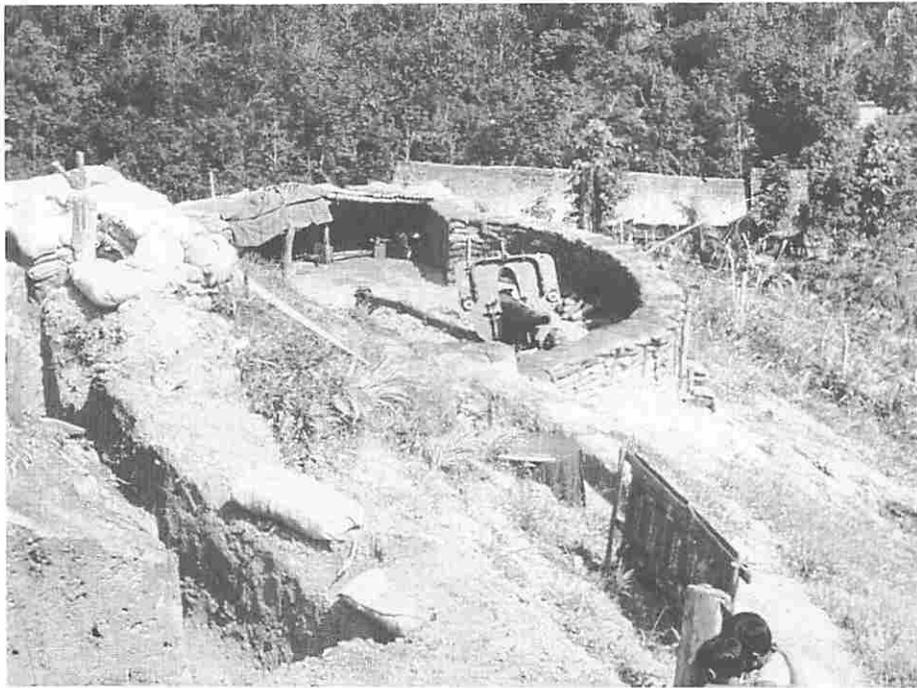
Re-fuelling the front tank of a Belvedere at a forward base in Borneo. Note the proximity of the front engine jet pipes to the re-fuelling airman, and the fuel dipstick which passes through the rotor disc.



Belvedere re-fuelling at a typical semi permanent Army base near the Indonesian border.



Forward semi-permanent army post near the Indonesian border, with 105 mm positioned by helicopter in its emplacement centre left of the picture. Note also the extensive use of corrugated iron, all of which had to be delivered by air.



105 mm gun placed by helicopter in its firing position near the Indonesian border.

Semado and Bario in the fourth and fifth divisions and Sepulot and Tawau in Sabah. RAF helicopter detachments were maintained at all these strips and, as the situation demanded, at forward locations of Company or Platoon HQs. For example:—

From Kuching—Balai Ringin, Serian, Tebedu
From Simanggang—Engkelili, Lubok Antu, Jambu
From Sibu—Song, Kapit, Nanga Gaat (permanent detachments), Long Jawi
From Labuan—Pensiangan, Meligan, Long Pasia

The following extract from the Operations and Exercises section of No 110 Squadron Operations Record Book gives some indication of the sort of operations being undertaken in late 1964, and considered by the Squadron as worthy of comment as distinct from the more regular continuous task of troop redeployment, resupply and casualty evacuation. It starts with a reference to the Indonesian incursions in Malaya (West Malaysia) which are outlined in the subsequent narrative.

Extract from No 110 Squadron ORB—December 1964

'Seletar Operations

There was little call for operational Whirlwind flying during the early part of this month. Over the Christmas period another Indonesian landing by sea of some 30 Indonesian soldiers and Malaysians took place. The Squadron provided an aircraft on Christmas Day for this operation. Again aircraft unserviceability plagued the Squadron and training flying was restricted.

Borneo Detachment

No 110 Squadron continued to meet their commitment in the Borneo territories and two aircraft are based at Bario in support of the Army units there, 2/6th Ghurka Rifles. During the early part of December the Bario detachment was unusually busy. The Director of Operations has now given permission for forces in the border area to counter incursions and pursue the enemy up to 5000 yards beyond the border. This has increased the scope of offensive patrolling and the use of Landing Points (LP) very close to the border has become a regular occurrence.

Three incidents typical of the kind of operations in which the Squadron aircraft take part are worthy of note. One patrol from D Company 2/6th Ghurka Rifles led by Major Robinson, was landed close to the border near Long Rapung by a Whirlwind from the Squadron, Captain, Flight Lieutenant D A W Todman. Some days previously a small "hide" had been constructed and it was from this that a man using a powerful monocular could observe a track used frequently by Indonesian patrols. A successful operation followed in which Squadron aircraft resupplied the troops. The troops were subsequently lifted out by helicopter.

The second incident concerning troops from the same Company took place between the 7 and 13 December. A Platoon deployed in the Long Banga area was airlifted to an LP at 5100 feet very close to the border. The crew of the aircraft was: Captain—Flight Sergeant Spinks; Second Pilot—Flying Officer Edwards. It was the intention of the Platoon to penetrate the maximum distance across the border and set up a small base. On a subsequent resupply run the same crew, who incidentally were carrying out theatre conversion for Flying Officer Edwards, found that the LP was unmanned and therefore insecure. The small party who were to have returned from the forward base and secured the LP had run into a band of 90 Indonesians. They were unable to reach the rendezvous and one man was wounded. Two soldiers were killed in the subsequent follow-up action against the 90 Indonesians. The Platoon at the forward base now appeared to be cut off from its supplies and the LP was unmanned and therefore insecure. This was particularly significant to the helicopter crew as Indonesians were now known to be in the area in strength. However, the crew, knowing the nature of the situation and the pressing need for medical assistance flew into the LP eight Ghurkas and a Medical Orderly with supplies. This patrol had instructions to push through to the forward base and the wounded man. It was unfortunate that this rescue Platoon put in by the helicopter was unable to continue after they had lost one man on the track which had been mined. Shortly after this incident the beleaguered Platoon started to cut a new track back to the LP. Carrying the dead and wounded they reached the LP 25 hours later. Both parties were lifted out by aircraft of this Squadron and fresh troops were lifted in to replace them. Operations in this area continue.

The third incident highlights the value of Sarbe beacons, now standard equipment with each Special Air Service patrol. A small party of SAS troops became separated during a night patrol and one man failed to arrive at the rendezvous the following morning. A search was mounted and two small patrols were airlifted to the area by Squadron aircraft. The 'Violet Picture' UHF presentation was switched on by the lead aircraft and a strong signal was received emanating from a Sarbe beacon in the area. The aircraft was homed to this beacon which was found situated in a disused clearing. A grateful SAS soldier was airlifted out.

Monthly Achievements

The monthly flying achievement is as follows:

- a. Operational hours 240.35
- b. Operational sorties 782
- c. Non-operational sorties 140'

West Malaysia

In the second half of 1964, the Indonesians temporarily switched the emphasis of their incursion activity to the southern part of West Malaysia (Malaya),(34) making several landings by small boats driven by powerful outboard engines. Initial landings were at three points in South Johore, as well as one on Shell Island near Singapore. On 2 September a major parachute assault was made by night when 97 troops were dropped by C-130 transport aircraft near the town of Labis in Johore. The communal situation in Singapore was already very tense—there had been political rioting and consequent curfews during July and August—and the war seemed to be getting uncomfortably close. Preparations for the arrival of the Bloodhound Anti-Aircraft Missile Squadron (No 75) in Singapore continued, anti-aircraft guns were deployed around the main installations and local aircraft dispersal schemes on the Singapore airfields were prepared.(35) Seletar helicopters, at first given deployment positions on the Station golf course, were later directed to Sembawang for dispersal. Sandbag blast walls were erected at the entrances to important buildings, air raid shelters were constructed(36) and watchers, including personnel of the FEAF band, were deployed by helicopters to man four visual reporting points (VRP) on the nearby islands (two more VRPs were provided by the Marine Craft Unit).(37) The RAF Regiment was deployed in its primary role of airfield defence at Butterworth, Tengah and Seletar, but a Flight of No 15(F) Squadron RAF Regiment defending the airstrip and helicopter detachment at Sepulot in Borneo was not disturbed.(38)

The Indonesians who actually landed did not have much success. Insurgents in Singapore were quickly rounded up; those in the jungles of Johore took a little longer to find, but were bombed by Shackletons and vigorously harried by air strikes by Hunters and Canberras, Whirlwinds and Sycamores (the latter only recently relegated to the VIP communications role for the Air Commander) providing the aerial platform for the FACs, as well as acting with the Belvederes in their standard support role for the ground forces.

The helicopters, of critical importance in these operations, were found from the rumps of Nos 103, 110 and 66 Squadrons not deployed to Borneo, but retained in Singapore for just such an eventuality and normally employed in exercises with 28 Commonwealth Brigade in Malaya, providing operational training for new pilots and monthly continuation training for those rotated from the two or three-week detachment periods in Borneo which was the usual pattern for the Singapore-based squadrons. The many new helicopter pilots arriving during this period from the UK for the FEAF squadrons received highly realistic operational training in this period even before going to Borneo. By October, the Indonesian parachutist parties in the Labis area had all been accounted for—28 killed and 63 captured.(39)

Further small incursions by boat continued for two months or so, but met with no success whatever. The boats could not be hidden from the helicopter and Pioneer reconnaissances flown along the beaches soon after dawn, daily at first and subsequently at irregular intervals. The Indonesians were dismayed to find they were given no help or encouragement by the Malaysians in the incursion areas,(40) and in addition confessed to being confused and demoralised by the continual sound of helicopters.(41) Some were captured while still at sea. In April 1965, for example, the enemy casualties in what was now known as Operation Oak Tree were 38 killed, 39 captured, 10 drowned.(42) Between August 1964 and March 1965 there were 41 landings, attempted landings or acts of sabotage. 740 Indonesians were involved of whom 451 actually landed. 142 were killed and 309 captured.(43) The last incursion in West Malaysia was by 25 Indonesians at Penggarang in May 1965 and, like the others, was swiftly contained by helicopter-borne troops. Beach reconnaissance around the lower part of the Malay Peninsula continued with diminishing frequency for a further year. Borneo operations, by contrast, continued at a rising rate through 1965.

Borneo Operations—Second Stage

The slight reduction of activity in Borneo during the Indonesian incursions into West Malaysia (Malaya) came to an end in mid-1965. During that year British and Commonwealth troop strength doubled from approximately 10000 to 20000.(44) The political decision originally made to eschew any move which could possibly be construed as offensive action was carefully maintained. Thus, the presence of Javelins and Hunters served to deter the Indonesian Air Force from offensive action, but they never fired over the border. Cautious cross-border forays by the SAS in hot pursuit of fleeing Indonesians or in establishing ambush positions were eventually permitted in specifically authorised cases only, and for strictly limited ranges of between 1000 and 5000 yards.(45) Great care was taken to prevent general knowledge of these activities since it was of paramount importance to avoid accusations of aggression and the risk of precipitating escalation of the conflict. Even when the Whirlwind was shot down in November 1965 only a few hundred yards over the border at Stass, strong pressure from Kuching for a Hunter strike on enemy troops in the area so that a SAS rescue party could attempt a possible rescue was resisted as being 'provacative', even though Hunters were positioned at Kuching in readiness for such a sortie.(46) Cross-border fire by 105 mm guns on specific targets was permitted and enemy mortar fire was returned.(47) All military initiative was left to the enemy, the objective being solely to detect rapidly and defeat any incursion across the border, while awaiting political acceptance of the situation by Indonesia.

For the helicopters then, the second phase of the Borneo operations consisted of their becoming more active and more efficient in performing the tasks carried out

in the first phase but for a much larger number of troops. It also meant more specialised development of techniques in three main fields:

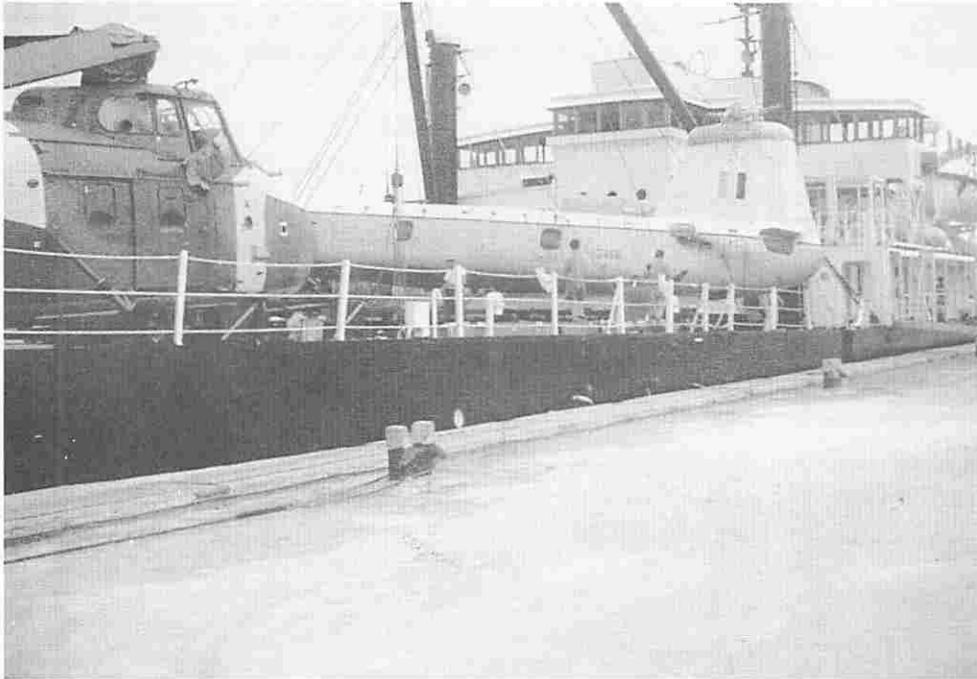
- a. the covert insertion and recovery of SAS troops or emergency casualty evacuation in deep jungle with helicopters having a maximum winch cable length of only 50 feet; (See Appendix 3).
- b. the positioning of ground radar equipment in jungle sites;
- c. development of night landing techniques in jungle sites—mainly for casualty evacuation. (See Appendix 4).

In each of these roles the Helicopter Wing formation at Seletar was able to play a major part in co-ordinating trials for new tasks as well as initiating development of new techniques and equipment.

Continuing Build-Up of the Forces

The build-up of forces in Borneo continued throughout 1965 to match the increasing Indonesian activity. In January 1965, No 230 Squadron—the last SRT Whirlwind Squadron in No 38 Group—was withdrawn from Germany to Odiham, relieved of its UNFICYP role in Cyprus by Wessex of No 18 Squadron (see Chapter 10) and strengthened by the absorption of No 1310 Flight from Guyana (see Chapter 10). Its thirteen aircraft were delivered by the aircraft carrier HMS Triumph to Singapore on 22 February 1965 and after about two weeks Theatre training were, like those of No 225 Squadron before them, delivered complete in this case by the aircraft carrier HMS Centaur to Labuan, where they arrived on 10 March and commenced operations on the Sabah/Kalimantan border on the next day.(48) At the end of 1965, No 225 Squadron, having arrived with the Spine Force in December 1963 for a one-year unaccompanied tour, was approaching its second one-year tour expiry date, but apart from the United Kingdom SAR units there was now no 'pool' of Whirlwind crews with which to replace them. No 225 Squadron was disbanded and its aircraft distributed between Nos 103 and 110 Squadrons, and a proportion of its personnel was absorbed into FEAF on a two and a half year tour basis.(49)

No 66 Squadron, having lost one aircraft to Aden (XG 474—the RAF Museum aircraft) shortly after the Spine Force reinforcement, now benefited from the collapse of the Belvederes in Aden (see Chapter 11) and in December 1965 received from the disbanding No 26 Squadron their remaining four Belvederes (including XG 474). The aircraft were transported to Singapore on the aircraft carrier HMS Albion in December 1965, although they were in such bad condition that it took some four months of extensive servicing before they were all considered fit for operations in



Helicopters requiring redeployment between Singapore and Borneo were usually carried as deck cargo either on RN Aircraft carriers when available, or on civilian ships.



Manoeuvring a Belvedere on a supply ship deck prior to being lifted off by crane.



It was possible to fly single Belvederes directly on to the supply ship deck.



Four Belvederes and one Scout as deck cargo on the Maxwell Brander.



Twelve Whirlwinds of 230 Squadron on HMS Bulwark in Singapore Naval base estimate from UK to Borneo early in 1965.



Preparing to re-deploy a 105 mm gun near the Indonesian border.

FEAF. In February 1966, conversion of Belvedere pilots at Odiham ceased and local conversions in FEAF were started. No 66 Squadron looked forward to receiving the last three Belvederes from the OCU at Odiham later in the year.(50)

In the first half of 1966, British forces in Borneo, including the helicopters, had reached their peak. Army deployments in forward bases were well established, reliable maps were at last readily available, radar cover was established, airstrips and helicopter pads development was complete and the general level of experience was high. In January 1966, the RAF helicopter deployments were as follows:

- a. No 66 Squadron. Three Belvederes at Seletar. Five Belvederes at Kuching. (When the ex-No 26 Squadron Belvederes from Aden became operational in May, this was increased to five and seven respectively).
- b. No 103 Squadron. Four SH Whirlwinds plus two SAR Whirlwinds at Seletar, one SAR Whirlwind at Butterworth, twelve SH Whirlwinds at Kuching (with detachments at Lundu and Simanggang).
- c. No 110 Squadron. Four SH Whirlwinds plus two communications Sycamores at Seletar, six SH Whirlwinds at Kuching, six SH Whirlwinds at Sibul (with detachment at Nanga Gaat).(51)
- d. No 230 Squadron. Twelve SH Whirlwinds at Labaun (with detachments at Sepulot and Tawau).(52)

All were working at the maximum rate possible.

The attention paid to ensuring that the military actions and general behaviour of the Security Forces was popular with the indigenous population succeeded. The hearts and minds of the Ibans, Dyaks and the rest were generally on our side and against the Indonesians—occasionally dramatically so. In June 1966 a Whirlwind pilot—Flying Officer Ramshaw—based at Nanga Gaat (a forward permanent helicopter deployment from Sibul in the third division of Sarawak) was returning to base in the late afternoon having spent much of the day ferrying troops on the Kalimantan border near Long Jawi. When only a few miles from Nanga Gaat he found himself hemmed in a narrow river valley by violent thunderstorms. Although he had seen a Longhouse he could not find any clear area in which to land and wait for the weather to improve, and was eventually forced to shut down on a temporarily exposed shingle bank in the middle of the river.(53) Two Ibans came past in a canoe and pointed out the obvious fact that the river would shortly rise and cover the shingle bank to a depth of 'two men high'. They returned after about half an hour and announced the unlikely news that a place was now prepared for the helicopter on the bank opposite the Longhouse a short distance away. With

nothing to lose, Flying Officer Ramshaw took off and was surprised and relieved to find a cleared flat space which had not been there before. The inhabitants of the Longhouse, recalling that a helicopter clearing had been cut there a year or two previously, had all emerged, crossed the river and removed the secondary jungle which had covered the site. Ramshaw and his crewman plus his passenger—a Gurkha Corporal who fortunately spoke some Malay—were entertained in the Longhouse overnight and the helicopter recovered undamaged to Nanga Gaat the following morning. In August 1966 a Belvedere was landed on the dry edge of the river near the Longhouse and the headman—Ugoh Anak Belayong Teliai—was presented with a certificate signed by the FEAF Air Commander and recounting the incident in English, Malay and the appropriate Iban dialect.(54) Twenty years previously, perhaps much less, these people had been head hunters. Their antagonistic response to Indonesian incursions and approval of the Security Forces' anti-Indonesian operations was naturally a critical element in the campaign.

In early 1966 the Indonesian political scene had started to disintegrate visibly, and by March it was being described as 'in chaos'.(55) A Communist coup having failed in late 1965, Sukarno had lost power to Suharto in an anti-Communist Army coup and on 11 August 1966 a peace treaty was signed with Malaysia. Confrontation has lasted three years and eight months. Although there was a major Indonesian incursion (about 50 men) into Borneo in late August resulting in a brief but large increase in helicopter-borne troop movements, it was rapidly contained and many Indonesians were captured in the Long Semado area.(56) The war was suddenly over.

Command and Control of the Helicopter Force

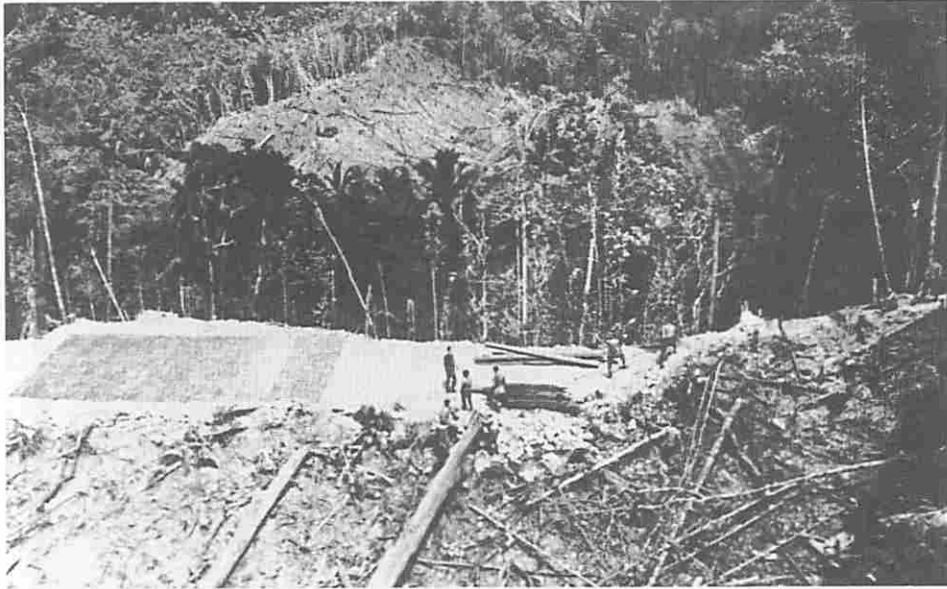
The command structure in the Far East during the Borneo campaign was unusual in many respects and, on occasion, difficult to understand. This was due chiefly to the simultaneous tri-Service organisations in Singapore and Borneo, the latter being subordinate to the former in individual Service posts, but with a Joint Force Commander in Borneo having overall operational command in Borneo, and reporting direct to the C-in-C Far East—the latter post created to head the tri-Service Joint Force Headquarters organisation named 'Headquarters Far East Command', which came into being purely coincidentally with the start of Borneo operations on 1 January 1963 at Phoenix Park, Singapore. Thus the RAF had a Commander Air Forces Borneo (COMAIRBOR) in the Joint Headquarters at Brunei—later Labuan—with a BASO who became Forward Air Commander in the Joint Headquarters at Kuching, reporting either through the AOC No 224 Group or directly to the Air Commander in FEAF Headquarters in Singapore, but under the operational command of the Commander British Forces Borneo (COBRITBOR), responsible directly to the C-in-C Far East.



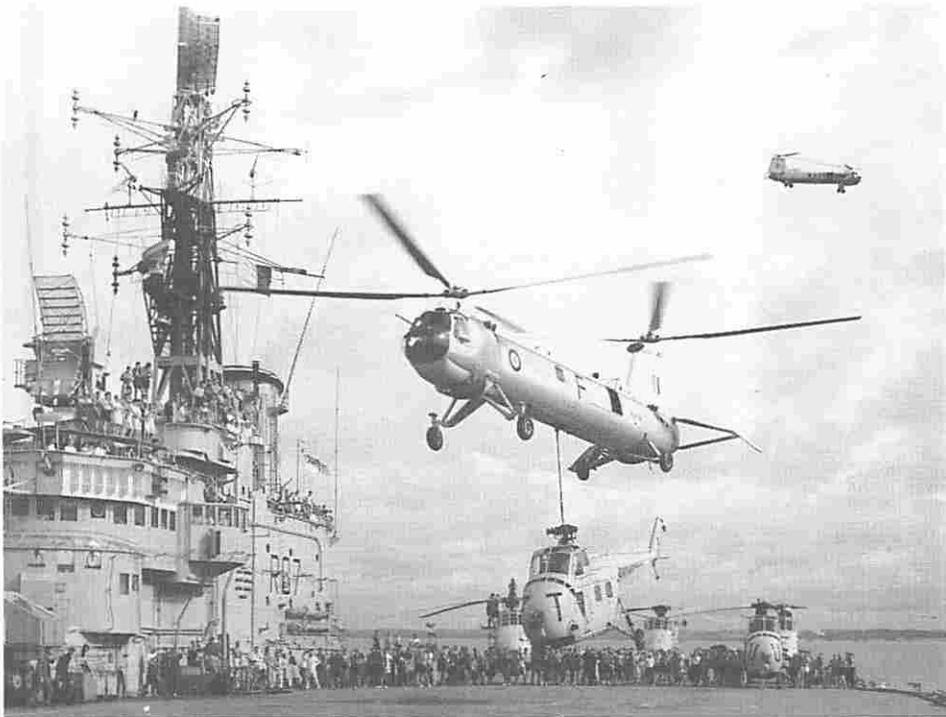
The height which the troops had to jump from the Belvedere was rather too high for comfort wearing full kit, but to use the ladder was even more difficult and slow.



Semi permanent Belvedere LZ in Borneo.



Semi permanent Belvedere LZ in Borneo.



Recovering a forced landed RN Whirlwind Mk 7 from Brunei to HMS Albion in January 1963.



Belvedere preparing to deploy 'Green Archer' radar near the Indonesian border.



Deploying Bloodhound anti aircraft missile to Kuching from the ship in which it was sent from Singapore.



Whirlwinds Mk 10 over Singapore.



The Whirlwind Mk 10 could deliver the 105 mm gun and ammunition, but the gun had to be stripped to allow the load to be spread over several sorties.



The Belvedere had a permanent LZ built for it on the top of Penang Hill in North Malaya, where the aircraft was used extensively to deliver components for the Ground Radars station being built there.



The permanent helicopter base at Nanga Gaat had sites for five helicopters, one large enough for a Belvedere.

This apparently alternative command structure for individual Service Chiefs was reflected in the lower echelons where the Seletar-based No 224 Group Helicopter Squadrons (Nos 66, 103 and 110) maintained permanent detachments at Labuan and Kuching and whose Station Commanders responded through COMAIRBOR and COMBRITBOR to C-in-C Far East, or COMAIRBOR and No 224 Group to FEAF, but not through Seletar. Even when reporting on administrative matters, the Commanding Officers of Seletar-based Squadrons spoke to No 224 Group through the Commanding Officer of RAF Seletar when in Singapore; through the local Commanding Officer of Labuan or Kuching when in Borneo; and even, on occasion, through the local Commanding Officer and COMAIRBOR direct to FEAF. It was not unknown for a Squadron Commander, while moving between Borneo and Singapore, to make use of more than one of these channels as seemed appropriate to him at the time, to achieve a solution of some administrative, personnel or even operational equipment problem which was proving intractable through the base organisation at Seletar.(57) Tasking of the helicopters was simple and direct through the Joint Operations Centres at Kuching for operations in the first, second and third divisions of Sarawak, and Labuan for operations in the fourth and fifth divisions of Sarawak, Brunei and Sabah.

Organisation of the Helicopter Force

The FEAF helicopter base organisation included a Helicopter Wing Headquarters, about which more will be said later, which had two main functions; to co-ordinate training, standardisation and maintain categorisation for the crews as they arrived from the UK or rotated from Borneo; and to provide Seletar with a Helicopter Flying Wing organisation paralleling the existing Flying Wing Headquarters but concerned only with the three helicopter squadrons on the station. With the exception of the Indonesian incursions in West Malaysia in late 1963 and early 1964, all the main helicopter operations took place in Borneo, so regular visits to the operation areas were necessary for the Helicopter Wing staff. The position of the Helicopter Wing Commander was at times quite delicate, for example when visiting Kuching, whose Commanding Officer was also a Wing Commander. Each regarded the helicopter crews, their performance and their welfare, as his own direct responsibility. The Station Commander of Seletar visited 'his' helicopter crews at Kuching and Labuan and on one occasion, the Station Commander of Odiham—the official home of No 225 Squadron—also paid a visit to Kuching to see how 'his' squadron was getting on.(58) A further difficulty was that while the No 38 Group Spine Force Belvederes and crews had been absorbed by No 66 Squadron within two months of arrival,(59) the separately established No 38 Group Whirlwind Squadron—No 225—had not. The No 225 Squadron aircraft, theoretically as well as practically, still belonged to No 38 Group since they had no connection with Seletar and were allotted, complete with ground crews, for exclusive use by COMAIRBOR, on a one-year unaccompanied basis. The Seletar Helicopter Wing

had no formal connection with them whatever, but the reality of the situation was that they, together with the Nos 110 and 103 Squadron detachments, formed part of the total Whirlwind force in Borneo and were tasked as such.

As a final twist to the complicated administrative position, while the aircrews of the three Seletar-based helicopter squadrons were rotated on a two, three or four week cycle through Singapore and Borneo, most of the ground crews were not. For reasons of efficiency of work rates and economy in traffic of personnel between Singapore and Borneo, it was found preferable to supply the ground crews in Borneo from the UK on a one-year unaccompanied basis. This gave them a completely different lifestyle from their colleagues on the same squadrons who were based in Singapore with their family lives, golf courses, boat and sailing clubs, parties, nightlife and a five-and-a half day working week. Whilst neither group was envious of the other, the one-year unaccompanied six/seven days per week work group in Borneo tended to regard themselves as more professional than their supposedly hedonist colleagues in Singapore.

Helicopter Engineering Control Organisation

The Engineering staffs who controlled the technicians paid little heed to the delicate pattern of responsibilities in the executive tapestry—merely running Seletar, Labuan and Kuching from No 224 Group and FEAF Headquarters as RAF Stations having particular engineering problems. The Command background situation described may have added stimulus to the almost universal engineering staff preference, completely victorious in Aden and much in evidence in FEAF during this period, to amalgamate the servicing for co-located squadrons or detachments and avoid having technical ground crews with exclusive allegiance to particular flying squadrons, especially ones with such a variety of executive controls. The result was that the centralisation, decentralisation and partial centralisation of the helicopter ground crews proceeded more or less continually in FEAF (and to some extent in the UK) throughout the 1960s and early 1970s.

Without exception, the Squadron Commanders resisted the centralisation trend most vehemently, being acutely aware of their reliance on the morale and motivation of the airmen to respond with selfless dedication and disregard of formal working hours, to the fluctuating operational urgency of their work. This stimulus, it seemed to them, could only be effectively applied within the squadron as a unit under pressure—a glimpse of the obvious they thought, more especially in terms of previous experience of the Royal Air Force.(60) This view was naturally shared by the GD officers further up the Command chain, albeit with the diminished vehemence more appropriate to senior staffs required to respond with reasoned argument to the barrage of statistical justification deployed by the senior engineering staffs freshly imbued with the latest concepts embodied in the then newly current term—

'Management'. In May 1966, a survey by engineering staffs of servicing in Borneo concluded that there should be visiting Management Teams consisting of a technical officer and four NCOs, convinced of the value of Management aims in improving servicing support, having no other servicing responsibilities and reporting direct to Headquarters FEAF.(61)

In July 1964 the Whirlwinds and crews at Labuan, having been contributed in roughly equal parts by Nos 103 and 110 Squadrons during the build-up period, achieved their ambition to divide the now more settled operational and servicing tasks along Squadron lines. Each provided their own first and second line servicing under their own engineering officers. Both Squadrons had rejoiced at recovery of Squadron control at Labuan and all Squadron servicing at Seletar, and in June 1965 the Commanding Officer of No 110 Squadron, having presumably heard of the latest centralization plans about to be announced, commented on the importance of having Squadron ground crew owing allegiance to the Squadron.(62) In mid-1965 a determined effort was made by Headquarters FEAF to amalgamate all helicopter servicing under Station rather than Squadron control. At a conference in FEAF, the Air Staffs reluctantly conceded that there was no arithmetical answer to the brilliantly presented graph and chart case for centralised engineering control at all levels unveiled by the FEAF Senior Engineer staffs, and described as incontrovertible in argument by the FEAF Financial Adviser.(63) Reorganisation of Station servicing was planned for Seletar, Kuching and Labuan which would be fully centralised for both first and second line servicing and even include fixed wing aircraft with the helicopters, that is giving the Station engineering organisation freedom to deploy all technicians within the Station as required, regardless of the flying units being served, and leaving the latter no airmen at all. The beleaguered Air Staffs reluctantly acceded to this plan but imposed three innocuous 'conditions':

- a. the flexibility of the Whirlwind Force was not to be impaired;
- b. the reorganisation would only be allowed to continue if substantial economy was being achieved;
- c. the decision was subject to alteration or rejection after six months.(64)

This policy was issued in September 1965. The Commanding Officer of No 110 Squadron immediately recorded his dismay and in October the Commanding Officer of No 103 Squadron described the adverse effect on general morale amongst the airmen. In November, the Commanding Officer of No 110 Squadron reported that at Seletar enthusiasm for No 110 Squadron by the airmen who had belonged to it was undiminished, and added that the case for squadron servicing was not susceptible to numerical measurement in a form which would influence the Finance and Establishment branches. To this the Station Commander, Group Captain (later Air

Chief Marshal) R W G Freer added in his own hand on the Squadron ORB the comment 'hear hear'.(65) In December 1965 No 110 Squadron was, with due ceremony, presented with its Standard. The airmen who had belonged to the Squadron were drawn from the centralised servicing pool for the occasion and participated in the parade with great enthusiasm. It was not until May 1967 that Nos 110 and 103 Squadrons, now with different Squadron Commanders, recovered control of their own first line servicing. Both had complained of abysmal serviceability in the preceding months at Seletar and No 110 Squadron reported Squadron servicing as an 'immediate success' with more serviceable aircraft than they could use at first, and the total of 396 monthly hours against a target of 400 as 'a rare achievement'.(66) In July the Commanding Officer of No 103 Squadron reported exceeding the Squadron task for the third month in succession, adding that he hoped they had 'now heard the last of centralised servicing'.(67) In September 1971, with FEAF disbanded, the move of No 103 Squadron, the last RAF Squadron in Singapore, to Tengah was used as a reason for once more separating the Squadron servicing from the unit and attempting to run it as part of the RAF Support Unit Engineering Organisation. Three months later, the Squadron Commander was complaining that this had been a 'misguided decision'. The airmen were arguing about to whom they belonged, and he affirmed that 'socially' (that is unofficially and for all practical purposes) what was called the Whirlwind Servicing Flight was part of No 103 Squadron. It was not until June 1972 that his successor was able to announce their formal return to Squadron control, by means of an official statement as follows:

'The long battle for Squadron autonomy reached a satisfactory result during the month with approval to full autonomy. Many things have changed in the Royal Air Force over the years but it is still very true that airmen are the lifeblood of a Squadron and vice versa. Whether you call it "management, leadership or esprit de corps" it is blatantly obvious that people work better in an environment that allows personal contact through all levels, a sense of involvement in the task, identification with, and pride in, a unit and its record. I am most pleased to command a "proper" unit again.(68)

Signed P R BOND
Sqn Ldr
OC No 103 Squadron
RAF Support Unit Tengah
5 July 1972'

Significantly, the large servicing centralisation reorganisation of mid-1965 did not include the Belvederes. No 66 Squadron had had a bad time in mid-1963 and 1964. Following a fatal crash (YAW cable failure) in 1963, second line servicing had been transferred from Squadron control to the Station Technical Wing. Several starter explosions, persistent vibration problems due to absence of proper rotor blade

tracking equipment and various other difficulties had shaken the morale of both air and ground crews. By 1965, there was good evidence of recovery from these difficulties and there seemed no point in opening the possibility of interfering in any way with the now highly specialised Belvedere servicing teams in Seletar and Kuching. Certainly, the Officer Commanding the Engineering Wing at Seletar saw no advantage in attempting to mix them with the Whirlwind crews on the other side of the airfield. Control of their own second line servicing had been returned to No 66 Squadron in July 1964 along with Nos 103 and 110 Squadrons—the very opposite procedure to that being practised in Aden. In late 1965, as the Whirlwind serviceability declined following application of full centralisation of servicing, that of the Belvederes improved.(69)

Although in 1967 the Belvedere second line servicing at Seletar was transferred once more to the Station Engineering Wing alongside the Whirlwind second line servicing,(70) this was mainly an organisational device and did not dilute the Belvedere specialisation. Belvedere first line servicing remained under Squadron control. It must be remembered that throughout this whole period, in contrast to the later practice, for example, at Odiham in Phase 4 (the 1970s), first line servicing included by far the largest element of rectification work, and that was the key to the number of operational aircraft actually available for tasking. Second line servicing was involved almost exclusively with statutory minor and major inspections. Both the No 66 Squadron Commander and Engineer Officer later testified to the crucial value of unit pride and competitive spirit both between the Belvedere technicians and others, as well as between the one-year unaccompanied airmen at Kuching and their unknown colleagues on 2½ year tours in Seletar.(71) The Squadron Commander summed up the attitude as essentially: 'We have got to make them fly because if we don't, nobody else will'.(72)

The Belvederes went on to achieve a very satisfactory utilisation rate until the day when the Unit was disbanded some four years later.(73)

Technique Developments and the Helicopter Wing

The Helicopter Wing Headquarters at Seletar had been formed in October 1964 at the instigation of the Station Commander—Group Captain Freer. He had been concerned that the workload generated by the three helicopter squadrons being added to the fixed wing complement (which included a Beverley Squadron and a large Twin and Single Pioneer Squadron, all having detachments in Borneo) was beyond the capabilities of a single established Officer Commanding Flying Wing, particularly one who had no helicopter experience. Unlike the previous Helicopter Wing—No 303—formed in 1952 in Malaya as a mainly administrative device (see Chapter 3) the Helicopter Wing formed at Seletar in 1964 was a Seletar Flying Wing Establishment and consequently had no individual number plate. Apart from

its function in the Station organisation it also provided co-ordination of the Helicopter Squadron's monthly continuation training and categorisation requirements, gradually acquiring for the purpose a small staff of QHIs who were initially drawn from the squadrons themselves. The single QHI established on each squadron was frequently unable to meet all the on-site training requirements for squadrons split between two or three locations more than 400 miles apart, for example regular engine-off landing practice for the Whirlwind and Sycamore pilots which was not practised solo, and renewal of out-of-date pilot categories. The Squadron Commanders themselves were greatly stretched having semi-permanent detachments in both Kuching and Labuan—an equivalent deployment in Europe amounting to an Odiham-based squadron with permanent detachments in Hamburg and Oslo, another at Aberdeen (representing Butterworth) and all, including the Headquarters Base, having an immediate operational task. They also had to provide individual theatre conversion training at Seletar for the more or less continuous stream of new pilots arriving to replace those tour expired. In early 1966 the Seletar Helicopter Wing acquired the role of Belvedere OCU on the transfer of that function from Odiham to Seletar.(74)

Quite apart from these predictable tasks for the Helicopter Wing, a third role soon appeared, arising from the technique and equipment modifications characteristically generated in an active operational theatre. The small Helicopter Wing staff was, fortuitously, in a position to co-ordinate and progress the various developments demanded but, more especially, to observe, identify and devise new solutions for most of the problems arising. There was a comparatively large continuation training, theatre conversion and night flying training task at Seletar. However, except for the few months in late 1964 and early 1965 when the Indonesians were attacking South Malaya, there was usually sufficient flying capacity for experimenting with techniques and equipment modifications, and a large number of pilots (up to 70 excluding those of the No 38 Group squadrons) from whom to gather a consensus of reactions. There was no equivalent of A&AEE or any other body claiming exclusive rights to development progress; but a ready enthusiasm in Group and Command Headquarters to encourage and apply quickly, if possible, any appropriate procedures recommended at the operational level. In these respects the opportunities for rapid and positive development progress were uniquely favourable; but when active operations in Borneo ceased, the impetus for such innovations fell back to its more usual rate of scarcely discernible change. In some respects the advances made were never consolidated in the United Kingdom. Four examples are given below.

Emergency Long Lift Hoist

The solution to the problem of having a 50 foot winch cable—no longer than that found to be unsatisfactory in Malaya 10 years previously (see Chapter 3)—became

known as the multi lift hoist method and was derived from an idea first formulated in No 225 Squadron in May 1964.(75) This somewhat desperate remedy consisted essentially of supplying a webbing line of the required length (normal maximum 200 feet) and raising or lowering it 50 feet by means of repeated attachments of the winch hook. The procedure is comparatively complex to describe so the Standard Operation Procedure for its use eventually issued by Headquarters FEAF and dated 8 January 1966 is attached as Appendix 3.(76) It could take up to 20 minutes for the whole procedure to be completed for one man during which time the Whirlwind was required to maintain an accurate hover at up to 200 feet with almost full left rudder, probably uncomfortably close to trees. After five complete cycles of the winch it required a 10-minute pause to cool down. Abseiling eventually replaced this system for inserting troops but the multi-lift hoist method remained the only practical way of lifting them from deep jungle. In September 1965, four months before the multi-lift hoist system was approved for use, a No 225 Squadron Whirlwind was faced with the problem of recovering a casualty from a position just beyond the reach of the winch cable, and too late in the evening to allow for enlargement of the clearing. The casualty was carried on an extended strop at 20 knots to a place where the aircraft could land and recover him.(77) Such drama gave a powerful impetus to the trials to obtain official clearance for the multi-lift hoist system.

As it was obvious there would never be a winch for the Belvedere, some thought was given to an alternative method of inserting and recovering whole patrols in deep jungle. Insertion of troops involved the use of abseiling as for the Whirlwind, but the system proposed for recovering them consisted in essence of carrying ballast of greater weight than the load to be lifted, and disposing of it in appropriate quantities as a counter weight to the loads to be raised. The system envisaged using the webbing cages known as 1-ton containers employed for freight delivery by the MRT Force—one each at front and rear of the Belvedere cabin, with a length of webbing strop running through the fuselage carried by two pulleys—one each on the roping brackets outside the front and rear hatches, and adjusted for length so that with one 1-ton container lowered to the ground, the other was level with the hatch at the opposite end of the cabin. It was calculated that up to four soldiers could enter the container on the ground, the crewman could load the upper container with ballast (about 1000 lbs) and on releasing a brake, the upper and lower containers would change places. The process would be repeated until the ballast was exhausted and the aircraft would complete the procedure at a slightly lower all-up weight at the end of the operation than at the start. A working mock-up of the system was made and demonstrated in the Belvedere at Seletar at a height of 200 feet above ground using sandbags for ballast and pay load, but the end of the war in Borneo put a stop to this development which, in the subsequent peaceful atmosphere, tended merely to excite tolerant amusement. Nevertheless it attracted a monetary inventions prize from the Air Commander. It was named the Seletar Helicopter

Winchless Elevator (SHWEL). In the post-Borneo period, there was a slow development in which the cargo winch fitted in the Beverley was adapted and mounted on the floor of the Belvedere, operating through a pulley outside the main door. In September 1968, a trial with a 400 lb load was successful,(78) but the system was never used operationally.

The SHWEL could have been developed for the Whirlwind or any other helicopter (although attention would have had to be paid to adequate spacing between the ascending and descending loads). It was not. For the following sixteen years, that is, until the last SAR Whirlwinds in the UK were exchanged for the Wessex with 300 feet of winch cable, the FEAF emergency long-lift hoist, known in the UK as the 'multi-lift hoist', was available for mountain and cliff rescue where the SAR Whirlwind could not get within 50 feet of the rescue. All subsequent helicopters fitted with winches were supplied with an adequate length of winch cable.

Ground Radar Carriage

There were two ground radar equipments which had to be deployed in jungle areas—UPS1 for air space control and Green Archer for locating the origin of enemy mortar fire. The UPS1 cabin weighing about 4000 lbs was well within the Belvedere's lifting capability and with some splitting down of components could even be carried by the RN Wessex Mk 3 (ceiling 3500 feet—maximum range 50 miles—9 sorties) (79), but being a brick shaped box 13 feet×6 feet×4 feet it was difficult to control in forward flight since it spun and consequently developed a swing. After various unsuccessful attempts to add stabilising tail surfaces or drogues, the solution consisted of adding four false sides to the box to form a regular hexagon which could then spin without swinging at speeds up to 90 knots. Thus the Belvedere was able to deploy it from Labuan to Bario.(80)

Green Archer required more frequent deployment over shorter ranges since it was part of a tactical weapon system. In the second phase of Borneo operations the company bases near the border, already described as resembling jungle fort, were tempting targets for Indonesian mortars from across the border, particularly at night when the launching point might be expected to be safe from identification. Green Archer could detect the launch and calculate its origin so fast that it was frequently possible to fire a return round with great accuracy immediately after or sometimes even before the incoming shell landed. The radar vehicle was moved with its crew and equipment, normally by two Belvederes, from site to site with gratifying success in discouraging enemy mortar fire.(81) The task of placing the Green Archer was one of considerable delicacy, and the 'split control' technique with two pilots was used, as developed three years earlier for the placing of the spire on Coventry Cathedral (82) (See Chapter 10).

Helicopter Refuelling

With refuelling bowsers only available at main airfields, helicopter refuelling remained a significant problem. Since the days of Phase 1 when petrol had to be poured through filters out of four-gallon tins, the appearance of the turbine helicopter at Phase 2 resulted in the change to 44-gallon drums of Avtur and a sharp increase in the work involved in transferring the larger volumes of fuel consumed. The Belvedere represented a much larger jump in the size of fuel transfer required, not only because of its larger engines and the fact that there were two of them, but also because refuelling stops were reduced to a minimum owing to the unreliability of the engine starter systems. For several years this problem had resulted in the provision of a series of more or less unsatisfactory portable petrol-driven pumps which, in the nature of things, were either unserviceable and absorbing the time and effort of the aircraft technicians attempting to repair them, or somewhere else when wanted. Although theoretically portable, they were all too heavy to be carried everywhere in each helicopter and the time-consuming and exhausting alternative of carrying and using a manually operated 'wobble pump' was often the only solution for individually operating helicopters in forward areas. It would take about 20 minutes of energetic wobble pump work to transfer fuel for one hour for a Whirlwind and up to an hour to supply a Belvedere for an hour and a half.

The solution proposed was to transfer the fuel from the 44-gallon drums by pressuring them with air from the engine compressor, and to modify the Belvedere fuel intake to permit engine running refuelling. The war in Borneo stopped in 1966 before either modification was complete, and when the pressurised drum was first used on an exercise in Malaya in July 1968 (83) the emphasis was on modifying vehicles, eg the Landrover, to provide a servicing platform with a 24-volt electrical system for Whirlwind starting. Two years previously it would not have occurred to anyone in the Helicopter Wing to propose for tactical helicopter use anything dependent on the presence of a surface vehicle. Exercise areas on the other hand, even if not actually accessible to surface vehicles, were and perhaps always will be served from bases which are, and after operations in Borneo ceased only exercises were carried out.

Helicopter Night Flying

Perhaps the most significant radical development of helicopter techniques during the Borneo campaign was, ironically, one which had only limited application at the time, but its subsequent treatment provides an insight into the contrasting attitudes in a distant operational environment as against the more formal committee procedures of the very numerous formations feeling a need to be heard in the United Kingdom. There was no tactical night flying requirement in Borneo apart from

emergency casualty evacuation and, very occasionally, recovery to base after dusk or early positioning for dawn operations—the latter extremely rare because of the morning mists in jungle areas. Even for these infrequent tasks, and because it was a standard role for Support Helicopters and therefore had to be practised monthly, regular night flying training was instituted. The night flying lighting pattern had not changed since the first cautious steps taken by the new CFS Helicopter Unit in 1954 resulted in a 'T' shaped pattern which it was hoped would give pilots an indication of approach direction with lateral level as well as descent paths by observing the relative apparent length of each element of the 'T'. It did not. Nevertheless, in 1965 this pattern had already been standard for some time and was known as the NATO 'T'.

Monthly continuation training was normally carried out in Singapore rather than Borneo but night flying in such a brilliantly illuminated area was of little value. The Helicopter Wing instituted night flying training on unmanned Auster strips in South Johore, acquiring its own MAOT to provide control and tactical lighting, in conditions which were more often nearly completely dark than those normally obtainable in the United Kingdom. In these circumstances it was discovered that if the standard NATO 'T' formed the only lights of any sort visible to the pilot, with no apparent horizon and cloud obscuring the stars, a successful approach was often impossible and inherently dangerous in a confined space. This was confirmed by the visiting categorization examiner from the Transport Command Examining Unit who encountered these conditions during his six-monthly visit in March 1965.(84)

The Helicopter Wing set about designing a lighting pattern which would give the pilot the approach information he needed, that is, position vertically and horizontally in relation to the desired descent path, together with a positive indication of the safe limits of error in both respects. In accordance with the discipline of actual war conditions, a further stipulation accepted was that whatever lighting pattern was chosen, it had to be possible to construct it out of materials which it was reasonable to expect jungle patrols to carry. (This virtually eliminated sophisticated glide path/angle of approach indicators in boxes together with delicate optical systems which were, in any case, of very limited value when used singly). The pattern was to indicate also a point in space where the helicopter could hover with an external load just clear of the ground and it was to use the minimum number of lights consistent with safety. Such a pattern meeting all these criteria was found surprisingly quickly and, over the course of about three months (about 12 night flying sessions) with opinions on each development being expressed by the pilots of all three FEAF squadrons, it was finally reduced to a mere five lights, and these consisted of hand held torches. All the pilots expressed satisfaction with this new lighting pattern for use at night in confined spaces, and many of the newer pilots, having previously been privately baffled by the only other pattern they had ever seen—the enigmatic 'T'—were extremely enthusiastic.(85)



Nanga Gaat from ground level in its usual state of brisk activity.



The first operational use of the SHNAP was made at this site in a rubber estate in central Malaya when several re-supply sorties were carried out in total darkness by a Whirlwind of 103 Squadron as part of an Army/RAF exercise. The three poles for the red lights (see Appendix 4) have been enhanced on the photographic print.

It remained to write a simple set of instructions which any of the various nationalities of soldiers in Borneo could follow so that they could construct the pattern wherever they were. British, Malay and Gurkha troops were shown to be perfectly capable of setting up the patterns, it was demonstrated to and accepted by the Forward Air Commander in Kuching, was backed by both CFS and the Transport Commanding Examining Staff (TCES), was approved by Headquarters No 224 Group, and used by night in a comparatively small clearing during a 28 Brigade exercise near Malacca (Exercise Kangaroo Tail) in July 1965—some five months after development work started.(86) A permanent version was erected at the Kuching Hospital. Inter-Service agreement was then sought and in June 1966, at a tri-Service Conference in Headquarters FEAF, the Seletar Helicopter Night Approach Pattern (SHNAP) was agreed as the standard pattern in the Far East, the Royal Navy stipulating only that it was not applicable for use on board RN ships. Instructions for laying and using the pattern were then issued in a pamphlet bearing the crest of Headquarters, Far East Command, and was thus applicable to all three Services.(87) A copy of its contents, which include both a description of the pattern and the manner of its use, is included at Appendix 4. The SHNAP attracted the second L G Groves Memorial Prize for contribution to flight safety in 1966.

By October of that year, 116 pilots in the Far East (not including Army Air Corps and Royal Naval helicopter pilots) had been fully trained and categorised with the system and about 600 incident free hours had been flown. This represented some 4000 night approaches of which approximately 1500 were carried out in forward locations under tactical conditions and control.(88) The SHNAP continued in use in the Far East until July 1967 when, to the dismay of the Helicopter Wing, it was replaced on orders from MOD by the ill-fated diamond pattern generated by the Army Air Corps and described below.

In 1966 the Commander-in-Chief Far East forwarded to Whitehall and the Joint Warfare Establishment the results of all this development work and recorded the tri-Service agreement successfully achieved in the Operational Unit in the Far East. In the UK, apart from No 38 Group, CFS and the TCES, the SHNAP was ignored at first and then suppressed. The consequent arguments which took place and which lasted nine years involved Headquarters No 38 Group, Headquarters Air Support Command, Headquarters Strike Command, the Joint Warfare Establishment, the Joint Helicopter Tactical Development Unit (JHTDU) and the Joint Helicopter Tactical Development Committee (JHTDC); subsidiary roles were played by TCES and CFS. If considered relevant, a description of them would belong in Phase 4 under the title of 'Policy Considerations in the 1970s' in a continuation of this history. The file (89) constitutes a well documented example of the contrast already mentioned between development motivated by real operational conditions, and the complex motives of peacetime committee work. In summary, the SHNAP, although never criticised adversely in operational use, was suppressed in the UK

in favour of a rival (Army) system which was belatedly recognised by MOD (Air) as unacceptable to the Royal Air Force and was eventually forbidden by No 38 Group as positively dangerous, but not until 1972.(90) The SHNAP was officially revived in 1973, endorsed at the final of several tri-Service practical night flying tests, officially accepted in 1974 by the JHTDC (now under the title 'Proportional Lighting System') and finally strangled in paperwork when the instructions for laying the pattern, prepared in the JHTDU, were judged to be too complex for practical use. Its origins and use by Malay, Gurkha and British troops in Borneo had evidently been completely forgotten and at the time of writing (1982) all that remains is the original NATO 'T' from the early 1950s, which proved unsatisfactory in real operational service and remains so. Even when embellished with an expensive optical AAI, as is the current practice, for reasons fully explained by Headquarters Strike Command in November 1972 regarding the use of a single AAI (91) it remains unsatisfactory for use in confined spaces in total darkness and for stream landing several helicopters; thus the progress made in Borneo was effectively lost. With the Borneo war 15 years in the past, innovation was concentrated on the sophisticated developments of night vision goggles, although ground lighting patterns were still regarded as necessary for landing. The SHNAP, with its three poles, five hand torches and ten yard length of string, did not fit this high technology image.*

A third pattern, which also used a three-dimensional display to replace the standard 'T', had been produced in Germany by a pilot of No 230 Squadron in 1964, and was known as the 'Forest T' after its inventor. It attracted the L G Groves Memorial Prize for contribution to flight safety in 1965, but was not suitable for use in FEAF, mainly because of the weight of equipment involved and the limited range (500 yards) at which it could be interpreted. It served to show, however, that dissatisfaction with the NATO "T" was not confined to the Far East and also that

*Quite unknown to those responsible for developing the SHNAP, a paper entitled 'Helicopter Night Flying—Triangular Ground Lighting Pattern' dated 26 May 1954, had been prepared at A&AEE, Boscombe Down, and was not noticed until early in the 1970s. It reports trials with a pattern described as of American origin and consisting of three lights—two on the ground 25 feet apart and one at a height of five feet a short distance in front of them.(92) Except for minor dimensional differences, this pattern is almost identical to that described in the SHNAP pamphlet, Chapter 1 para 13 under the heading 'Emergency SHNAP' (see Annex 4). Although unsuitable for most jungle terrain, this version was included because it could be laid by a solitary person in comparatively open spaces and was an obviously valuable derivation for emergency use from the more comprehensive full SHNAP which required five lights, three of them at a height of 5 feet six inches. This independent double invention of the same principle for a helicopter approach lighting pattern was not known by the participants when the arguments and trials were conducted between 1965 and 1974.

a three-dimensional pattern of lights was seen by a third independent developer as an attractive solution to the problem.

It is likely that the Forest T formed the basis or at least the 'trigger' for the development of the Army Air Corps three-dimensional lighting pattern known as the 'Diamond' which emanated from Germany shortly afterwards, and appeared in opposition to the SHNAP in the arguments already mentioned which started in the UK in 1967.

Withdrawal from East Malaysia

Following the Peace Treaty in August 1966, British withdrawal from Borneo (but not Brunei) started immediately, and helicopter activity consequently increased sharply for a few weeks. No 230 Squadron, in mid-1966 based in Labuan with detachments at Sepulot and Tawau, exchanged them for Bario and joined with No 110 Squadron in the last operations to sweep up the Indonesians involved in the incursion launched in the Long Semado area of the fifth division of Sarawak in the latter part of August. In the following month, No 230 Squadron was withdrawn and returned to the UK and No 38 Group to whom they belonged, six Belfast sorties being used to accomplish the move. Since their arrival in Labuan in March 1965 with 13 Whirlwinds they had lost one, flown 8550 hours and carried 39779 troops, 414 casualties and 3.3M pounds of freight.(94)

The No 103 Squadron detachment withdrew from Kuching to Seletar in October 1966. The two remaining FEAF helicopter squadrons (Nos 66 and 110) continued assisting the withdrawal of British troops and their replacement (on a much reduced scale) by Malaysian forces, and were then left with a maintenance support role for the Malaysians who initially lacked sufficient helicopter forces for the task. This continued support, reduced to six Whirlwinds at Labuan and four Belvederes at Kuching, and including some MRT assistance and personnel to run the airfields at Kuching, Labuan and Tawau, was authorised to continue until March 1968 without any charge being raised for their services.(95) The six Whirlwinds withdrew from Labuan to join the four Belvederes at Kuching in February 1967, and on the 20th of the same month the Belvederes, after flying a farewell formation of all four aircraft, were shipped back to Singapore. Since January 1963 between three and seven Belvederes had flown in Borneo 4555 hours, carried 10M pounds of freight and 95000 troops.(96)

The No 110 Squadron Whirlwind tasking at Kuching was not heavy and, shared with No 103 Squadron (aircrew only) on a monthly rotation, continued to decline until in September 1967 the detachment reported that it was reduced to an ambulance and flying doctor service for the first division of Sarawak.(97) The last RAF unit in Borneo, No 110 Squadron, left Kuching on 6 November 1967, after a

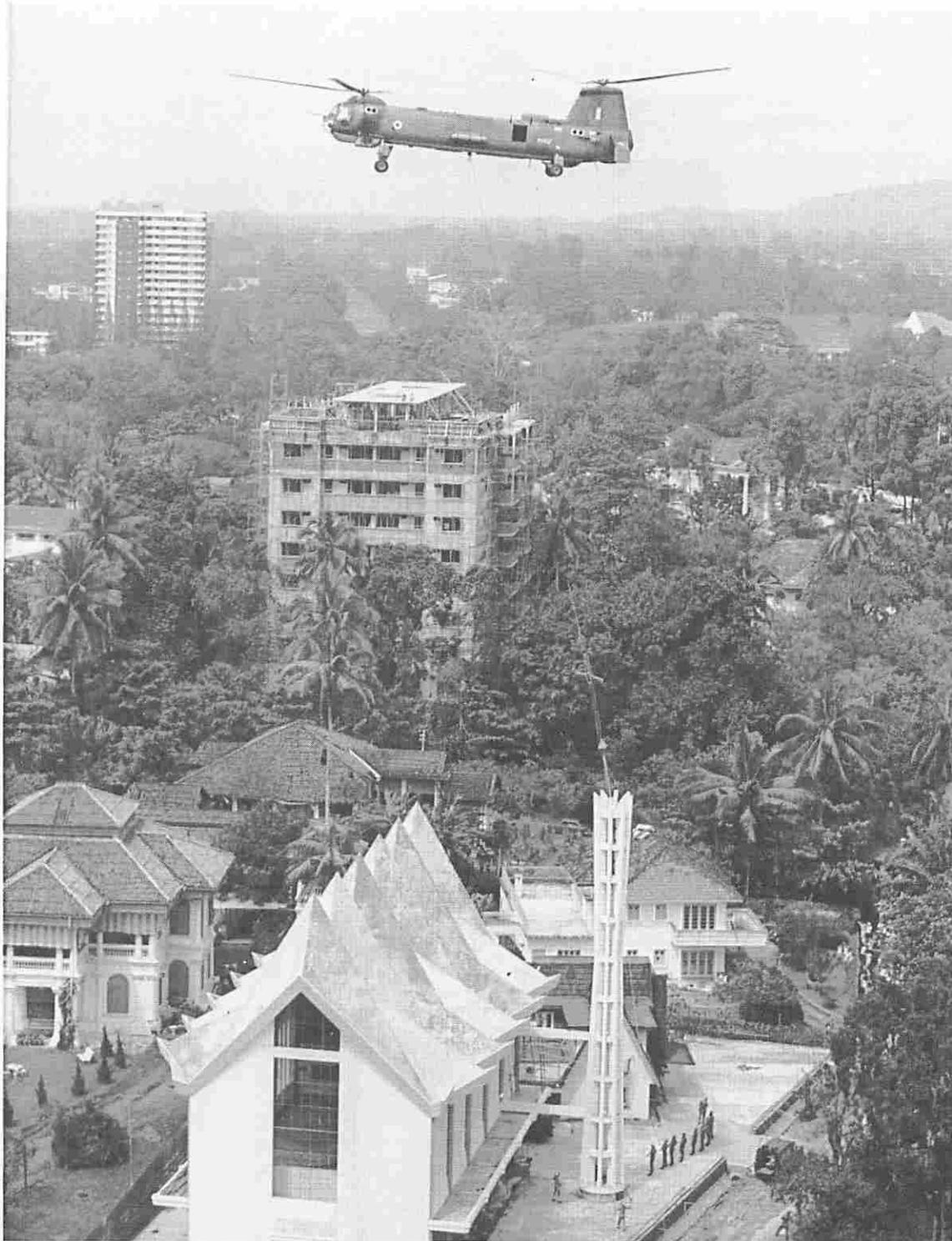
series of farewell parties culminating in a reception given by the Malaysian Infantry Brigade then in residence, and with the whole Station waving goodbye (how different from Aden!) flew via Sibu and Labuan to Kota Belud for a joint contingency exercise with No 99 Gurkha Infantry Brigade near Mount Kinabalu which lasted until 19 November.(98) This instant replacement of Borneo operational tasks with FEAF-sponsored exercises was characteristic of what was already happening with the rest of the helicopter force, now all back in Singapore. A further sign of the new patterns was a reconnaissance of Hong Kong for future detachments carried out in the same month by No 110 Squadron. Happily, all tasks were completed in time for the whole of No 110 Squadron to join together in Seletar on 29 November (the first time since 1962) to celebrate the Squadron's 50th anniversary. No 103 Squadron had celebrated a similar event two months previously. This did not prevent the Squadron Commander commenting adversely on the low serviceability state caused by persistent low frequency vibration—adding sardonically that the Belvedere was not the only one to suffer this way.(99)

After Borneo

1967 and 1968 were peaceful years in FEAF. All of the helicopter force was back in Singapore by the end of 1967. The Sycamores were at last retired from service in FEAF in May 1967, there now being ample alternative VIP lift available. Much greater helicopter participation in No 28 (Commonwealth) Brigade exercises in West Malaysia (Malaya) was now possible and was used fully. The helicopter squadrons busied themselves with developing their capability for mobility in deployment—a feature scarcely required in the static bases used in Borneo—and doing the various interesting, useful and amusing things which seem to arise when helicopters are about with no pressing operational tasks to burden them.

In December 1966, the Officer Commanding the Helicopter Wing, who had placed the spire on Coventry Cathedral in 1962 (see Chapter 10), was able to repeat the trick using the identical technique, with a 30 foot high cross which the building contractor was reluctant to install in the top of the tower of a new Hakka Methodist church in Newton Road, Singapore. The successful event was recorded on a brass plate in the base of the tower.

In a reversal of situations, the Belvedere Squadron now regarded the detachment remaining in Borneo since Confrontation ended as providing an excellent opportunity for theatre operational training for the crews which were now all being trained on the Squadron, and were accordingly being rotated every two weeks.(100) In December 1966, Belvedere first line servicing at Kuching was being done under cover for the first time but there was little time to enjoy it since, as already reported, the last four aircraft were withdrawn in February 1967. Three of them were shipped on the LST Maxwell Brander and delivered direct to Butterworth—



A Belvedere of 66 Squadron positioning the cross on the steeple of the Hakka Methodist Church in Evelyn Road Singapore in December 1966. The technique was the same as that for placing the sculpture in the flèche in the Coventry Cathedral operation. The ground handling party can be seen at the base of the steeple.

345-A



66 Squadron near the end of its life in early 1969, flying all eleven Belvederes in formations round Singapore.



66 Squadron air and ground crews on the day of disbandment in March 1969 with the eight aircraft used for the final ceremonial demonstration at Seletar.

the Belvedere's first operational base when they arrived in FEAF in 1962. Operation 'Hill Climb'—the carriage of a large amount of radar equipment to the top of Penang Hill—had started in April 1966 with 53 Belvedere loads. In March 1967 the task was to be continued with 65000 lbs of equipment (32 sorties). Two months later, 33 steel beams weighing up to 3500 lbs each had to be taken to the same site which, being very small, was now heavily obstructed by the various radar aerals and equipment previously delivered. The 80 foot strop had to be used to keep the aircraft clear of obstructions and the resultant hover height placed the aircraft some 3000 feet above the nearest ground visible to the pilot. Once again the split control technique used on the Coventry Cathedral operation and several times subsequently, had to be employed in order to achieve the accuracy required. Operation Hill Climb continued monthly through 1967 until September, and included a successful calibration service provided by a Belvedere hovering at 7000 feet, positioned by radio instructions from a theodolite operator on the ground. This procedure produced unexpected problems in turbulent conditions when sudden height losses of up to 800 feet were experienced. The Butterworth Belvedere detachment was withdrawn to Seletar in October, bringing No 66 Squadron together for the first time since 1962. They flew a nine Belvedere formation round Singapore to celebrate and two days later demonstrated their pride and confidence by flying eleven of the twelve aircraft then on strength in the largest Belvedere formation ever assembled.(101)

No 103 Squadron, having left Borneo in October 1966, almost immediately after troop withdrawals were complete, inherited the SAR standby tasks at both Seletar and Butterworth, as well as the first tentative exercises for the RAF in January 1967, providing tactical support for the security forces in the Hong Kong border areas. These were to lead to a detachment of six Whirlwinds, shipped to Hong Kong on the aircraft carrier HMS Triumph in September 1967. This detachment, initially for three months, became permanent in the sense that it never withdrew, but after being shared on a rotational basis with No 110 Squadron through the remainder of 1967, grew into a new helicopter squadron, No 28 Squadron, on 1 March 1968, adopting the number plate of the departing Hunters.(103) This Squadron was destined to outlast all the others and eventually, in 1975, to be the sole remaining RAF helicopter squadron in the Far East, providing the link with Phase 4 of this history in much the same way that the solitary Sycamore squadron at Butterworth (No 110) had formed, in 1962, the connection between the Malayan operations of Phase 2 and the Borneo campaign in Phase 3.

HQ No 224 Group was reduced to a mobile role in February 1967, having operational control of tactical squadrons and units only when assigned by FEAF for specific operations and exercises. It had no administrative function.(103) In October 1968 it was fully absorbed into FEAF HQ as a Joint Warfare Branch.(104)

Throughout 1967 and 1968, numerous exercises with No 28 (Commonwealth) Brigade were flown in which Whirlwinds and Belvederes complemented each other in the same way as had been found so effective in the pre-overseas development days at Odiham in 1960-62 (see Chapter 10). Conditions described on occasion as 'extremely rugged' posed no problem for the Belvederes which were, nevertheless, continually plagued by starter failure, including explosions. The Belvedere modification to permit engine running refuelling (involving the fuel tank drainage points) was still proceeding at the stately post-Borneo rate when it had to be pre-empted in emergency. In August 1967, a party of VIPs was to be flown ashore from the aircraft carrier Hermes which was found to be 40 miles off station. The Belvedere had to be refuelled on the carrier deck with rotors turning and only the rear engine was stopped.(105)

In November 1968, a No 103 Squadron Whirlwind had to carry out an engine-off landing into jungle. The crew of two were rescued by another Whirlwind using the multi-lift tape method. The crewman spent an hour suspended from the aircraft amongst the trees under the jungle canopy, transferring the survivors from the tapes to the winch 50 feet above ground level—a feat for which he received the AFM.(106)

In addition to the Army-generated exercises the Helicopter Wing was, during this period, able to institute its own Squadron mobility exercises in which small groups of helicopters were detached to live independently for a few days at chosen locations in Malaya. Such exercises were both useful and popular, as were various opportunities to practise deck landings and to take part in small-scale Naval assault exercises with the Royal Navy ships which were in frequent transit. In October 1968, four Whirlwinds and crews were carried by the LSL Sir Galahad for an exercise with the Australians in North East Queensland.

The usual SAR sorties continued as a permanent backdrop to all these other activities, and represented perhaps the only role in which the climate was usually a help rather than a hindrance. Sometimes there was flood relief work, for example in North East Malaya in January 1977, and once, in September 1966, one Whirlwind was taken by Beverley to Laos where flood relief work was required near Vientiane. 71 helicopter hours were flown on this task.(107) Crews for SAR, although specially practised for the role, were exchanged regularly with the other squadron crews and there was no sharp division between the SAR and SH roles as existed in the United Kingdom. SS-11 firing was another speciality spread amongst the Whirlwind crews in this period.

The Reduction of FEAF

In most respects, 1967 and 1968 were golden years for the personnel of the FEAF helicopter force, who lived in the comparative luxury of the Singapore base, most

of them with their families. Flying tasks were always interesting, usually congenial, there was no enemy and the future seemed bright in the short term. No 66 Squadron, evidently expecting their Belvederes to be replaced by Chinooks, recorded in November 1967 that this was not now going to happen, and they looked forward to prolongation of the Belvederes beyond March 1969.(108) The 1966 Defence Review made it clear that a UK-based contingency force would replace expensive overseas garrisons, and subsequent White Papers forecast large reductions in the Far East. The policy for world-wide deployments on which the original arguments for the Belvedere were based (Chapter 9) were no longer valid. The idea of a light cargo force to support a short range transport force had long since vanished, but the need for a heavy lift helicopter had been amply demonstrated. However the decision to get rid of the Belvedere in favour of the Chinook had been taken as long ago as 1965 (see Chapter 13) and it was too late to reverse it when the Chinook was cancelled in late 1967.(109)

In August 1967 FEAF expected to lose Seletar by 1969. In October the Government Defence White Paper announced withdrawal from Arabia in 1968, and from the Far East by the mid-70s. It seemed to FEAF that the SEATO obligations and Malaysian Defence Agreements were to be 'honoured only by talk'.(110) By January 1968 the plan was for total withdrawal from Singapore, Malaysia and Brunei by December 1971. After a change of government in the UK, this plan was modified by the Five Power Agreement of 1971 (Australia, New Zealand, United Kingdom, Singapore, Malaysia) and some Whirlwinds were consequently to be retained for use in this ANZUK force which would be formed when FEAF disbanded.

Against this ominous background the last large scale joint tactical exercise scheduled to be mounted by Headquarters, Far East Command, was planned for March 1969 and titled 'Crowning Glory'. It was a notable success, particularly for the Belvederes, for which it turned out to be a singularly apt title. Having broken several records in the first two months of 1969 (ten Belvederes flew 331 hours in January) Belvedere XG 474, due for inspection, was 'retired' as the most travelled Belvedere to the RAF Museum. All nine remaining aircraft were deployed in Malaya at the end of February in readiness for Exercise Crowning Glory in March. Typically, four were delayed by engine starter troubles. 315 hours were flown in the first few weeks of March, and an eight Belvedere formation flew a farewell circuit of Singapore on the day before disbandment of the Squadron—there would have been nine but, consistent to the last, one engine starter exploded at the outset.(111)

On 20 March 1969, after a parade reviewed by the Air Commander and witnessed by most of the FEAF Air Staff, a final six aircraft formation, complete with underslung 105 mm guns and gun crews on board, flew a farewell demonstration placing the guns and their crews on the flying boat slipway at Seletar, where they fired a salute. XG 474, the Museum aircraft, made the last landing on the Seletar

slipway where Seletar's first aircraft came ashore in 1928.(112) The next morning, the remaining nine aircraft started to be broken up for sale as scrap, and No 66 Squadron disbanded for the fourth time since 1916.

From 1964, the year when the Spine Force build-up became effective, the Belvedere utilisation had increased annually. In the ensuing years the addition of the Aden No 26 Squadron and Odiham OCU Belvederes continued the trend. The following table shows the annual increment of hours flown, together with the average number of Belvederes available for use in FEAF from early 1964 to March 1969:

<u>Average No of Aircraft Available</u>	<u>Year</u>	<u>Hours Flown</u>	
8	1964	1547	
8	1965	2336	
12	1966	3243	
13	1967	3320	
12	1968	3536	
10	1969	903	(in 2½ months)

The instantaneous demise of the Belvedere with no replacement available seemed in Singapore to be arbitrary and damaging, such was the status the aircraft had achieved in the last four years. The FEAF Chief of Staff (Air Vice Marshal Le Cheminant) had proposed to VCAS that three of the last nine aircraft could profitably be maintained for some time yet.(113) Apart from valuable support for No 28 (Commonwealth) Brigade, there was the question of recovery of the radar station on Western Hill, Penang, most of which had been positioned there by Belvedere in the previous few years. It was suggested also that there were useful roles for the aircraft in theatres other than FEAF. As will be seen in the last chapter (Policy Considerations 1965-70), the fate of the Belvedere had been sealed as early as late 1965, largely as a result of its difficulties in AFME, and for the last three and a half years the Whitehall staffs had concerned themselves with the question of how quickly they could get rid of the aircraft by replacing it with the Chinook. Such was the anxiety to eliminate this technically troublesome helicopter that even some remedial modifications (such as a new engine starter system) had been denied, not merely because the Belvedere had a short projected life beyond 1966, but for fear of having its life thereby extended still further.(114) A decision in November 1967 which meant that the Chinook would not appear for several years, if at all, resulted in the Belvedere being retained until March 1969, but late suggestions from FEAF that even three of them should be kept in service beyond that date were swiftly and firmly squashed in London on personnel, technical and, especially, financial grounds. (See Chapter 14).

On 28 March 1969, Seletar closed as a flying station. With one exception the Whirlwinds of Nos 103 and 110 Squadrons had all been flown to their new base at Changi, and at 2015 hours the last Whirlwind took off from the Officers' Mess lawn for its delivery flight to join the others. The drama of the situation was enhanced by the extinction of all the airfield lights as soon as the aircraft left.(115) As a station however RAF Seletar did not close until March 1971.

The End of FEAF

The disbandment of No 66 Belvedere Squadron in March 1969, followed a few days later by the closure of Seletar as a flying station, effectively ended the Helicopter Wing in its original form, although it helped the two remaining Whirlwind squadrons to continue to function as a helicopter force in their new base at Changi. When the incumbent of the post of Officer Commanding Helicopter Wing became tour-expired in July 1970, he was not replaced. Seven months later, in February 1971, No 110 Squadron disbanded (for the fourth time in its life) leaving No 103 Squadron as the last helicopter squadron in Singapore.

Much attention has been focussed on the technical peculiarities of the Belvedere, but it must not be imagined that the generally reliable Whirlwind was without serious design and material faults which, had the aircraft not been far more numerous than the Belvedere, would have grounded the fleet completely from time to time. In the last two or three years of FEAF, it was decided that the rather high incidence of engine rundowns was due to water ingestion and that redesign of the nose doors was required. Meanwhile, flying in heavy rain was to be restricted—this in South East Asia and after ten years in service. Gearbox troubles, partly due to corrosion, caused much trouble (all but one of No 110 Squadron aircraft were grounded for this reason immediately after arrival at Changi),(116) but perhaps the most ironical circumstance of all, remembering the Sycamore rotor troubles suffered by No 110 Squadron at Butterworth in 1961 (see Chapter 3) which had been easily explained as due to using wooden blades in tropical climates, was a spate of Whirlwind metal tail rotor blade failures. Their replacement rate overloaded the supply sources to such an extent that a shortage reported in January 1970 had grown by March to a point where No 110 Squadron had only two aircraft left with tail rotors.(117) By April, No 103 Squadron reported that few crews had even managed to complete their monthly continuation training; both squadrons were detaching crews to the Hercules and Argosy squadrons for supernumerary flying duties and the Air Commander was going to work by car.(118) There was limited participation in a major No 28 (Commonwealth) Brigade exercise 'Bersatu Padu' in June 1970, but this resulted in there being no tail rotors at all. Significantly, priority was now accorded to No 28 Squadron in Hong Kong whose unit establishment was raised from six to ten with a task, in addition to reconnaissance and internal security duties, of being able to lift a complete platoon with weapons.(119) The situation was not back to normal until December.

Operations in this period consisted of the usual SAR tasks and participation in the No 28 (Commonwealth) Brigade exercises in Malaya; several multi-tape lift rescues were carried out and the SAR detachment at Butterworth which had been maintained almost continuously since the Sycamores first went there in August 1959 (Phase 2) was finally withdrawn in May 1970, the task now being handed over to the Royal Malaysian Air Force. These Whirlwinds of No 103 Squadron, which had supplied the detachment for the last five years, were the last RAF operational aircraft to be permanently based on Malayan soil.(120)

These last two years in FEAF, with the helicopter units continuing to do what they did before but without much conviction, correspond roughly to the continuation of No 103 Squadron in Cyprus after the end of the emergency there (Chapter 7), and the four years for No 78 Squadron in Sharjah after leaving Aden (Chapter 10). Everything except SAR operations was training, but exercises with the Army were called operations.

Eventually, in 1971, FEAF started to disintegrate visibly. No 103 Squadron, due to outlast FEAF, was fighting to maintain its mobility—the accepted operational word meaning independence as far as the Squadron was concerned—but by May 1971 there was no ‘mobility equipment’ left to issue. By August, with all around them preparing to depart but with No 103 Squadron still receiving replacement crews from the UK, they could not even obtain jungle green clothing to equip the newcomers.(121) Women and children were leaving and general disbandment of the huge FEAF structure was well advanced. The SAR Flight in Singapore was finally disbanded on 31 August. Since its inception in No 103 Squadron as a separate Flight on 1 February 1964 (previously part of No 110 Squadron), 511 emergency calls had been answered including aircraft incidents, land/sea casualty evacuations, and searches. The multi-tape rescue procedure had been used several times. Theoretically, the SAR role was now the responsibility of No 120 Squadron of the Singapore Air Force (SAF) equipped with Alouette helicopters, but doubts about the practicality of this arrangement may be deduced from the fact that two RAF SAR Whirlwinds were specifically recorded as retained on standby until 6 September to provide cover for the Lightning pilots of No 74 Squadron.(122) In fact, the continued inability of the SAF fully to carry out the SAR role was obvious and, although not officially admitted as a formal operational responsibility, No 103 Squadron continued to maintain crews in practice and, as far as possible, to provide a modified standby alert (there was no establishment provided) for the following three years. September 1971 for No 103 Squadron consisted of farewells and departures. On the 10th twelve Whirlwinds (nine in formation) flew from Changi to what was to be their last Far East location at Tengah and on the 15th a six-aircraft formation accompanied the official handing over of Tengah to the SAF. On the 18th a two-aircraft formation joined a Bristol Freighter for the last Battle of Britain celebration at Changi and a fly past was arranged for the Commander-in-Chief’s farewell parade at Sembawang on 29 October 1971.(123)

Far East Epilogue

Under the new Five Power Agreement, No 103 Squadron now became the air element of the RAF Support Unit which constituted the RAF element of the ANZUK force stationed at the SAF base, Tengah. The rest of the RAF Support Unit consisted of a small administrative staff headed by a Wing Commander, an Air Movements Section to handle the Air Support Command traffic (mainly VC10s in transit to Hong Kong and Brunei), and an Engineering Squadron into which, to the considerable annoyance of No 103 Squadron, its ground crew disappeared.(124) In July 1971, during the rundown of FEAF, the Squadron had recovered control of its first line servicing. Now it had lost it again. However, with FEAF disbanded, the RAF Support Unit became a unit in Air Support Command, and following an on-site establishment review by the Org 2 (Establishments) staff of that Headquarters in April 1972 (headed coincidentally by the ex-Commanding Officer of the Seletar Helicopter Wing) the Squadron reverted in July 1972 to full autonomy as a mobile squadron with its own first and second line servicing as well as five RAF Regiment personnel.(125) This was the occasion for the triumphant farewell homily delivered by the outgoing No 103 Squadron Commander in July 1972 quoted earlier.

Whatever may have been the political advantages of this lingering presence of United Kingdom forces in the Far East after the general withdrawal, the effect for the RAF Helicopter Force was almost absurd. It was immediately confined to Singapore airspace except for formally arranged ANZUK exercises for which full diplomatic clearance had to be obtained from Kuala Lumpur in advance, and was supposed to include full nominal rolls of all participants. Several exercises had to be cancelled at the last moment because diplomatic clearance from Kuala Lumpur had not been granted in time. Practical training in jungle areas became almost impossible although in the course of 1972 some limited progress was made in persuading Kuala Lumpur to allow the occasional navigation exercise for one or two aircraft, but on strictly limited routes. In August, the Squadron succeeded in arranging a two-week camp exercise at Jason's Bay in South East Malaya, with its own servicing, catering and RAF Regiment personnel, but this was wholly exceptional. Some relief from this claustrophobic and frustrating situation was provided by a regular crew exchange programme with No 28 Squadron in Hong Kong.(126)

In August 1972, the first Wessex started to arrive to replace the Whirlwinds, and Phase 4 for the Far East helicopters may be said to have started. In the same month, the last nine Whirlwind formation was flown and in October the Wessex takeover was completed, crews having been detached in turn to Odiham for conversion training in the previous few months. The Whirlwinds were removed in pairs by Belfasts to the UK.

The eight Wessex aircraft, initially plagued by much corrosion, gradually recovered and by August 1973 were able to achieve a 100 per cent formation demonstration. Restrictions on training in Malaya gradually relaxed but remained irksome and the continuing crew exchange with No 28 Squadron in Hong Kong (equipped with Wessex just before No 103 Squadron) was much valued. The few ANZUK exercises were enthusiastically enjoyed—the ability to carry ten troops (twelve over shorter ranges) was a fillip to morale and the first taste of auto-stabilisation was greatly enjoyed. Operational (ie exercise) hours exceeded training hours for the first time in mid-1973.(127)

No 103 Squadron worked on for the following two years in this strange twilight of reality. While aware all the time of the token nature of their effectiveness, morale was high and in spite of severely restricted flying areas the Squadron succeeded admirably in maintaining expertise in all their operational roles, including SAR. There was no surprise when, at the end of 1974, the Defence Review presaged the final withdrawal from the Far East; the only remaining question was whether the Squadron would be withdrawn to the UK or disbanded. The latter course was taken and in July and August 1975 the No 103 Squadron Wessex were transported in pairs by Belfast to the UK. The Squadron disbandment in August was celebrated by a reception in the Officers' and NCOs' Messes, and attended by the British High Commissioner to mark the end of the British military presence in Singapore. No 103 Squadron sent a farewell signal to Hong Kong ironically acknowledging that No 28 Squadron was now the best squadron in the Far East.(128)

References to Chapter 12

- 1 No 224 Group ORB.
- 2 Squadron Leader Munro.
- 3 No 66 Squadron ORB.
- 4 Ibid.
- 5 ID9/D4-35.
- 6 No 66 Squadron ORB.
- 7 Squadron Leader Munro.
- 8 Mr J Banks.
- 9 No 66 Squadron ORB.
- 10 Wing Commander Dowling.
- 11 No 110 Squadron ORB.
- 12 Wing Commander Dowling.
- 13 No 110 Squadron ORB.
- 14 Pocock 'Fighting General'.
- 15 Sir David Lee.
- 16 P D A Austin.
- 17 No 66 Squadron ORB.
- 18 No 110 Squadron ORB.
- 19 No 66 Squadron ORB.
- 20 No 224 Group ORB.
- 21 Ibid.
- 22 FEAF ORB.
- 23 Ibid.
- 24 P D A Austin.
- 25 No 224 Group/No 66 Squadron/No 225 Squadron ORBs.
- 26 FEAF ORB.
- 27 Pocock.
- 28 Sir David Lee.
- 29 Pocock.

- 30 No 66 Squadron ORB.
- 31 Wing Commander Dowling.
- 32 Ibid.
- 33 No 225 Squadron ORB.
- 34 FEAF ORB.
- 35 Ibid.
- 36 No 110 Squadron ORB.
- 37 No 234 Group ORB.
- 38 Ibid.
- 39 Ibid.
- 40 FEAF ORB.
- 41 No 103 Squadron ORB.
- 42 No 224 Group ORB.
- 43 Sir David Lee.
- 44 Pocock.
- 45 Ibid.
- 46 Wing Commander Dowling.
- 47 No 66 Squadron ORB.
- 48 No 230 Squadron ORB.
- 49 No 224 Group ORB.
- 50 No 66 Squadron ORB.
- 51 FEAF ORB.
- 52 No 230 Squadron ORB.
- 53 No 110 Squadron ORB.
- 54 Wing Commander Dowling.
- 55 FEAF ORB.
- 56 No 230 Squadron ORB.
- 57 Wing Commander Dowling.
- 58 Ibid.
- 59 No 66 Squadron ORB.
- 60 Nos 103, 110 & 66 Squadrons ORBs.

- 61 No 224 Group ORB.
- 62 No 110 Squadron ORB.
- 63 Wing Commander Dowling.
- 64 No 224 Group ORB.
- 65 No 110 Squadron ORB.
- 66 Ibid.
- 67 No 103 Squadron ORB.
- 68 Ibid.
- 69 Squadron ORBS.
- 70 FEAF ORB.
- 71 P D A Austin/Squadron Leader Munro.
- 72 P D A Austin.
- 73 No 66 Squadron ORB.
- 74 ID9/941/11.
- 75 No 225 Squadron ORB.
- 76 FEAF ORB.
- 77 No 225 Squadron ORB.
- 78 No 66 Squadron ORB.
- 79 No 224 Group ORB.
- 80 No 66 Squadron ORB.
- 81 P D A Austin.
- 82 No 66 Squadron ORB.
- 83 FEAF ORB.
- 84 Squadron Leader A S Clarke.
- 85 II/80/61/24.
- 86 No 103 Squadron ORB.
- 87 II/80/61/24.
- 88 Ibid.
- 89 Ibid.
- 90 Ibid.
- 91 Ibid.

- 92 Ibid.
- 93 Ibid.
- 94 No 230 Squadron ORB.
- 95 FEAF ORB.
- 96 No 66 Squadron ORB.
- 97 No 110 Squadron ORB.
- 98 Ibid.
- 99 Ibid.
- 100 No 66 Squadron ORB.
- 101 Ibid.
- 102 No 28 Squadron ORB.
- 103 No 224 Group ORB.
- 104 FEAF ORB.
- 105 No 66 Squadron ORB.
- 106 No 103 Squadron ORB.
- 107 Ibid.
- 108 No 66 Squadron ORB.
- 109 ID9/941/11.
- 110 FEAF ORB.
- 111 No 66 Squadron ORB.
- 112 Ibid.
- 113 ID9/941/11.
- 114 Ibid.
- 115 No 103 Squadron ORB.
- 116 No 110 Squadron ORB.
- 117 Ibid.
- 118 No 103 Squadron ORB.
- 119 FEAF ORB.
- 120 No 103 Squadron ORB.
- 121 Ibid.
- 122 Ibid.

- 123 Ibid.
- 124 Ibid.
- 125 Ibid.
- 126 Ibid.
- 127 Ibid.
- 128 Ibid.

CHAPTER 13

UNITS IN EUROPE IN PHASE 3—1962-1972

Introduction

The beginning of Phase 3 and overseas deployments described in Chapters 10, 11 and 12 traced the Belvedere and Whirlwind Units which went to Aden, Borneo and Guiana in the early and mid-1960s, and the Whirlwind Squadron (No 230) established in Germany in 1962 before it too, in 1965 and 1966, played its part in Borneo. Support Helicopters Units remaining in Europe consisted of two Wessex Squadrons—Nos 72 and 18, with No 230 (Whirlwind) Squadron sharing the Army exercise task in the UK and Germany before and after its one and a half year stint in Borneo.

All three squadrons shared in turn the United Nations Forces in Cyprus (UNFICYP) communications tasks from 1964, until No 84 (Whirlwind) Squadron was formed there at the beginning of 1972 (Phase 4) also incorporating the SAR task in Cyprus previously carried out by No 1563 (Whirlwind) Flight. No 1564 (Whirlwind) SAR Flight at El Adem, having received its Whirlwinds Mk 10 in 1965, was withdrawn at the end of 1966, and re-formed for a brief seven-month period in 1969 leading up to the closure of El Adem as a Royal Air Force base.

In the UK, the two SAR Whirlwind Squadrons, Nos 228 and 22 (the former being retitled No 202 Squadron in mid-1965) continued with Whirlwinds Mk 10 from late 1962 until the end of the 70s, that is, well into Phase 4.

The Central Flying School expanded its pilot and QHI training task in Phase 3, first with Dragonfly, Sycamore and Whirlwinds Mk 10, with the Skeeter added for Army Air Corps needs, and later with Sioux and Whirlwinds Mk 2/4. A comprehensive programme of standardisation visits to all Service helicopter units including liaison with some foreign air forces had been instituted by the CFS in the 1950s, and was expanded during the 1960s. Both Transport Command and Coastal Command instituted operational categorisation schemes with examining visits to all RAF helicopter units on a regular basis.

The Queen's Flight was mentioned briefly in Chapter 6. Its growth in both Phases 2 and 3 is described here in more detail.

The Metropolitan Communication Squadron (retitled No 32 Squadron early in 1969) acquired a helicopter flight at the beginning of 1960, equipped with Sycamores which were gradually replaced by Whirlwinds Mk 10 starting in 1970. The last Sycamore flight in the RAF did not occur until August 1972.

Support Helicopters in Europe in Phase 3

Following the brief lives in Europe of Nos 225 and 230 Whirlwind Squadrons, the former in the UK and the latter in Germany, before their departure to FEAF in 1962 and 1965 respectively, the Helicopter Transport Support role was sustained by No 72 Squadron in the UK and No 18 Squadron in Germany, both newly equipped with Wessex Mk 2 in the first half of 1964. While the dramatic events in AFME and FEAF were being played out in Aden, Borneo and Singapore, the SRT Helicopter Force in the UK and Germany proceeded with the continuing routine task of supporting Army exercises in the UK and Germany, with the unexpected bonus of a larger Wessex force than had been planned, due to the decision by FEAF not to replace its Whirlwinds with Wessex during the Borneo campaign (see Chapter 14). Rejoined by No 230 Whirlwind Squadron which returned from FEAF in October 1966, the UK/Germany SH Force remained substantially unchanged until the Pumas arrived in 1971, marking the start of Phase 4.

No 18 Squadron re-formed as a Wessex squadron at Odiham in February 1964, containing the Wessex Conversion Unit. Crewman training by CFS had started in 1962 but practically the whole output was still being absorbed by the overseas units which had hitherto managed with volunteers from amongst the technical personnel on the units. No 18 Squadron itself had initially to use volunteer technicians as crewmen. They were expected to do 40 hours flying each month in addition to their normal technical duties, and received two shillings per day (10p) in acknowledgement.(1)

The remaining assets of No 72 (Belvedere) Squadron formed the Belvedere Conversion Unit when the Squadron reformed as the second Wessex squadron in August 1964. The Wessex Conversion Unit was transferred from No 18 Squadron to No 72 Squadron at the end of the year in readiness for No 18 Squadron's move to Germany in January 1965, where it replaced No 230 (Whirlwind) Squadron which was going via Odiham to the Far East. At the same time No 18 Squadron inherited the UNFICYP task in Cyprus from No 230 Squadron. The No 72 Squadron build-up was accelerated so that in May 1965 it could be split to form No 78 Squadron in Aden (see Chapter 11) this being the last exodus from Odiham to east of Suez. No 230 Squadron was the only one to return, which it did in October 1966.

Prior to 1967 the SH Force was prepared for a continuing world-wide role and the exercise schedule reflected this. In addition to the more or less continuous Army exercise support tasks in the UK and Germany, deployments continued for exercises in the Middle East. In September 1965, No 72 Squadron (depleted after forming No 78 Squadron) flew its seven available aircraft with long range tanks to Bomba in North Africa via Lyons, Nice, Pisa, Naples, Malta, Idris, Benina and El Adem. Remembering the debacle for No 225 Squadron in Exercise Triplex West in 1963

(see Chapter 10) the force was accompanied by an Argosy with spares and technical support. All returned satisfactorily in October. A similar self-flown deployment of four aircraft to Malta occurred in June 1966, and in the following August two Wessex were carried to Cyprus in a Belfast—an event which was greeted with the enthusiastic comment that the Squadron was now able to deploy anywhere.(2)

Much effort was devoted in 1966 and onwards to the deployment of day and night large scale troop movements and logistic resupply, as well as the domestic and technical equipment to maintain the force in field conditions. In March 1967, Exercise Stardust involved technical and logistic support of a brigade and required ten Wessex of No 72 Squadron, eight Whirlwinds of No 230 Squadron (newly returned from FEAF) plus 16 Royal Navy Wessex of No 848 Squadron. A typical task was the lift of a battalion to a forward position by 20 Wessex. No 72 Squadron had assumed the UNFICYP task (four aircraft) from No 18 Squadron in December 1966 and was to hold it for about a year.

Both Nos 18 and 72 Squadrons built up steadily so that by February 1967, No 72 Squadron had 20 Wessex and at the end of that year No 18 Squadron had a similar strength. At this point the question was raised whether it was appropriate to have units of this size as individual squadrons. The decision was taken to raise the established level of command in the Wessex units and in early 1967 the Squadron Commander posts became established at Wing Commander level—thus creating a precedent followed thereafter in the SH world (but not by the SAR Squadrons). No 230 Whirlwind Squadron, established for ten Whirlwinds rising to 13 by mid-1968, was to remain under the command of a Squadron Leader until re-established with 13 Pumas in 1971. In both Germany and the UK in the late 1960s the transport helicopter lift available was thus of unprecedented size and generated much enthusiasm for that reason, although its quality in terms of realistic capability and reliability had hardly improved at all. Apart from basic DECCA position finding navigation equipment, there was none of the tactical navigation facilities which came in the following decade, and no specialised night flying equipment. More serious was the problem of icing. In conditions of high humidity, the original nose door configuration of the Wessex tended to encourage ice formation in the engine air intakes with consequent high risk of damage to the engines. As a result, a minimum air temperature operational limit of plus 5° centigrade had to be imposed—as had been for the Belvederes (see Chapter 8) albeit for different reasons.

For all practical purposes therefore the Wessex force, although comparatively large, had no comprehensive IFR and very little night flying capability, while for a considerable time was subject to grounding when temperatures of less than plus 5° centigrade were experienced. Operations by night or at first and last light in Europe were unlikely to be completed since daylight operations required a visibility of half a mile with a minimum cloud base of 100 feet, rising to three miles and

700 feet by night, and great caution had to be exercised with regard to humidity and air temperatures.(3) All this added up to a potentially impressive but thoroughly unreliable service, and it will be seen that Army exercises which had to be planned in such a way that they could continue in some form in the event of last minute cancellation by the helicopter force, were unlikely to be more realistic than those of the early 1960s during the transition from Phase 2 to Phase 3 (See Chapter 10) when the capabilities of the helicopters themselves were so unsatisfactory. The fact that all real operations involving the Support Helicopters during the previous 15 years had taken place in tropical or near tropical conditions and with little or no night flying requirement, must have been a significant factor leading to the inadequately equipped force of the late 1960s.

Nevertheless considerable progress was made in building upon the framework of ground/air co-operation in field operations started in 1960 with No 225 Squadron (ex JEHU) and the Belvedere squadrons before their departure overseas. The practical problems involved in field deployment and operations on a realistic scale were becoming better understood and the deployed facilities required by the Support Helicopters themselves were being demonstrated, especially in the larger scale exercises now possible. Even if at first it required especially favourable weather conditions, the techniques for mounting light assault operations by helicopter were being developed in 1966, and Standard Operating Procedures for the force designed and brought up to date. The effort in this period to achieve realism as far as possible in field exercises, coupled with the emphasis on the limitations imposed by lack of night and all-weather capability, undoubtedly enhanced the drive to remedy these defects for the SH force which was to exist at the beginning of Phase 4 when the crews from overseas had returned and the Puma was entering service. Nevertheless, it was an uphill struggle to convince all, including the budget controllers, of the essential nature of the expensive equipment needed to provide a night and all-weather capability for the SH force, and its relative impotence without it. Progress was very slow.

No 18 Squadron

Following the Defence Review of 1967 and the announcement of withdrawal from east of Suez responsibility and sharp budget cuts (see Chapter 12), a flying unit had to be withdrawn from Germany to the UK. It was hardly surprising that the choice fell on the helicopter squadron—not then regarded as a vital front-line unit. No 18 Squadron was withdrawn and redeployed to Acklington in January 1968 from where it was to help No 72 Squadron by dealing with Army exercises mainly in the northern part of the country. In the following month, however, the Squadron had to provide three aircraft and crews on permanent standby against the possibility of a German border incident, a contingency requiring helicopter assistance for which No 18 Squadron had long been prepared, but now had to mount from

Acklington. By May 1968, No 18 Squadron had six aircraft in Germany for Army training and two were permanently retained there for border incident standby. Eight were there for Army training exercises in September and October, twelve for a NATO exercise in February 1969 plus two for internal security duties in Berlin for the presidential election, and by May the continual detachments to Gutersloh were replaced by an officially permanent presence. The Squadron Headquarters moved from Acklington to Odiham in July 1969 and the Germany detachment continued on a permanent basis until in August 1970 No 18 Squadron returned officially to Germany with twelve aircraft at Gutersloh and four at Wildenrath.(4) The withdrawal of the Squadron from Germany in 1967 and its piecemeal return over the following two and a half years shows that the Support Helicopter force in that theatre had, unnoticed by some, already become indispensable.

During its last six months at Odiham, No 18 Squadron relieved No 72 Squadron of the helicopter support task in Northern Ireland and detached six aircraft there in addition to its deployments in Germany. This was the beginning of the commitment with the security forces in Northern Ireland which was to escalate and continue well into Phase 4. The task again devolved upon No 72 Squadron when No 18 Squadron went back to Germany in 1970.

No 230 Squadron

Returning from FEAF in October 1966, No 230 Squadron spent January 1967 retraining, updating categories and requalifying in engine-off landing practice, becoming available for No 38 Group exercise tasking in February. It must have seemed to the Squadron that little had changed since its departure to FEAF in early 1965. The Operational Record Book describes 'typical 38 Group tasking' with 3-5 day detachments on exercise. Even the field refuelling facilities were unchanged and complaints about the portable refuelling pumps continued as before (see Chapter 10). In June, for example, four Kelston pumps were taken on an exercise deployment and after two days' operations only one was still serviceable. Neither technical nor domestic ancillary equipment requirements of the SH force were high on the list of financial priorities.

No 230 Squadron was not large, having only ten aircraft which were expanded to thirteen early in 1968 to allow four to be detached to Cyprus to take over the UNFICYP task from No 72 Squadron. The Whirlwinds self-deployed with long range tanks via Lyons, Nice, Pisa, Rome, Brindisi, Andravida, Athens and Rhodes, returning the same way (Kerkira instead of Andravida on return) and handing the task back to No 72 Squadron in February 1969.

Back at Odiham in 1967 No 230 Squadron, like No 72 Squadron, experienced a similar reorganisation to that occurring in FEAF—centralisation of servicing and

loss of Squadron ground crew (see Chapter 12). It was similarly short lived. In March 1969 No 230 Squadron was moved to Wittering where the No 38 Group Harriers were building up. The Squadron navigators, having been absorbed into Operations Plans at Odiham together with the first line ground crew, were returned to the Squadron. This reorganisation—really a return to a Squadron formation—was specifically mentioned in the ORB for April as ‘working well’—especially the first line servicing’. The squadron now had ten aircraft, 24 officers and 64 first line airmen.(5)

In February 1970 No 230 Squadron again took over the UNFICYP task, and continued with it until the end of 1971 when No 84 Squadron was formed in Cyprus at the beginning of Phase 4. With only six Whirlwinds left at Wittering, No 230 Squadron spent 1971 tasked by No 38 Group, giving hovering experience to the new Harrier pilots and preparing to become a Puma squadron at Odiham.

A Puma conversion unit was set up at Odiham in late 1970 (described loosely in the ORB as a Puma OCU) and in the last quarter of 1971 there appeared at Odiham what was called ‘No 230 Squadron—Puma Echelon’ consisting of four pilots, three crewmen, a Ground Liaison Officer and four ground crew. The Whirlwinds left Wittering in December 1971 and No 230 (Puma) Squadron was established at Odiham on 1 January 1972. Simultaneously, the Wessex Helicopter Operational Conversion Flight amalgamated with the Puma Conversion Unit to form No 240 Operational Conversion Unit.

No 72 Squadron

In the second part of Phase 3 and well into Phase 4, No 72 Squadron could be described as ‘Odiham’s own’. As a Belvedere squadron it had given birth to No 26 Squadron which went to Aden. As a Wessex squadron it split to form No 78 Squadron which replaced No 26 Squadron in Aden in 1965, but it remained based at Odiham for some 20 years receiving the freedom of Basingstoke in July 1968. In the second half of the 60s it was the mainstay of the No 38 Group exercise, demonstration, technique and equipment development work and military and civilian casualty evacuations (there were very few civilian helicopters at the time). It controlled the helicopter Operational Conversion Flight and there was a small continuous Internal Security Intelligence task as well. In 1965 engine-off landings were being practised on a three-monthly basis but the records do not show when this exercise was discontinued.

Some of the larger exercises involving No 72 Squadron in the 60s have already been described. There were certain other events which have some significance. In July 1967 No 72 Squadron records the imposition of centralised servicing (see No 230 Squadron above and Chapter 12) as being ‘against the wishes of the

Squadron Commanders'. (No 18 Squadron was spared because of its move from Germany to Acklington rather than Odiham). First line servicing was returned to No 72 Squadron in July 1969, coincidentally with the deployment of four aircraft to Ballykelly, at the start of the Northern Ireland disturbances which were to continue for several years. In August this detachment was increased to six and moved to Aldergrove where all subsequent deployments were to be based. No 18 Squadron took over this task briefly in early 1970 while No 72 Squadron sent ten aircraft to the Far East for Exercise Bersatu Padu (see Chapter 12), the first and last of what was vainly hoped would be regular large-scale exercises in the Far East mounted from the United Kingdom. On return, No 72 Squadron resumed responsibility for operations in Northern Ireland which were increasing in intensity. In October 1970 the new Phase 4 exercise deployment pattern was initiated with Exercise Deep Express involving four Wessex in support of the Allied Command Europe Mobile Force (Land) in Turkish Thrace.

The flexibility of the SH force was dramatically demonstrated in December 1967 when the crash of the Queen's Flight Whirlwind (see below) was followed by the grounding of all Whirlwinds, which included the entire SAR force. The order for No 72 Squadron to take over the role was received at 1100 hours on 13 December and by 1945 hours on the same day Wessex SAR standby was provided at Chivenor, Valley, Acklington, Leconfield, Leuchars and Coltishall with a further two aircraft on standby at Odiham. By the end of the following day the Nos 22 and 202 SAR Squadrons' crewmen were qualified on the Wessex. The SAR role for No 72 Squadron ended on 5 January 1968.

In September 1968 No 72 Squadron Wessex appeared in support of Harriers at the SBAC Show. A typical month's work at this period consisted of a series of four aircraft detachments and a total of about 500 flying hours; in November 1968, for example, 303 operational hours and 197 training hours were flown, although in the previous month the figures were 453 and 243 respectively. The establishment was for 20 aircraft and 30 pilots. The Northern Ireland commitment of six to eight aircraft detached was routine by 1970 and the pattern for Phase 4 was established.

The Queen's Flight

For the Queen's Flight, Phase 3 was late in starting. The explanation requires reference to events in Phase 2, and as indicated in Chapter 6, both Phases 2 and 3 for the Queen's Flight are described together for clarity and continuity.

The first RAF Helicopter Royal Flight was for HRH Princess Margaret visiting British troops in Germany in June 1954. Although planned and organised by the

Queen's Flight, it was carried out using a Dragonfly borrowed from the newly established CFS Helicopter Unit and flown by Flt Lt J R Dowling. The Royal flight was from Costedt near Buckeburg to Sennelager and had to be aborted after one hour's flight due to bad weather. The Dragonfly, sumptuously furnished for that occasion, was temporarily attached to the Queen's Flight in September 1954 together with a CFS pilot (Flt Lt A J Lee—previously one of the Hoverfly pilots in the King's Flight flying mail to Balmoral in 1947, and recently returned from Malaya). Other early Royal users of the helicopter were the Duke and Duchess of Gloucester and the Queen Mother but it was Prince Philip who became the champion of the helicopter.

Having qualified as a helicopter pilot under the auspices of the Royal Navy, Prince Philip continued to use the Naval Whirlwind Mk 22 for official visits, and this lead was followed by other members of the Royal Family until eventually Royal helicopter flying was carried out solely in the Naval Whirlwinds, although the flights continued to be planned and organised by the Queen's Flight. The Dragonfly was used for route and landing site reconnaissance, communications work and pilot continuation training, since a Queen's Flight pilot always accompanied the Naval helicopter on Royal flights.

Agreement in principle by the Air Council for two helicopters to be established in the Queen's Flight had been obtained in June 1954, but took a long time to become reality. It was December 1955 before a decision to establish a training Whirlwind in the Queen's Flight was taken, to be effective in the Spring of 1956 and followed by two VVIP versions a few months later. The training aircraft, only held for the first week in June, demonstrated the unsuitability of this underpowered Pratt and Whitney engined helicopter for the Royal Flight while it soon became clear that the modifications needed, principally duplicate power controls, would delay for an unacceptably long time the appearance of the two VVIP versions. Sycamores were offered as a temporary solution but were rejected as unsuitable in size and shape.

In November 1956, the Air Council decided that the policy of establishing Whirlwind helicopters on the Queen's Flight should be reconsidered when a firm estimate for the Mk 5 (with the Alvis Leonides Major engine) could be provided against an agreed Standard of Preparation. A draft form of the Standard of Preparation was issued in February 1957, but a whole year went by with interminable discussions and bickering on minor differences of furnishings, radio and engineering fitments, and general finish, before the draft was agreed by all the interested parties. This was not however, significant for by this time the Leonides Major had run into serious development problems and it seemed likely that delivery of the first aircraft would take at least another year after a contract had been placed. Meanwhile the Naval Whirlwind, now flown by Lt Cdr E C Spreadbury, carried out most of the Royal flights whilst the Dragonfly continued to operate from Benson; in August 1956 the Dragonfly carried out the first of what were to become annual flights,

delivering Royal Mail to Her Majesty's Yacht Britannia which was cruising off the Western Isles with the Royal Family on board.

In July 1958 a contract for the VVIP Whirlwinds (now known as Mk 8s) had at last been placed with Westlands, delivery being expected the following Spring, and a Mk 4 aircraft was collected from Aston Down at the end of the month for crew training. The faithful Dragonfly, XF 261, was returned to South Cerney in August 1958 but again the change proved somewhat premature in terms of crew training, for in January 1959 the Leonides Major was still giving trouble and the first engine had not even arrived at Westlands. Despite these delays, the Queen's Flight Captain—Air Cdre Fielden—continued to press for the establishment of two helicopter crews on the Queen's Flight. In 1954, a meeting of senior RN, Army and RAF representatives had agreed that, as the Naval and Military helicopter resources were greater than those of the RAF, which might have been unduly strained by the provision of two crews for the Queen's Flight, one of the eventual crew vacancies should be filled alternately by Naval and Army officers. Air Cdre Fielden now felt that as the Naval authorities had been so helpful with previous helicopter trips, and as in any case the Army had no Whirlwind qualified pilots, the Admiralty should be invited to appoint a Naval helicopter pilot to join the Queen's Flight when the VVIP helicopters were delivered. Lt R M Kerr, who had taken over the Naval Whirlwind flying from Lt Cdr Spreadbury, was selected to fill this post—one which is incidentally, still in 1983 filled by a Naval pilot. Lt Kerr eventually joined the Flight in January 1960 and, having subsequently transferred to the RAF, remained until 1976 as Prince Philip's personal helicopter pilot.

The Leonides Major engine continued to give trouble and by June 1959 all the Naval Whirlwind Mk 7s, from which the Queen's Flight machines were derived, had been grounded for modification. A new series of trials was started at Culdrose in July 1959, the successful outcome of which resulted in the Mk 8s receiving their release to service in October 1959 by which time, however, Air Cdre Fielden was showing interest in the Gnome gas turbine powered version of the Whirlwind. The first of the new Mk 8 aircraft was collected from Boscombe Down on 1 October and the second from Yeovil on 5 November. The Mk 4 Whirlwind was soon disposed of and there followed a short period of crew training and working up before the helicopters were successfully introduced to Royal flying on 23 February 1960, with a flight from Kensington Palace to Papworth—almost four years after the originally projected date of introduction.

The cancellation by the RAF of the re-engining of Whirlwinds with the ill-fated Leonides Major engines and the substitution of Gnome gas turbines did not extend to the Queen's Flight. The VVIP Mk 8 Whirlwinds, partly perhaps because they were derived from the Naval Mk 7s but doubtless also because they had only just been obtained after such a long struggle, continued in the Queen's Flight until the

RAF changeover from the Mk 2 and 4 to the Mk 10 was practically complete. In early 1964 the change was made and the Mk 12 (VVIP version of the Mk 10) Whirlwinds arrived marking the start of Phase 3 for the Queen's Flight.

The fatal crash in December 1967 described in Chapter 14 dealt a severe blow to the Queen's Flight by killing the new Captain and Engineer Officer of the Flight as well as the crew. The party was on its way to Yeovil for a conference at Westlands concerning the standard of modification required to prepare the Wessex Mk 4 for the Queen's Flight. The subsequent grounding of the Whirlwinds, followed by another grounding a few months later, did not enhance the Whirlwind's reputation on the Queen's Flight, but in any case, the twin-engined reliability of the Wessex and the obvious advantage of its cabin size ensured that the Whirlwinds would be replaced as soon as possible. In both 1967 and 1968 No 72 Squadron at Odiham was called upon to lend a Wessex for flights by HRH Prince Philip, and when the first Wessex Mk 2 was delivered to the Queen's Flight for crew and technician training in December 1968, it was used quite extensively for Royal flights even before the first VVIP Mk 4 Wessex arrived on 25 June 1969.

The second Wessex Mk 4 was duly delivered on the appointed day—1 July 1969—and after the phasing out of the Whirlwinds and the allocation of the Mk 2 Wessex to No 72 Squadron, the helicopter part of the Queen's Flight stabilised satisfactorily with these two aircraft for several years. This constitutes the start of Phase 4 of the Queen's Flight.

Metropolitan Communications Squadron/No 32 Squadron

The Queen's Flight was late in entering Phase 3 with turbine-engined helicopters, but the Metropolitan Communications Squadron was even later. In fact, it did not have any helicopters until November 1959, and then operated Sycamores until 1972, with a gradual replacement by Whirlwinds Mk 10 starting in 1970. The Squadron did not really fit the pattern of phases which has been used to describe the progress of the rest of the helicopter force.

The reluctance to allow the RAF to spend money on helicopters purely for communications tasks was mentioned in Chapters 4 and 6, and the consequent misuse of Central Flying School and occasionally Search and Rescue helicopters for the most pressing communications tasks during the 1950s (mainly VIP trips) became progressively more disruptive of their specialised roles. The Royal Navy and the Army, by contrast, had no hesitation in finding helicopters for their own VIPs, but there was developing a much wider recognition that there was a considerable number of Staff Officers below VIP category whose effectiveness could be greatly enhanced by access on a regular basis to small transport helicopters. There could, however, be no question of purchasing aircraft specifically for that purpose.

C Flight (Helicopters) was formed in the Metropolitan Communications Squadron at Northolt in November 1959 with two Mk 11 Sycamores.* Lacking night flying or any form of navigation equipment the helicopter flight flourished only modestly but by the end of 1962 had four aircraft. The Mk 14 Sycamores were now surplus in comparatively large numbers having been withdrawn from the Far East—Phase 3 was beginning everywhere else in the helicopter world.

Initially, tasking for the helicopters was done by the Air Transport Operations staff in the Air Ministry but by 1968 the role had been assumed by No 38 Group. There were now five aircraft and the Flight was finding the longer and more difficult flights demanded by No 38 Group progressively more of a challenge; it was becoming clear that a more suitably equipped helicopter would soon be needed. A regular task was a daily shuttle between Northolt, HQ Strike Command at High Wycombe and No 11 Group Headquarters at Bentley Priory. Between 1968 and 1970 some 20–40 passengers were flown monthly on this regular run and by mid-1971 the figures were between 50 and 70.

No 32 Squadron—a Canberra Squadron of the Near East Strike Wing—was disbanded in Akrotiri in 1969 and the number plate allocated to the Metropolitan Communications Squadron. In January 1970 No 32 Squadron received its first Whirlwinds Mk 10 and by the end of the year all the Squadron helicopter pilots had been converted and categorised on both Sycamores and Whirlwinds (another Squadron type conversion). The second Whirlwind, fully VIP-equipped, came in early 1971 from the Queen's Flight which was now entering Phase 4 with its Wessex Mk 4. Spread over the following two years, the five Sycamores were replaced on a one for one basis by Whirlwinds Mk 10, ending in August 1972 when the last Sycamore in the RAF departed for the Torbay Aircraft Museum. En route, it was landed on the lawn of the Officers' Mess at Upavon where the AOC of Air Support Command presided at a luncheon attended by the Sycamore designer Mr Raoul Hafner and several of his design and engineering staff from Filton and Weston-super-Mare where the Sycamores had been built in the days of the Bristol Aeroplane Company in the late 1940s and early 1950s. After lunch, the Sycamore joined an escort of three Wessex and three Pumas from Odiham for a flypast before proceeding on its way to Torbay.

Insofar as there was a Phase 3 for the helicopters of No 32 Squadron, it consisted of the two-year long substitution of Whirlwinds for Sycamores in 1970 and 1971. Phase 4 may be said to have started following the ceremonial departure of this last Sycamore from the Phase 2 period.

*The Mk 11 was an early version of the Sycamore which could not be used operationally in the Short Range Transport role and, having a substantially different cockpit layout from the Mk 14 Sycamore which was in general RAF use, could not even be used in the training role. These were survivors from No 1906 AOP Flight (Chapter 6) which became surplus on the formation of the Army Air Corps in 1957.

Force Liaison visits. In addition, communication and demonstration tasks seem to have been accepted with some abandon. In June 1967, for instance, there were 17 'special flights' as follows:—

- One Whirlwind —Wycliffe College, for the AOC RAF Record Office.
- One Whirlwind —CFS Garden Party at Little Rissington.
- One Sioux —Tushingham Gala.
- One Sioux —Little Rissington Display.
- Three Sioux —Little Rissington Display Team.
- One Whirlwind —Radley College for the AOC No 25 Group.
- One Whirlwind —Gaydon—Solihull—AVM Robinson.
- One Whirlwind —Solihull Carnival.
- One Whirlwind —Static Display Valley—Prince Philip.
- One Whirlwind —RAeS Garden Party—Desborough House—Ripley.
- One Sioux —Colston Display.
- One Whirlwind —Principal Medical Officer, Technical Training Command to Lake Bala.
- One Whirlwind —Shrewsbury Agricultural Show.
- One Whirlwind and
- Three Sioux —Demonstration, Royal Observer Corps Day.
- One Whirlwind —Sutton Ashford Schools' Careers Convention.
- One Whirlwind —GOC West Midland District to Scarborough.
- One Whirlwind —Lake Bala.

In the same month a liaison visit was paid to the Royal Danish Air Force Helicopter Wing at Vaerloese, and a standardisation check made on No 22 (SAR) Squadron. In the following month there were 18 special flights and one of the regular visits to the French Air Force at Chambéry. Flying times split between course training and 'other' flying in typical high season months of July and September were as follows:

<u>Month</u>	<u>Aircraft Type</u>	<u>Dual and Solo Training</u>	<u>Other Flying</u>
July	Whirlwind	469	264
	Sioux	314	91
September	Whirlwind	681	176
	Sioux	318	170
		<u>1782</u>	<u>701(11)</u>

By 1965 the demand for Sycamore pilots had reduced almost to zero and the Sycamores were being used rather unsatisfactorily as the basic element leading to an advanced phase in the Whirlwind. There was considerable pressure at CFS to replace the Sycamore by the Sioux in the basic phase and in February 1966 there

C Flight (Helicopters) was formed in the Metropolitan Communications Squadron at Northolt in November 1959 with two Mk 11 Sycamores.* Lacking night flying or any form of navigation equipment the helicopter flight flourished only modestly but by the end of 1962 had four aircraft. The Mk 14 Sycamores were now surplus in comparatively large numbers having been withdrawn from the Far East—Phase 3 was beginning everywhere else in the helicopter world.

Initially, tasking for the helicopters was done by the Air Transport Operations staff in the Air Ministry but by 1968 the role had been assumed by No 38 Group. There were now five aircraft and the Flight was finding the longer and more difficult flights demanded by No 38 Group progressively more of a challenge; it was becoming clear that a more suitably equipped helicopter would soon be needed. A regular task was a daily shuttle between Northolt, HQ Strike Command at High Wycombe and No 11 Group Headquarters at Bentley Priory. Between 1968 and 1970 some 20–40 passengers were flown monthly on this regular run and by mid-1971 the figures were between 50 and 70.

No 32 Squadron—a Canberra Squadron of the Near East Strike Wing—was disbanded in Akrotiri in 1969 and the number plate allocated to the Metropolitan Communications Squadron. In January 1970 No 32 Squadron received its first Whirlwinds Mk 10 and by the end of the year all the Squadron helicopter pilots had been converted and categorised on both Sycamores and Whirlwinds (another Squadron type conversion). The second Whirlwind, fully VIP-equipped, came in early 1971 from the Queen's Flight which was now entering Phase 4 with its Wessex Mk 4. Spread over the following two years, the five Sycamores were replaced on a one for one basis by Whirlwinds Mk 10, ending in August 1972 when the last Sycamore in the RAF departed for the Torbay Aircraft Museum. En route, it was landed on the lawn of the Officers' Mess at Upavon where the AOC of Air Support Command presided at a luncheon attended by the Sycamore designer Mr Raoul Hafner and several of his design and engineering staff from Filton and Weston-super-Mare where the Sycamores had been built in the days of the Bristol Aeroplane Company in the late 1940s and early 1950s. After lunch, the Sycamore joined an escort of three Wessex and three Pumas from Odiham for a flypast before proceeding on its way to Torbay.

Insofar as there was a Phase 3 for the helicopters of No 32 Squadron, it consisted of the two-year long substitution of Whirlwinds for Sycamores in 1970 and 1971. Phase 4 may be said to have started following the ceremonial departure of this last Sycamore from the Phase 2 period.

*The Mk 11 was an early version of the Sycamore which could not be used operationally in the Short Range Transport role and, having a substantially different cockpit layout from the Mk 14 Sycamore which was in general RAF use, could not even be used in the training role. These were survivors from No 1906 AOP Flight (Chapter 6) which became surplus on the formation of the Army Air Corps in 1957.

TRAINING IN PHASE 3

The Central Flying School

Towards the end of Phase 2 in August 1961, the CFS Helicopter Squadron had moved from South Cerney to Tern Hill and become a Wing with two squadrons—one training squadron with 'basic' and 'advanced' phases for both pilot and QHI training, and one 'standards' squadron to deal with the rising pilot and QHI categorisation commitment; the expanding programme of visits to all Service helicopter units at home and overseas; and foreign Air Force liaison exercises. The CFS Helicopter Wing had by then acquired a somewhat motley collection of helicopters—two Dragonflies, two Whirlwinds Mk 2/4, eight Sycamores and two Skeeters—reflecting the 'ad hoc' character of the unit's growth over the previous eight years. The arrival of one Whirlwind Mk 10 in November 1961—the first turbine powered helicopter at CFS—marked the start of Phase 3. The piston-engined Whirlwinds were phased out in the following five months.(6)

At Tern Hill the Helicopter Wing expansion programme was completed in the first quarter of 1962 with the split of the Training Squadron into two separate squadrons, one for basic pilot/QHI training and one for advanced pilot/QHI training. The standards squadron became No 3 Squadron.(7) (Ten years later the division was made between pilot and QHI training, each squadron having basic and advanced flights). A training flight was established at Valley in March 1962 for mountain flying training in Snowdonia and SAR sea training for crews destined for that role. Formal crewman training started in May and, being for SAR crews initially, was for the most part carried out at Valley. The syllabus for pilot training, originally 50 hours on one type of helicopter but progressively increased to 80 hours (50 basic and 30 advanced) on two helicopter types, now reached 100 hours with the inclusion of night and instrument flying plus mountain and maritime exercises. There being no OTU, CFS was performing the introductory part of an operational training unit course, so reducing the diversion of operational squadrons to the training tasks for new crews. The course at Valley was adjusted to suit crews destined either for the SRT or SAR role as required.

The number of simultaneous courses had grown considerably. In September 1962, for example, there were two pilot courses in progress—one at the basic stage (Sycamore) and one at the advanced stage (Whirlwind)—one crewman course, two QHI courses, one Staff Officer familiarisation course and one pilot refresher course. The Valley detachment had become permanent.(8)

QHIs, in addition to those needed for basic pilot training, were established on the operational squadrons at a rate determined by the number of permanent detachments maintained by those squadrons. The CFS courses varied considerably in size

as the demand for QHIs fluctuated and new helicopter units were formed. In February 1965, for example, No 54 Basic Pilot Course consisted of 17 students out of a student population of 44 officers and 12 airmen aircrew—the latter being crewmen. QHI courses were naturally much smaller. In June 1965, for example, there were ten courses in progress—four basic pilot training, three QHI, one refresher and two crewman courses—one (SRT) at Tern Hill and one (SAR) at Valley. In January 1966 there were no less than five QHI courses running—No 89 with three RAF, four RN and one Australian Army students, No 91 with six RAF students, No 92 with three RAF and five RN students, No 93 with one RAF, two Army and one Australian Army students, No 94 with three RAF students.(9)

The training syllabus was treated with considerable flexibility to accommodate these different requirements but remained basically similar to that shown in Appendix 2 expanded to include night and instrument flying, mountain flying and basic SAR training. The basic pilot course which had grown to 100 hours by 1962 remained substantially at that figure while various combinations of training helicopters were tried. CFS issued standard syllabi for rotary wing training in April 1972 which specified the QHI course as 68 hours in 12 weeks on either Sioux or Whirlwind, 45.45 hours basic and 59.15 advanced in 23 weeks for pilot training including two and a half weeks at Valley for mountain flying and sea winching, and for Harrier conversion pilots six hours in Whirlwinds in five days (no solo). The Skeeter, used for Army QHI courses and as a lead-in to the Sycamore or Whirlwind for pilot courses was replaced by the Sioux (Bell 47) in November 1964 but in February 1965 three basic students were trained experimentally throughout on the Whirlwind, in accordance with one theory of how to obtain the best results with economy.(10) (This system was used for training the pilots of No 230 Squadron at Odiham—see Chapter 10—and again at CFS in 1973 when the Sioux was phased out).

Standardisation visits to all operational helicopter units were a well-established regular feature by 1962, and the time was coming when CFS was to find itself advising on operational rather than only pure flying matters. In February 1962, Transport Command acquired a Squadron Leader from CFS (Sqn Ldr A J Clarke—late of Malaya) and included him in the Transport Command Examining Unit, thus allowing CFS to revert to its proper role of standardising and categorising QHIs and sampling the quality of the output from the Flying Training School (in this case CFS itself), leaving the operational standard to be measured by the Operational Commands. Coastal Command established helicopter crews in its own Categorisation Board for the same purpose in respect of SAR units. The CFS continued to visit all units in its role of observing pure flying standards and checking on the performance of recently qualified pilots from the training machine.

Between 1962 and 1972 the CFS Helicopter Wing was highly active in all its roles—pilot, QHI and crewman training; standardisation and examining; and foreign Air

Force Liaison visits. In addition, communication and demonstration tasks seem to have been accepted with some abandon. In June 1967, for instance, there were 17 'special flights' as follows:—

- One Whirlwind —Wycliffe College, for the AOC RAF Record Office.
- One Whirlwind —CFS Garden Party at Little Rissington.
- One Sioux —Tushingham Gala.
- One Sioux —Little Rissington Display.
- Three Sioux —Little Rissington Display Team.
- One Whirlwind —Radley College for the AOC No 25 Group.
- One Whirlwind —Gaydon—Solihull—AVM Robinson.
- One Whirlwind —Solihull Carnival.
- One Whirlwind —Static Display Valley—Prince Philip.
- One Whirlwind —RAeS Garden Party—Desborough House—Ripley.
- One Sioux —Colston Display.
- One Whirlwind —Principal Medical Officer, Technical Training Command to Lake Bala.
- One Whirlwind —Shrewsbury Agricultural Show.
- One Whirlwind and
- Three Sioux —Demonstration, Royal Observer Corps Day.
- One Whirlwind —Sutton Ashford Schools' Careers Convention.
- One Whirlwind —GOC West Midland District to Scarborough.
- One Whirlwind —Lake Bala.

In the same month a liaison visit was paid to the Royal Danish Air Force Helicopter Wing at Vaerloese, and a standardisation check made on No 22 (SAR) Squadron. In the following month there were 18 special flights and one of the regular visits to the French Air Force at Chambéry. Flying times split between course training and 'other' flying in typical high season months of July and September were as follows:

<u>Month</u>	<u>Aircraft Type</u>	<u>Dual and Solo Training</u>	<u>Other Flying</u>
July	Whirlwind	469	264
	Sioux	314	91
September	Whirlwind	681	176
	Sioux	318	170
		<u>1782</u>	<u>701(11)</u>

By 1965 the demand for Sycamore pilots had reduced almost to zero and the Sycamores were being used rather unsatisfactorily as the basic element leading to an advanced phase in the Whirlwind. There was considerable pressure at CFS to replace the Sycamore by the Sioux in the basic phase and in February 1966 there

seemed to be a good excuse for doing so. A tendency for the Sycamore to roll to port on take-off if certain precautions were not taken is described and explained in the notes on the Sycamore in Appendix 1. These precautionary techniques had evidently been allowed to fall out of prominence and in February 1966, while a Board of Inquiry was still investigating an accident at CFS, another occurred. Five new Sioux had recently been delivered. The CFS Sycamores were grounded and remained so pending a decision on their continued suitability in the training role. The result was the disposal of the CFS Sycamores in May-August 1966, and there followed a six-year period of stability in which the Sioux filled the basic role and the Whirlwind the advanced. In February 1968, with a strength of 16 Whirlwinds and ten Sioux, a formation consisting of eleven Whirlwinds and ten Sioux was flown to celebrate the 50th Anniversary of the RAF.

In October 1972 the two squadrons at Ternhill, previously carrying out both pilot and QHI training, one on Sioux (basic stage) and the other in Whirlwinds (advanced stage) were reorganised to separate pilot and QHI training, each squadron having a basic and an advanced flight. This set the pattern for the later change (Phase 4) when No 2 Flying Training School was reformed to carry out the helicopter pilot and crewman training, leaving the Central Flying School Helicopter Unit to its own special functions in line with the rest of the CFS.

Phase 3 ended for CFS in December 1973 with the completion of No 138 Basic Pilots' Course, the last to use Sioux and Whirlwind. The Sioux was phased out and 'all through' training on the Whirlwind instituted. Phase 4 began at the same time with the introduction of the Gazelle (SA 340) in the instructional role for QHI training.

Transport and Coastal Command Examining Tasks

From the formation of the CFS Helicopter Unit in 1954 until 1962 the CFS was responsible for and actively engaged in operational standardisation visits to all helicopter units. In 1960, for example, CFS visits were paid to the Army Air Corps Centre, the Metropolitan Communication Squadron, the Queen's Flight and the two Search and Rescue Squadrons in the UK; to No 110 Squadron at Butterworth, the Royal Malaysian Air Force in Kuala Lumpur and the Hong Kong Auxiliary Air Force in the Far East; and to the SAR Sycamore Flight at Khormaksar in the Middle East and No 103 Squadron at Nicosia and El Adem.

With the addition of helicopter operational examining staff to Transport and Coastal Commands (Transport Command Examining Unit and Coastal Command Categorisation Board in 1962 and 1963 respectively) the CFS visits did not greatly diminish, but they changed in character to the extent that pure flying standards and techniques were observed and categorisation of unit QHIs became the main function. Operational categories for all crews became the responsibility of the

Operational Command examiners whose visits to units were now added to those of the CFS. In the mid-1960s, for example, this included four squadrons in the Far East (three with detachments in both Singapore and Borneo), one flight at Nicosia and El Adem, one SRT squadron and one SAR flight in Aden, one flight in Guiana, two squadrons and a conversion unit at Odiham, the Metropolitan Communication Squadron at Northolt, the Queen's Flight at Benson and the two Search and Rescue squadrons at nine locations in the United Kingdom. The RMAF and Hong Kong Auxiliary Air Force were regularly included in Far East visits by invitation.

It may seem that the examining visits of the CFS, added to those of the TCEU (retitled Transport Command Examining Staff—TCES—in 1964 and Air Support Command Examining Unit—ASCEU—in 1967) created a heavy additional load on the very busy overseas operational units. But in fact the value in maintaining and enhancing standards was generally apparent and the service provided was enthusiastically welcomed by most crews and especially at all supervisory levels.

Only the Transport Command examining responsibility has been mentioned in respect of the overseas units and that is because until the late 1960s the SAR function of overseas helicopter units was secondary to the tactical role, and the helicopter examiners of the Coastal Command Categorisation Board concentrated their efforts on the exclusively SAR-dedicated UK SAR squadrons. It was not until the FEAF operations began to run down and the SAR role, still officially secondary, began to assume relatively greater importance, that the Coastal Command Helicopter examiners started regular visits to the Far East. It was not until then that the diminishing Far East authorities made a plea for co-ordination of the three types of examining visits which otherwise were tending to become a main feature of life for the reducing helicopter force. Co-ordination of visits was arranged because of the obvious inappropriateness of having two separate operational helicopter examining teams, in addition to the Central Flying School, visiting one helicopter unit in Singapore and one in Hong Kong on a six-monthly basis, simply because the SH and SAR roles were performed by separate units under different Commands in the UK. On the withdrawal of the last helicopter squadron from Singapore the SH helicopter force returned to its main role in the United Kingdom and Europe where SAR continued to be provided by a separate specialised maritime Group.

The regular standardisation and categorisation of the widely dispersed helicopter units throughout the world from the mid-1950s and through the 1960s was assiduously pursued and undoubtedly greatly enhanced the flexibility and efficiency of the developing RAF helicopter force to a degree which can scarcely be exaggerated.

The SAR Squadrons in the UK in Phase 3

The pattern of the UK SAR helicopter force was established in Phase 2 as described in Chapter 7. Phase 3 started for the SAR force at the end of 1962 by which time

both Nos 228 and 22 Squadrons had exchanged their Whirlwinds Mk 2 and were fully equipped and trained on the Whirlwind Mk 10.

The drama following the closure of the central South Coast flight of No 22 Squadron at Thorney Island had continued through 1960 (see Chapter 7) and had shown that however well justified the RAF was in legal terms in spending defence funds and deploying the SAR flights solely for the benefit of RAF fixed-wing aircraft crews, the public had already learned to regard them in much the same way as they did the Royal National Lifeboat Institution, and fierce lobbying by local officials could force or at least influence modifications to the RAF deployment plans. Thus in mid-1961 the flight at Felixstowe, due to be deployed to Manston, appeared instead at Tangmere—closer than Thorney Island to the South Coast towns whose Mayors had been most pressing. A further flight then had to be established at Manston.(12) An additional motivation for this change existed because there was some Air Staff annoyance that in the holiday weeks, the Solent and South Coast generally were treated to frequent views of rescue helicopters flying to and fro bearing the words 'Royal Navy' in large letters, but since these were anti-submarine warfare equipped aircraft often not available for rescue tasks, they could not be placed on SAR standby and were operated only during standard working hours. As such, they were no more than an occasional bonus to the regular seven-days a week SAR service which the RAF was obliged to operate.(13)

In May 1964, due to closure of Tangmere, D flight of No 22 Squadron moved to Thorney Island, thus returning the South Coast helicopter flight to its former home whence its withdrawal had caused so much trouble in 1960. In March 1969, history was repeating itself when D flight of No 22 Squadron at Manston was selected for closure. There was a shortage of crews, while the RAF fighter activity, and therefore SAR requirement, was decreasing in the North and it was judged that the Manston area could be covered by Coltishall to the north and east and Thorney Island to the west and south. This upset the local authorities at Margate to such an extent that a civilian (Bristow) helicopter was hired to provide local helicopter SAR cover. The arguments which took place in the early 1970s when the RAF wished to reactivate its SAR flight at Manston belong in Phase 4 of this history, ie after the disbandment of Coastal Command in November 1969 which marked the end of Phase 3 for the SAR Force.

At the beginning of Phase 3 then (ie the end of 1962) the RAF No 228 Squadron deployments were at Acklington, Leconfield (including Squadron Headquarters and a Communications Flight consisting of one Anson), Leuchars and Horsham St Faith. The latter flight was moved to Coltishall in April 1963. No 22 Squadron deployments were at St Mawgan (including the Headquarters Flight and SAR Operational Training Flight), Chivenor, Tangmere, Valley and Manston. The SAR Operational Training Flight at St Mawgan was able to disband in 1962 as the Central Flying School took over the task with its detachment at Valley, the QHIs

from St Mawgan then forming the helicopter element of the Coastal Command categorisation board.

The arrival of the Whirlwinds Mk 10 in the latter part of 1962 marked January 1963 as the beginning of Phase 3 for the SAR squadrons. They continued to operate as before but with up to 30% increase in fuel/pay load as well as speed, the aircraft had a greatly enhanced range and were able to respond more successfully to a wider range of tasks; and the public were becoming progressively more aware of and reliant upon the rescue service thus provided.

As the SAR service broadened its scope, so the method of recording SAR incidents became progressively more detailed and descriptive. Categories of incidents recorded were under only four headings in the early 1960s, but after the introduction of the Mk 10 Whirlwind and the consequent growth in use of the service, these categories had grown to seven. Direct comparisons before and after are therefore difficult to make, but based on the four categories of incidents in use in 1960 and 1961 (the last two years of the Mk 2 Whirlwind) an approximate comparison can be made with incidents grouped under the same four headings for 1965 and 1966 as follows:

<u>Category of Incidents</u>	<u>User</u>	<u>Number of Incidents 1961/62</u>	<u>Number of Incidents 1965/66</u>
Aviation emergencies	Military and Civil	61	219
Shipping		19 (16 rescued)	97
Civilians	Bathers, Yachtsmen	190 (89 rescued)	938
			A total of 97 lives were saved and there were 66 false alarms
Casualty Evacuation (air ambulance)	DHSS	141	162

This demonstrates the huge jump in all SAR operations except casualty evacuation (later referred to as aero-medical evacuation in order to describe the increasing use of SAR helicopters as air ambulances for transfer of patients to or between hospitals at the request of the Department of Health and Social Security, as opposed to the direct delivery to hospital of injured rescued persons). The figures show the number of times the SAR helicopters were scrambled (that is, launched) to deal with the types of incident shown, and do not indicate whether or not the intended operation was actually carried out; for example, in 1966 No 22 Squadron records 34 aviation incidents resulting in 14 persons being rescued, 69 aero-medical patients carried of whom seven were lifted from ships (thus becoming casualty evacuation as opposed

to aero-medical), 70 swimming incidents resulting in the rescue of 16 persons, 252 small boat/yacht etc incidents involving 137 rescues, 59 operations on behalf of persons marooned on cliffs resulting in 61 rescues, 56 operations and 42 rescues described as miscellaneous, and 27 false alarms. Nos 22 and 202 Squadrons had slightly different ways of categorising operations in their Operational Record Books making comparison and totalling extremely difficult.

The system of dividing operational SAR sorties into different statistical groupings continued to change into the late 1960s, and a longer view than is available in this history would be needed to assess any significance. In the meantime the following chart, deduced from the Coastal Command and Squadron ORBs shows the fairly constant rate of total effort.

No 22 SQUADRON

<u>Year</u>	<u>Total Hours</u>	<u>Operational Hours</u>	<u>Operational Sorties</u>	<u>Persons Lifted</u>
1964	4227	551	352	46
65	3651	536	304	45
66	4228	748	352	62
67	4085	508	340	42
68	4153	617	346	51
69	3553	457	296	38
70	3245	498	270	42

No 228/202 SQUADRON

1964	2647	268	294	30
65	3032	270	303	27
66	3332	366	333	37
67	3714	334	338	30
68	3855	404	321	34
69	4170	430	347	36

On 28 August 1964 No 228 Squadron disbanded (for the fourth time since 1918) and immediately reformed as No 202 Squadron with the same role and deployments as before, having been selected to carry that title after No 202 (Hastings) Squadron was disbanded, its meteorological reconnaissance role having come to an end.

The four flights of No 202 Squadron covering the East Coast of Britain had generally longer ranges to fly than the five flights of No 22 Squadron which, being deployed in the more highly populated South, consequently dealt with the higher rate of emergency incidents. The result was that whereas only about 14% of No 22 Squadron's flying time was classed as operational, the corresponding figure for No 202 Squadron was 10%. The remainder was classed as training. These figures

varied little year by year from 1964-1970, as did the total annual flying rate which averaged 3877 hours for No 22 Squadron and 3458 for No 202 Squadron. Both squadrons flew at a similar intensity as far as monthly hours were concerned (30 hours per established aircraft) regardless of the number of emergency scrambles, this being the rate required to keep all crews in full practice—ie about 15 hours per month per pilot. Only about two hours of this was essential in non-SAR roles—for example, instrument and night flying and periodic engine-off landing practice. In other words, a much greater rate of operational flying could have been accepted, but no reduction of aircraft or crews was possible in the absence of such demands while the SAR emergency service had to be maintained.

There was no promised night flying rescue task because the Whirlwinds lacked appropriate equipment such as auto stabilisation, target illumination, radar etc for the role in complete darkness. On the other hand it was judged that there would be many occasions when, although what was required was technically night flying, nevertheless conditions of partial darkness might be such that the crew considered the task could still be carried out.

The policy therefore was to offer a fifteen minutes readiness emergency SAR helicopter standby throughout the hours of daylight, but no more than a possible capability by night, for which a one-hour standby was provided. In practice, most night operations requested were in fact successfully carried out.

The proliferation of gas/oil rigs in the North Sea greatly enhanced the effective range of the SAR helicopters of No 202 Squadron by providing the refuelling points out to sea, and from the mid-1960s onwards were in regular use as forward operating bases. In January 1967, for example, the rig Neptune was used as a night landing base for an aero-medical evacuation carried out at dawn from a trawler. Shortly afterwards the oil rigs Orion and North Star were used to double the Whirlwind radius of action out to sea for a particular aero-med lift from a ship, providing both fuel and radio communications.

Throughout the period it was the policy to provide 'top cover' (a high flying aircraft acting as a communications link) for the helicopters—a standard precaution for single-engined aircraft operating significant distances over the sea. This could usually be arranged by designating an aircraft already patrolling or exercising in the area to act as a link with the RCC. Sometimes however this was either impractical or extremely difficult to arrange at short notice, but the absence of top cover would not normally prevent the helicopter from responding to an emergency call. This problem was to remain until the single-engined Whirlwind was replaced by the twin-engined Wessex in the late 1970s (Phase 4), but the oil rigs scattered widely throughout the North Sea were particularly helpful to the limited range Whirlwind not only as refuelling points but also as communication relays, navigation aid and emergency refuges.

In the 1960s, with the bulk of the SRT/SH Force overseas in Borneo, Singapore, Aden/Bahrain, Cyprus, Guiana and Germany, and with very few civilian helicopter operators in the UK, the two SAR squadrons constituted the main RAF helicopter force for much of the time. Their use for ferrying patients between hospitals as required by the medical authorities (Aeromed) only started to diminish when, in 1969, it was decided that non-emergency cases, ie those where more than 24 hours notice could be given, would be carried by the SH force. For much of this period the SAR squadrons were the sole, but highly successful, RAF representatives in the international 'helicopter meet' which took place annually from 1967 onwards. They usually won.

By the end of the 1960s the SAR squadrons were more than ever indispensable. The expansion of their operational capability involved them in more dramatic situations which earned them an increasing number of honours and awards—a trend which was to continue through the following two decades. As already mentioned, the withdrawal of the flight at Manston in 1969 resulted in considerable uproar and caused the Department of Trade to employ a civilian Whirlwind for local rescue services. This demonstrated better than anything the status of the RAF SAR helicopter service in the public eye.

It is not possible to point to any particular moment when the demands of the civilian population for the services of the RAF SAR helicopters became strong enough to attempt to challenge RAF deployment patterns, but the events of 1960 surrounding the RAF withdrawal of SAR from Thorney Island already mentioned, came as a surprise to many. The RAF accession to local demands seems to have set a precedent, although it worked the other way round in respect of withdrawal from Manston in 1969. The fact was that by the end of the 1960s, having once had SAR helicopter services, nobody was prepared to do without them. Fortunately for both the RAF and the coastal communities, the RAF requirement for total helicopter SAR cover round the coast of England and east of Scotland satisfied both parties. Where the RAF case was from time to time temporarily slightly weak, for example, in respect of Leconfield and Chivenor in the late 1960s and early 1970s, the strong civilian local feeling already expressed elsewhere was a factor which had to be given some weight. For the crews of Nos 202 and 22 Squadrons, their civilian 'clients' provided a welcome continuous useful activity, the RAF demands for actual rescue being mercifully rare. However, they did occur from time to time, and when successfully answered, produced a powerful boost to morale. For example, No 22 Squadron commented in November 1968 that 'the Squadron's whole existence was justified by the rescue of both pilots of a Gnat 18 nm south of Valley'. Having ejected, they were rescued by two double lifts after only 20 minutes in the water.

On 27 November 1969, Coastal Command was disbanded at a stand-down ceremony at St Mawgan, and on the following day No 19 Group was retitled Southern

Maritime Air Region (SOUMAR). From then on Nos 202 and 22 Squadrons both came under No 18 Group—now of Strike Command. This concluded Phase 3 for the SAR squadrons, but a trend had been set which was to dictate the development of the SAR force in the 1970s (Phase 4). The Whirlwind Mk 10, which has been described as an enormous improvement in range, speed and lifting capacity over its predecessor, the Mk 2, was in the late 1960s already being found wanting in all these respects. What had been happening since the Sycamore started in SAR in the mid-1950s (Phase 2) was that, as the benefits of SAR by helicopter in general were being recognised, the task was growing faster than the aircraft. The first pressure—cabin space—encouraged the use of the Whirlwind Mk 2 to replace the Sycamore. Demands for more lift, range and speed made the Whirlwind Mk 10 especially attractive in the early 1960s (Phase 3). Limitations of the single-engined helicopter over the sea, and lack of auto-stabilisation for full night flying capabilities, added to the continuing pressure for more speed and lift capability, generated a demand for the twin-engined Wessex in Phase 4. All these aircraft were found as a 'spin off' from the developments taking place in the SH world, but the apparently insatiable demand for bigger, faster and especially more reliable rescue services focussed attention on a truly all-weather capability. The efficiency of the successfully developing SAR force in the 1960s (Phase 3) was thus directly responsible for the entirely new situation in Phase 4 when, quite independently from the SH force procurements, the SAR force actually generated its own 'Operational Requirement' for a new specialised SAR all-weather helicopter. The Sea King thus became a logical if unforeseen development from the SAR Sycamores of No 275 Squadron in 1953.

Helicopter Development Unit

After the disbandment of the JEHU at the end of 1959, there was pressure to replace the capability for research and development of helicopter techniques in the Army support role. In 1961, a Helicopter Development Unit (HDU) was formed at Old Sarum alongside the School of Land/Air Warfare (SLAW).

As a RAF unit it had a short and uneventful life. It was supplied initially with three Sycamores Mk 12—surplus because they were useless for anything other than passenger flying—and this at a time when the operational scene was dominated by the Belvedere and Whirlwind Mk 10. In 1964 they were replaced by three Sycamores Mk 14—also because they were now in surplus—but these were withdrawn early in 1965. Inevitably little, if any, development was achieved. Shortly afterwards it ceased to be a RAF unit and acquired joint Service status, a series of title and organisational changes bearing witness to the contrasting views, uncertainties and doubts about the appropriate formation for a transport helicopter development unit, especially one with no operational aircraft. There was no Central Helicopter Establishment to advise or control such researches, while the Joint Helicopter

Tactical Development Committee (JHTDC) in Whitehall could not fulfil such a role.*

During the 1960s much 'rationalisation' took place. The SLAW amalgamated with the Amphibious Warfare School to form the Joint Warfare Establishment (JWE). The HDU, having become the Short Range Transport Development Unit (SRTDU), emerged in 1968 as the Joint Helicopter Development Unit (JHDU) and together with the Air Transport Development Unit (ATDU)—previously the Transport Command Development Unit (TCDU)—and the Army Air Transport Development Centre (AATDC) became one of the three elements of the new Joint Air Transport Establishment (JATE). The JHDU, consisting of a Commander RN (in a rotational post), a Lt Cdr, a Major and a Sqn Ldr, had no aircraft except the elderly RN Whirlwind already mentioned. The Unit was intended to undertake joint development of techniques and equipment affecting more than one Service, but at the time continuous change in the operational units required the concentration in the front line of all the experience and practical development available. The RAF, along with the other two Services, was unwilling to allot helicopters and crews to the JHDU for development work which was already proceeding apace in their own operational units. The JHDU therefore became a forum for theoretical doctrine with a briefing function for the JWE and its courses, and thus acquired the title Joint Helicopter Tactical Development Unit (JHTDU).

An example of a major development exercise was the assessment of several rival helicopter tactical night lighting systems using torches, one of them being the SHNAP which was already in joint Service use in the Far East, but not in Europe (see Chapter 12). A tri-Service practical demonstration was arranged as a result of which the crews involved were unanimously in favour of the SHNAP which was consequently recommended for joint Service use. The JHTDU then prepared an instructional document for troops laying the pattern which was of such length and complexity compared to the slim pamphlet used in the Far East (example at Appendix 4) that the system was judged to be impractical for field use and the whole idea was dropped.

*The RN, having maintained a Hiller HT1 at Old Sarum in the mid-1950s for the benefit of the SLAW, supplied a Dragonfly Mk 3 in the early 1960s, replaced by a piston-engined Whirlwind Mk 3/7 which lasted into the mid-1970s. The Army Air Corps looked after its own affairs at Middle Wallop.

References to Chapter 13

- 1 No 18 Squadron ORB.
- 2 No 72 Squadron ORB.
- 3 Wg Cdr Smith.
- 4 No 18 Squadron ORB.
- 5 No 230 Squadron ORB.
- 6 CFS ORB.
- 7 Ternhill ORB.
- 8 Ibid.
- 9 Ibid.
- 10 Ibid.
- 11 Ibid.
- 12 ID9/902/5/Pt 4.
- 13 Ibid.

CHAPTER 14

POLICY CONSIDERATIONS IN THE SECOND HALF OF PHASE 3 1964-1971

Introduction

During the transition from Phase 3 to Phase 4 of the Helicopter History, that is from the end of large scale operations outside Europe to the concentration instead on NATO requirements in the face of the mounting threat from Russia and the Warsaw Pact countries, there were two main fields of helicopter policy development: the maintenance and replacement of the current operational helicopters: and the appearance of the offensively armed helicopter and consequent expansion of the Army Air Corps. Both were to be greatly affected by the Anglo-French helicopter package which, together with the initially frustrated Chinook, constituted the next generation of helicopters supporting ground troops in or near the battlefield. The Wessex continued to provide a significant if diminishing contribution to the Support Helicopter Force.

The use of the word 'Support' in this context requires some definition. While the Army Air Corps helicopters, whether offensively armed or not, can be properly described as acting in support of the ground forces, the expression 'Support Helicopter' was used by the RAF to designate exclusively the troop carrying and logistic resupply roles accepted for the RAF. This emanated from the original pre-helicopter identification of air support roles as Offensive Support (OS) and Transport Support (TS)—the former consisting of fixed wing fighter ground attack aircraft and the latter of tactical fixed wing aircraft. RAF helicopters were naturally incorporated into the latter group as part of the Short Range Transport (SRT) Force and when the Pioneers disappeared without replacement in the late 1960s a purely helicopter SRT Force remained. Since no offensive role was seen for helicopters by the RAF, the renaming of this group as the Support Helicopter (SH) Force seemed logical, but the expression 'SH' thus became formally recognised as referring only to the troop carrying and logistic resupply roles of the RAF. Any putative offensive support role for helicopters was argued exclusively by the Army Air Corps and rejected by the RAF on the grounds that that function was the responsibility of the RAF and the helicopter was not regarded as suitable to perform it. There was much discussion of the subject during this period concerned with the arming of helicopters for defensive or offensive purposes, resulting in the expansion of the Army Air Corps and the RAF's loss of exclusive responsibility for OS helicopter operations. It is necessary to bear in mind that the RAF, in determining the armament appropriate for SH, was concerned only with troop carrying logistic resupply helicopters. There was no ready-made phrase to describe Army Air Corps offensively armed helicopter projects—they could not be called OS helicopters

without accepting their right to exist which would, in turn, have resulted in retitling the RAF SH Force as transport support helicopters, which in fact is all they were.

The replacement of the Whirlwind by the Wessex had been decided in the policy considerations of the first half of Phase 3 (Chapter 9). The disappearance of the Whirlwind from the SH Force marking the start of Phase 4 occurred in the late 1960s and early 1970s and a comment on its general aspects up to that point is included here. Of more complex significance was the demise of the Belvedere which was decreed in the first part of this period, and took effect in March 1969. The event and its timing coupled with the sharply conflicting views on the viability of that remarkable helicopter are of sufficient significance to require a critical review of its comparatively short Service life.

The Belvedere in Retrospect

Retrospective impressions of Service aircraft tend naturally to be based on a consensus of opinion formed by personal experiences and general observation and, in the case of aircraft based mainly overseas, these views are sharply limited by the fixed dates of individual overseas tours. Thus, for all who served in Aden between 1963 and 1965 the overall impression of the Belvedere was one of an unmitigated disaster despite the fact that it did useful work in early 1964. A less intensely adverse but still generally unfavourable opinion is likely to be found amongst those who served in the Far East in 1963 and 1964; thereafter, until the first quarter of 1969 when the Belvedere finished, it was seen more and more as a uniquely valuable VTOL load carrier, well liked by the pilots and marred only by a persistently unreliable engine starter system and, for the RAF servicing organisation, the fact that it required a constant struggle to keep vibration levels within bounds by frequent rotor blade tracking and drag damper adjustments.

A basic disadvantage suffered by the Belvedere in FEAF and Aden, and to a lesser extent in the United Kingdom, was an absence of detailed experience-backed servicing data from the manufacturers who, in fairness, had not had sufficient chance to acquire it themselves before the aircraft was thrust into operational service. One of the Westland representatives at the time describes the aircraft builders drawing on their own long experience in dealing with helicopter problems on an 'ad hoc' basis in the final production stages and initial flight testing as the aircraft was manufactured; and even records one case of a Belvedere with control or vibration problems so intractable that it was known at the factory as a 'rogue', and merely issued with its own individual maximum speed limit in order to meet the delivery timescale demanded.(1) The problems had eventually to be sorted out by progressive checking and replacement where necessary of the various control

and rotor head components involved, in the time-honoured way of the early helicopters.* Thus in Aden in 1965, the visiting Westland representative was able to rectify all four unserviceable Belvederes in the space of four weeks, but only a month after his departure they were all unserviceable again, apparently irremediably, until the chance came to get rid of them to FEAF on an aircraft carrier. Even then, a Westlands technician had to assist in their emergency recovery to enable them to fly to the aircraft carrier.

As will be seen below, the fate of the Belvedere was sealed in Whitehall as early as 1965, largely a result of its behaviour in AFME. Through 1964 and early 1965 energetic high level action in Whitehall had been focussed on dealing with the main Belvedere problems. It was hoped that the Plessey Olympe gas turbine starter would solve the engine starter problems by 1966; control modifications (yaw cables) and enhanced fire warning and suppression were being given high priority; and automatic rotor speed governing was being progressed. ACAS (Operations) advised VCAS in February 1965 that the AOC AFME could be assured that with all these remedies plus the In-Flight Tracker soon to be delivered, their problems should be solved. This contention, he said, was supported by the history of the Belvedere in FEAF.(2)

Following a visit to FEAF, AFME replied with a detailed apologia in June 1965 which concluded that the Belvedere, described as 'a cumbersome and temperamental piece of machinery' whose engine starting was 'a most delicate and dangerous procedure', could not be made to work satisfactorily or economically in AFME. It was claimed that operational conditions in FEAF seemed to be much more favourable than those in AFME. In particular:

- a. The majority of sorties flown in FEAF were below 2000 feet while in AFME they flew up to 8000 feet.

*Some 18 years later, in spite of advances in manufacturing techniques and use of new materials, the almost intractable nature of this problem is illustrated in comments made by the Squadron Engineer Officer of No 33 (Puma) Squadron reported in the RAF News, July 30-August 12, 1983-13: 'The black art is vibration, where experience and luck are the two ingredients of successful rectification. It is a skill which can only be partly taught: the remainder is experience. Most vibration problems originate in the main rotor head, and the basic procedure is simply to try different combinations of blades until you find four that run smoothly together. Theoretically they should all be interchangeable, but in practice it doesn't work out quite like that. Changing one of the £18000 blades requires around two hours work, and a particularly elusive source of vibration can keep an aircraft on the ground for several weeks before a cure is finally effected. Out in the field, the Squadrons usually carry minor defects if they cannot be readily fixed, and then do a comprehensive rectification on return to base.'

- b. There was no dust or sand problem in FEAF.
- c. Turbulence in FEAF was relatively insignificant.

None of these statements could be accepted at their face value in FEAF since Belvederes operated satisfactorily up to 8000 feet in Sabah and frequently experienced very severe turbulence. There was certainly less sand and dust, but this only affected the rate of engine changes and was satisfactorily solved by the intake blanks designed in AFME. Insofar as the sand in Aden may have contributed to the rate of rotor blade erosion, there is no evidence or likelihood that this would have caused more vibration problems than the tropical rain which was such a particularly damaging feature in FEAF operations.

In addition to the hazards mentioned, it was claimed by AFME that the Belvederes required 74 manhours work per flying hour but were only established for 21.4 manhours; and that 25.5 manhours per flying hour were needed for rectification with an establishment allowing only 7.7 manhours. It was admitted that the FEAF establishment was similar to that in AFME—one Flt Lt and 53 NCOs and airmen for the five Belvederes at Kuching compared with one Flt Lt and 55 NCOs and airmen for the six (in reality only four) Belvederes in Aden, but the argument rested on the misconception that the sand, turbulence and high altitude operations in AFME caused the vibration troubles and thus generated a heavier rectification load. High altitude operations would certainly have exacerbated the vibrations generated by rotor imbalances, but could not be cited as their cause. The fact was that despite spending many extra hours attempting to do so they could not cure the vibration problems in the Belvedere. That the vibration was capable of being solved is shown by the success of the Westland expert, Mr Banks, whose services were described by the AFME report as invaluable but setting 'standards impossible to maintain'.(3)

Finally, the AFME report cited Belvedere XG 474 (the Museum aircraft) which had recently returned from a two-month detachment in Beihan (see Chapter 10), and was currently undergoing a major inspection. It was stated that if vibration recurred on this aircraft after the inspection (as was clearly expected), the case would be proved that the Belvedere was not an economically sound proposition in AFME. The recommendation was that the Belvederes still due for delivery to AFME should be cancelled, the remainder reallocated to FEAF and the Wessex expected soon for No 78 Squadron should be advanced to replace the Belvederes. This course was accepted in Whitehall where, by late 1965, determination to replace the troublesome Belvedere with the Chinook at the earliest possible moment had been growing for some time.

The technical condition of the four aircraft from Aden, when seen in FEAF, was described as appalling. One had a partially seized throttle mechanism; a second

had a completely seized front engine; and a third had a control rigging problem and flew from the aircraft carrier to Seletar in a continuous gentle left-turn with the cyclic stick held for much of the time against the right hand stops in the fully forward position. All four aircraft were flown the few miles from the carrier to Seletar by No 66 Squadron crews soon after the ship passed Changi Point, the Royal Navy having declined in advance to allow the aircraft to fly off after the carrier arrived at the Naval Base.(4) One of the aircraft, described in Aden as a 'rogue' (ie impossible to correct in terms of power/performance/control rigging) was later found to have several hundred pounds of sand beneath the floor. Many control and rotor head components required regular greasing and the No 66 Squadron Engineer Officer suspected that they had received no attention since delivery from the Contractor.(5) Clearly, the servicing in Aden left much to be desired, but it must be remembered that these particular aircraft had been virtually abandoned by AFME some months before the opportunity came to get rid of them, partly because there seemed little chance of making them serviceable and partly because the Wessex Mk 2 was arriving to replace them (Chapter 11).

There seems to be no absolutely reliable evidence or single theory to explain the difference in outcome of the Belvedere's fortune in Aden and FEAF. The No 66 Squadron Commander, Engineer Officer and the Westland representative saw no reason to believe that the Aden climate or topography adversely affected the aircraft, and the Westland representative emphatically denied that sand and dust was a problem significantly affecting anything other than the engines, and said that in this respect the Belvedere was better off than the Wessex, Whirlwind and some fixed wing aircraft as well.(6) Engine changes were technically not a particular problem for the Belvedere.

Blade tracking problems were common to both theatres, although the In-Flight Tracker (IFT) was sometimes more difficult to use in Aden since it used an optical rotor blade sighting system and electronic timing comparison for identifying blade divergences, and the equipment did not perform well in strong sunlight, at low sun angles or in heavy turbulence.(7) Hence the 23 consecutive air tests flown by XG 474 in Aden mentioned in chapter 12. In FEAF, IFT measurements were often taken in the course of operational sorties.(8)

It is true that FEAF inherited the Belvedere Trials Unit servicing personnel in 1962, and they were better experienced than the technicians sent to Aden in 1963 who had received only a short qualifying course with Westlands at Weston-super-Mare. It is difficult, however, to accept that this difference should still exercise a noticeable effect some two years later. Of more significance perhaps, was the fact that in the totally centralised servicing organisation at Khormaksar, the Belvedere servicing personnel were not always devoted exclusively to that aircraft. On the contrary, when in 1965 the new No 26 Squadron Commander visited FEAF to compare servicing and operational practices, he commented that he had considerable

difficulty in obtaining servicing personnel from the Station Engineering Wing at Khormaksar. This, he was told, was because the Belvedere was the least cost-effective aircraft on the Station in terms of servicing manhours per flying hour achieved; and since the Station was less than 100% manned against establishment (80% at the time for the trades concerned), there were times when no servicing personnel were available to work on the Belvederes.(9) This very marked contrast with the autonomous or semi-autonomous servicing control in No 66 Squadron FEAF seems likely to have been one of the major factors resulting in the grossly disparate fortunes of the Belvedere in the two theatres.

The only other feature clearly emerging as likely to have been significant in this respect is that of aircrew morale, and this seems to have been affected adversely in Aden in three ways:

- a. Headquarters FEAF was, after twelve years' experience, warmly appreciative of helicopter capabilities when the Belvederes arrived in 1962 and were ready to do whatever was necessary to encourage them to function effectively. Headquarters AFME on the other hand was not yet convinced of the true value of the military mobility conferred by the large helicopter. The attitudes at Khormaksar in 1963 to the newly arrived No 26 Squadron, as perceived by the Squadron at least, were less than enthusiastic (see Chapter 11).(10)
- b. On an early visit to AFME the Westland representative was made aware by one of the most experienced pilots, that it was suspected that the Belvedere was being treated in a cavalier way by the less experienced pilots and that there was a lack of proper supervision.(11) This pilot was killed shortly afterwards during a cross-country night flight following an unexplained structural failure in the aircraft or its control systems.
- c. That accident, together with a yaw cable failure three weeks earlier, a crash following control failure on the airfield (servicing fault) (12) and several starter explosions, combined to produce in Aden a marked reluctance both by crewmen and some pilots (13) to fly in the aircraft.

In FEAF, on the other hand, a yaw cable failure at a very early stage (1963) which resulted in the death of all on board, produced no more than normal momentary anxiety, while engine starter failures, explosions and fires were regular occurrences.

Transmission failure—generally expected to have catastrophic consequences in a twin rotor helicopter—happened only twice. Both cases occurred in FEAF and involved the same aircraft. Neither event caused damage which amounted to a reportable accident. Unlike that of the later Chinook, the rear rotor of the Belvedere, although overlapping the front rotor, did not pass through the front disc in flying manoeuvres normal to the flight envelope, and so the blades would not necessarily

strike each other if the synchronous transmission failed—at least until the rotors were almost stopped after landing and the closing down of the engines, when blade droop would cause the rear rotor blade tips at the front to pass below those at the rear of the front rotor. Also unlike the Chinook, the Belvedere, having an engine beneath each rotor, would not, if the synchronising shaft failed, be left with all the power to one rotor and none to the other—merely an adjustable imbalance. In January 1968, having just completed an abseiling exercise for SAS troops at Grik in North Malaya, Belvedere XG 468 was hovering at 100 feet when the synchronising shaft connecting the two rotors broke. The aircraft landed successfully and the rotors did not touch each other until they were almost stopped.(14) Four months later, the same aircraft was hovering at 4000 feet near Mersing in South East Malaya while providing a calibration target for the Air Defence Ground Radar Station at Bukit Gombak in Singapore. A failure in the front gearbox was followed by an immediate forced landing in a sharply confined space—gaining the pilot a Green Endorsement in his log book. After a gearbox and synchronising shaft change in the field, the aircraft resumed flying six days later.(15) These two cases were classified merely as 'incidents', but would have been profoundly disturbing had there been any general lack of confidence in the aircraft.

The only questionable effect on morale noticeable in No 66 Squadron occurred early in the Borneo campaign when, in mid-1964, pilots were not required to complete their two or three week stint at Kuching if the aircraft serviceability was too low to employ them fully. There was some suspicion by the incoming Squadron Commander in 1964 that vibration levels—essentially a subjective judgement prior to the fitting of vibration meters—were held to require rectification too often, thus permitting an early return to Singapore by some pilots.(16) Whether this was so or not, a change in the system requiring the completion of fixed periods at Kuching regardless of aircraft serviceability soon coincided with a reduction in Belvedere rectification rates in Borneo. Generally morale in No 66 Squadron was extremely high and in April 1965, for example, all five Belvederes in Kuching were flown in formation to celebrate 100 per cent serviceability, and the starter explosion which followed soon afterwards was regarded merely as part of the accepted pattern. The eleven ship formation in October 1967 speaks for itself (Chapter 12).

It appears then that there may have been inappropriate Station servicing organisation and some initial lack of understanding in the Middle East theatre at Command, Station and/or Squadron level, which may have contributed to the ultimate fate of the Belvedere there. In the presence of evidence from FEAF, however, the conclusion must be that—as for all aircraft properly supported at staff level, serviced by dedicated specialists and flown by well supervised crews—the Belvedere was eventually no different from the first version of any other successful RAF aircraft, and better than some, with the sole exception of its engine starter system which, having been denied resolution for financial and future planning reasons (see below) was still being discussed and modified by the contractors (AEI) as late as 1967.(17)

Retrospective View of the Whirlwind in FEAF

Quantitatively, the Whirlwind Mk 10 in the Far East as well as elsewhere gave the impression of being a highly reliable, comparatively cheap, rather slow but flexible aircraft whose somewhat restricted payload (between one third and one quarter of that of the Belvedere) was nevertheless such and enormous improvement over the previous Mk 2 and 4 piston-engined versions that its qualitative defects seemed relatively minor, especially when compared to the notorious Belvedere problems. At least an attempt was made to correct them by modification action. The difference, however, was mainly one of scale, since some of the technical defects of the Whirlwind Mk 10 would probably have proved quite disastrous in practical terms had they occurred in the tiny Belvedere force. Throughout the main Confrontation period there were about 45 RAF Whirlwinds available in FEAF but never more than eight Belvederes up to the end of 1965, rising to 13 in 1967 (after Confrontation).

In July 1967, one of the two Mk 12 Whirlwinds of the Queen's Flight (VIP versions of the Mk 10 Whirlwind) suffered structural failure while carrying a crew of two and the Captain of the Queen's Flight together with the Flight Engineer officer. All were killed. At first it was thought this was due to a fatigue crack found in the spar of one of the rotor blades, and all Whirlwinds were grounded except for operational flights, pending Non Destructive Testing (NDT) of the rotor blades.(18) This was followed in December 1967 by the discovery of a serious fatigue crack in the spar of a Belvedere rotor blade originating from a score mark occurring during manufacture. 50 per cent of all Belvedere blades in FEAF were then found to have scribing or other marks on the blade spars, but in the same month the more serious news was revealed that the Queen's Flight crash resulted from loss of the rotor head caused by fatigue failure of the main rotor drive shaft originating in the manufacturing process of the high tensile steel shaft which was unique to the Whirlwind. All Whirlwinds were grounded and all Whirlwind gearboxes had to be returned to Westlands. Of 104 shafts inspected (RAF and RN) 42 were initially rejected, although some of these were later recovered after remedial action.(19) Replacement became a matter of extreme urgency and the priorities were allocated as follows:

1. FEAF SAR
2. Hong Kong
3. MEAF SAR
4. UK SAR
5. Flying Training Command
6. Balance of FEAF Support Helicopters
7. No 38 Group
8. Others

A two-year modification programme also had to be instituted for all existing Whirlwind (and Wessex) rotor blades, and serious doubts were expressed about quality control at Westlands.(20)

In early 1970, the rate of failure of Whirlwind tail rotor blade bonding had reduced stocks to a point where the shuttling of individual tail rotor blades between the UK, Hong Kong and Singapore was needed to avoid grounding of the whole fleet, and this did in fact occur from time to time in Singapore at this period (see Chapter 12).

Throughout the whole period from the introduction of the Whirlwind Mk 10 in 1962 to 1971, the Whirlwinds had suffered a series of more or less unexplained engine failures in flight, mostly taking the form of compressor stalls or progressive power loss described as engine rundown. In the early days these were mostly attributed to computer or computer-throttle actuator malfunctions, but many were not satisfactorily diagnosed. Later theories included malfunctioning of Inlet Guide Vanes or Fuel System Components, dirt and/or corrosion in the compressor, aerodynamics of the intake with door design changes coupled with rain ingestion and crosswind effects. In the UK it seemed that winter temperatures made matters worse. It was not until March 1971 that Strike Command generated a full study by the Director of Flight Safety (DFS) by complaining that they had experienced ten engine rundowns in 1970 and five in the last four months, adding that the trouble had existed undiagnosed for ten years. AMSO reported to VCAS in April 1971 that there had been a tendency to assume a solution was found as each of the various troubles had been identified and modification action taken but it was difficult to reproduce the effects and inconsistent results were produced after changing from one door shape to another. The latest mystery was stalling of the engine compressor four or five minutes after rain ingestion was stopped.

DFS produced a report in May 1971 (21) recording that Whirlwind engine rundown had been a major cause for concern since the aircraft first entered service. Of the 65 Whirlwind Mk 10 accidents which had occurred since then, 35 (53.8%) had been initiated by this cause resulting in twelve aircraft being written off and 23 suffering Category 3 or 4 major damage at an estimated cost of £1½ million. The rate had been seven rising to eight per 10000 flying hours and recent reports indicated an upward trend. 32 per cent in FEAF and 40 per cent of the total in the UK were due to 'causes unknown' and 72 per cent of these remained unknown after investigation by the manufacturer. In the Wessex, the gnome engine had reduced from an initial peak of 14 rundowns per 10000 flying hours on entry to service to six from 1965 until 1969 and thereafter to three. Statistics suggested that the Whirlwind problem was worse at low power settings in winter in the United Kingdom, and due to water ingestion in FEAF, and recommended a study of nose door shapes and the effect of low temperatures on minimum fuel flow settings.

Thus, while a statistical survey defined the situation for all to see, there was still no specific solution available. At least the Belvedere engines, once started, very rarely malfunctioned thereafter.

Policy Effects of Belvedere and Whirlwind Experiences up to 1971

In the case of the Whirlwind, no new policy stance was needed as a result of operational experience. The case for the Wessex to replace the Whirlwind was already well established and the change had begun in the UK in 1962 with Nos 228 and 22 Squadrons at Leconfield and St. Mawgan. The engine rundown problem had never been seen as a long term difficulty having for ten years been apparently on the very threshold of a solution, until Strike Command, who were going to be left with the Whirlwinds in the SAR and communications roles for the indefinite future (that is until the Wessex replaced the Whirlwinds in all other roles) drew attention to the actual situation as described above. Even then there was no undue excitement. Eight or nine unexplained engine failures per 10000 flying hours did not seem especially daunting to practical operators and although Buckingham Palace confirmed after the fatal accident to the Queen's Flight Whirlwind in July 1967 that it had not been the practice for Her Majesty The Queen to use helicopters and saw no reason to suppose that policy would change, once the main rotor drive shaft defects had been remedied Prince Philip and other members of the Royal Family resumed flying in the remaining Whirlwind Mk 12 of the Queen's Flight, pending its replacement by the Wessex.(22) The need to find a better and air portable replacement for the SH Force of the 1970s was a separate discussion and it is described later.

For the Belvedere, however, the effect of its behaviour on policy was much more profound. The refusal by AFME in June 1965 to believe that the Belvedere could be made to work satisfactorily in Aden (23) finally ended any remaining support for the aircraft in Whitehall and, by implication, any support there might have been for a developed version as a successor (eg WG7). Even before 1960 there had been a lobby in MOD which believed that the Vertol 107 (predecessor of the Chinook) was preferable to the Belvedere which was then in the throes of early development (see Chapter 8). The fact that the Vertol 107 was in many ways, including control and stability, in an even earlier stage of development than the Belvedere, was not generally recognised. The unfortunate consequences in the early Chinook (CH-47) became clear in 1965 at about the same time as the death knell was sounded for the Belvedere. Two simultaneous arguments then took place—how to get rid of the Belvedere and how to obtain the Chinook—against the background of a policy which called for a future SH capability to provide a seven-company lift (24) which is described later.

How to Get Rid of the Belvedere

In June 1965 VCAS recorded that since 1961 the Belvedere was notorious for unserviceability and rate of wastage. The engine starters had caused two aircraft to be written off, resulted in Category 2 damage to two more and had caused 37 categorisable incidents since the beginning of 1963.(25) Even with the latest modifications the AVPIN system remained dangerous both inherently and in vulnerability to enemy ground fire. This was supported by DFS with the information that Belvedere wastage was double that of the Whirlwind and that the aircraft had the highest write-off rate of any aircraft in service—more than double the next highest. The Director of Air Engineering (D Air Eng) joined in with statistics showing that the Belvedere rectification was four times more expensive in manhours than the Whirlwind or Wessex, in scheduled servicing 12 per cent more than the Whirlwind and 50 per cent more than the Wessex, and in costs per flying hour for all servicing in the ratio of 12 : 6.5 : 9 for Belvedere/Whirlwind/Wessex respectively, but no comment was recorded on the small size of sample then available, or on the size, payload and speed of the Belvedere. From then onwards all discussions started from the premise firmly and repeatedly urged by the Assistant Chief of the Air Staff (Operational Requirements) that the Belvedere should be disposed of and replaced by the Chinook by whatever means and as soon as possible.(26)

On 4 August 1965 a meeting was convened by the Minister of Defence for the Royal Air Force attended by CAS, VCAS, DCAS, ACAS(OR) and DG Eng intended to relate the Belvedere to current general helicopter policy. The Minister agreed with the principle enunciated by ACAS(OR) that the Belvedere should be deleted as soon as possible but he was not sure about the availability of the Chinook to replace it. The question of the modification to introduce the Olympe engine starter to deal with the Belvedere starting problems had been discussed by the Air Force Board in the previous month and the point was taken that it would be difficult to justify the modification unless the aircraft was to remain in service for at least two years subsequently, ie until 1969 (which in fact it did). The resurgence of the Belvedere in FEAF, where it was at last beginning to demonstrate its longer term potential, was clearly something of an embarrassment in this atmosphere and DG Eng said that while it now appeared to be satisfactory in FEAF, it was 'not being used in real operations'. This extraordinary statement is not explained further in the records, neither is the reply to the consequent question by CAS as to how or whether the Belvedere could be kept out of the battle.(27) The feeling was clearly that the starter modification should not be incorporated because it might extend the Belvedere's life and ACAS(OR) asked DG Eng directly whether the Belvedere was now otherwise modified to a safe standard for the next two years—ie to 1967. DG Eng replied that it was, with the proviso that the engine starters could still blow up. CAS thought this was contradictory. The decision was to delay three months to November pending the forthcoming September evaluation of the Chinook.

The following month AUS(AS) repeated the warning to the Minister that if the Olympe starter was fitted the Belvedere might have to be retained in service for some years to come, and at a meeting on 24 August 1965 (28) the Air Force Board agreed to defer the engine starter modification pending a clearer picture of the future size and shape of the helicopter force with particular reference to the Chinook. No further attempt was made to replace the Belvedere engine starter system. CAS advised the COS Committee that the RAF did not wish to keep the Belvedere longer than was absolutely necessary.(29)

How To Obtain The Chinook

In February 1965 the Chiefs of Staff discussed the need for an increase in SH for a seven-company lift and recorded that the required Wessex increase would take two years but the Chinook would be available in the current year and should therefore be the preferred choice.(30) It was thought possible that two per month might be obtained starting in July. It was recognised that certain difficulties might arise—there might be political problems in buying American so soon after the purchase of Phantoms and Hercules and, it was now noticed, there were many modifications and much development work still needed on the Chinook. It was decided to send an investigating team to the United States in March to evaluate the situation. What they found was not encouraging. Following two fatalities all Chinooks were grounded and remained so throughout the visit. A failure in the stability augmentation system (none was necessary on the Belvedere) had resulted in a complete loss of control, there were technical problems with the blade droop stops, there had been fires in the aft pylon after gearbox oil starvation and also following a double engine failure, a blade root had failed resulting in blade disintegration and all of the eight major accidents recorded so far had terminated with a major airframe fire. Ease of escape from the cabin was most unsatisfactory—only three push-out windows were provided and two of these would be lost if the aircraft fell on its side. A delay of at least one year was expected with a possible in-service date at the end of 1967.

The Operational Requirements branch of MOD now demonstrated a single-minded determination not to be deflected from obtaining the Chinook similar to that which had been needed six years earlier to bring the Belvedere to life. They recommended waiting for the Chinook problems to be solved and resisted any idea to add to the Wessex force even if an increase in SH should be approved; or that the S-61 or RN Wessex 5 should be accepted in order to help the RN to obtain the S-61—evidently a proposal which had been made or was being prepared. By February 1966 they were advising Air Plans to refuse to discuss a trade-off of SA-330s (Puma) against a Chinook order and not to 'give up the ghost' because there might be financial difficulties with the Chancellor; they urged that the Chinook would have great value in logistic support and could lift the P-1127 (Harrier); and, finally, that failure would mean expensive attempts to keep the Belvedere in service—a course which

had already been agreed as a most unproductive exercise.(31) As a final fall-back position, the recommendation was that the intended Chinook numbers (24 to support a UE of 18 were intended) (32) could be further reduced to 15 supporting a UE of 12 so that it became no more than a Belvedere replacement rather than the widely flexible multi-role aircraft they envisaged. The important thing was to get some into service.

At this point a red herring appeared in the form of the Sikorsky CH-53. (The French three-engined Super Frelon had also been considered but discarded because of inadequate performance). In August 1965 the Ministry of Technology was preparing a paper on the whole field of helicopters and the industrial implications having an implicit threat to the very continuance of Westlands. By December they were applying pressure in support of Westlands for the tactical version of the Sikorsky SH-3D (CH-3C—later CH-53) as a competitor for the Chinook (33), Westlands expecting to build the aircraft under licence as in the case of the previous Sikorsky designs—Wessex, Whirlwind and Dragonfly. During 1966 this option was kept alive with tentative interest shown by the German Air Force and a detailed comparison was made. The CH-53 was expected to have a similar performance to that of the Chinook but while being more modern it was not yet ready and so unproved. The favourable German reports were regarded with some caution as they were known to be biased towards a single main rotor configuration.(34) The costs would be 25 per cent higher than for the Chinook, and although there was a last minute offer by Sikorsky to reduce the price, the clinching argument and the one placed first in the brief for the Secretary of State in March 1967, was that to choose the CH-53 would delay the date for the Belvedere replacement.(35)

Treasury approval was obtained early in 1967 for the purchase of 15 Chinooks to support a UE of 12, including two for training. Belvedere unit viability experience was quoted to support the case for placing them all together and, since they were not air transportable and the active service areas of responsibility were mainly east of Suez, they were to be located in the Far East where they would directly replace the existing Belvederes.(36)

To prepare for the introduction of the CH-47 Chinook into RAF service, a combined Ministry of Technology and RAF Group consisting of a management team (Wing Commander Engineer team leader, Pilot deputy team leader, one Squadron Leader Electrical, a Secretarial officer and a representative from the appropriate Finance Branch), and a Provisioning Team (one Squadron Leader, one Flight Lieutenant and three civilian supply experts) was dispatched to the United States Army AVCOM at St Louis in April 1967. A CSDE technical servicing team consisting of one Squadron Leader and two Flight Lieutenants was set up at the manufacturer's plant in Philadelphia.(37)

All went well and arrangements were made in October 1967 for a CH-47 to carry out a demonstration at Odiham which took place in early November. However, the Defence Review of 1967 which announced (inter alia) a sharp reduction in defence spending and the intention to withdraw completely from east of Suez by December 1971, had virtually demolished the arguments chosen to support the case for the Chinook, all of which were destined for the Far East. On 22 November 1967, with the RAF Chinooks appearing on the production line, a signal from the Ministry of Technology to the United Kingdom CH-47 teams in the United States announced the cancellation of the Chinook order.(38)

Offsetting to some extent the brutal finality which seemed to be implied by this sudden shock, Air Plans took the opportunity to remind the Air Staffs that in April 1966 (39) DCAS, in setting out the SH requirements for the 1970s, made the point that the helicopter crane lift facility was not exclusively tied to military deployment plans and that aircraft recovery was a valuable role as well. The P-1127 (11000 lbs), Wessex (9000 lbs), SA-330 (8200 lbs), also bulky spares such as engines for the P-1127 (Harrier) were all legitimate loads for the crane lift helicopter, the case for which might possibly be raised again sometime in the future.(40) In fact the raising and dashing of hopes in this respect continued throughout the 1970s—that is, beyond the scope of this part of the history—finally succeeding with Chinook deliveries in 1980.

The 1965 decision to discard the Belvedere in favour of the undeveloped CH-47 rather than to solve its problems with the modifications known to be needed, had two main consequences: firstly, there was no heavy lift helicopter at all for over ten years after the Belvedere, whose life had, surprisingly to some quarters, been very successfully prolonged until 1969, when it ceased to exist; secondly, the opportunity to design and build a British-developed successor to this comparatively very advanced twin rotor helicopter was permanently lost.

Future Plans For The Support Helicopter Force

Apart from the formation of a new helicopter squadron in Hong Kong (No 28 Squadron) and support for the UNFICYP Forces in Cyprus mentioned later, basic policy discussion in the second half of the 1960s was concerned mainly with updating the plans for the Support Helicopter Force for the 1970s after the Belvedere and Whirlwind were to have been replaced. The Wessex Mk 2 although new in the early 1960s was realistically seen as basically obsolete and no more than an interim vehicle but the only one actually available on which calculations could at first be based. In any case, there was likely to be a hiatus until 1970 before the aircraft to meet NAST 365—the 'utility' battlefield helicopter (see Chapter 9) would be available and in the meantime there was a rising demand which needed to be satisfied.

In early 1965, the requirement was for a six-company lift—two by the Royal Navy and four by the RAF—and this was translated into 54 Wessex for the RAF plus 16 representing the logistic support requirements currently being supplied by the waning Belvedere force. There was reluctance to increase the Wessex force both because of the timescale involved and the prejudicial effect this would be likely to have on the progress of NAST 365. This, together with the Army heavy lift requirement and the support likely to be needed for the forthcoming Kestrel (Harrier), was the first argument deployed in the efforts to obtain the Chinook which was optimistically described as having only financial difficulties in its way.(41)

In August 1965) the Royal Navy withdrew anti-submarine warfare as a role for NAST 365, announced that they preferred the SH3D (CH 53) and would therefore withdraw completely from NAST 358 (heavy lift helicopter). NAST 365 was then redrafted exclusively as a tactical helicopter and discussion centred on how many there should be and what mix was desirable with the Wessex and hoped for Chinook.

Shape of the Support Helicopter Force

The calculations based on the number of companies requiring helicopter lift and the types of helicopter likely to be available had always been the crucial denominators of the size and shape of the SH force. A third element was added to these considerations in the mid-1960s—that of air portability of the helicopters and their likely permanent deployment pattern. From 1965 until the end of 1967 some permanent deployment in the Far East was assumed, but by January 1966 both the Army and the RAF had concluded that in any case the main SH force should be air portable.(42) Self-ferry was too difficult, ship transport would be too slow and adequate support for the helicopters after an initial ship-mounted assault would be lacking. The Army stressed the importance of immediate helicopter support from the moment of the initial assault. Available airlift consisted of the small fleet of Belfasts (six) and the more numerous and therefore more reliable Hercules. All this added up to strong pressure to obtain the SA-330 (Puma) helicopters, ideally to replace all, but initially at the very least a significant number, of the Wessex (which would not fit in the Hercules) on which plans current in 1965 depended. Chinooks replacing the Belvederes and placed in the Far East were assumed throughout as part of the background scenery.

There had since 1964 been a Helicopter Sub-Group of an Anglo-French Aircraft Working Group which is mentioned later, exploring the possibility of formulating a joint RAF/Army/RN/French Operational Requirement and preparing for possible collaboration. In March 1966 this Group undertook a detailed examination of the SA-330 with strong encouragement from the French.

There was a momentary interruption in this enthusiastic progress when the Foreign Office suddenly inserted a bid to have the Italian Agusta 205 considered for

collaborative development for diplomatic reasons. This was sharply rebuffed by the Air Force Department OR branch as a non-starter, at the same time pointing out that collaboration with the French offered the only chance of expanding British industry with original as opposed to foreign licensed activity.(43)

A note by the Defence Secretary in January 1966 foresaw with remarkable accuracy, with the exception of the Chinook, the future pattern as:

- a. SA 330s arriving in the early 1970s.
- b. Wessex used for the training role and replacing the SAR Whirlwinds.
- c. 24 Chinooks starting to replace the Belvederes in 1966.
- d. Sycamores in the training role to be replaced (SA-340?) in 1967.(44)

The case for as many SA-330s as could be afforded to replace the Wessex was strengthened by the RAF calculation that while two SA-330s could be loaded in the Belfast in 13 hours, two Wessex would take 24 hours due to the need to remove the rotor heads. Four SA-330s could be loaded in 33 hours but two Wessex was the maximum load. Perhaps more realistically, two SA-330s could be loaded in a Hercules in 43 hours, but the Wessex could not be carried thus at all. In an example it was said that two days spent dismantling Far East based SA-330s in order to carry them in indigenous Hercules to an operational scene in, for example, Africa, was greatly preferable to waiting, perhaps for weeks, for Belfasts or sea lift to become available.(45)

Size of the SH Force

As recorded in Chapter 9, the SH requirement expressed in terms of company lifts had been calculated in 1964 as six companies, two of which were to be carried by the RN Commando ships and the other four by the RAF. All subsequent calculations of the number of companies to be lifted included the two by the Royal Navy—a requirement which remained unchanged.

In 1965 the total company lift required had grown from six to seven. By April 1966 the Chiefs of Staff had established a requirement for seven and a half companies disposed as follows:(46)

- a. Two and a half companies East of Suez—one company air portable based in Singapore, one company in the Commando Ship East of Suez and a half company in the Persian Gulf.

b. Two companies, both air portable—ie deployed by Hercules—for the strategic reserve in the UK.

c. Two for BAOR.

d. One in the Commando Ship normally West of Suez.(47)

Because it was assumed that financial constraints would prevent this plan being approved, the generally agreed procedure seemed to be to state this requirement and then acknowledge the overriding economic strictures by voluntarily reducing the bid for planning purposes. Thus, the five and a half company lift for the RAF (13 SA-330s, or 20 Wessex per company) was argued for three companies by SA-330 (39 Unit Establishment) and two and a half companies by Wessex (50 Unit Establishment) supported by 18 Chinooks. These figures were then reduced, in deference to the economic situation, by one company of SA-330s in BAOR (in order to maintain the all important East of Suez needs) and a reduction in the number of front-line Chinooks from 18 to 12. (15 Unit Establishment). The package could then be produced showing a reduction in costs from £214M to £176M with the SA-330 bid reducing from 68 to 48 and the Chinook purchase initially at least 15.(48) The Chief of the General Staff showed his reluctance to accept this deal by pointing out that in the 52 operations in which the Army had been involved since the Second World War there had seldom if ever been enough helicopters and that the priority given to helicopters compared to other requirements should be extremely high. The Air Force Department added in a note to the Chiefs of Staff that the strategic reserve and its helicopter force were now inseparable and that a seven and a half company lift was the true minimum requirement. Nevertheless, it was agreed that for financial reasons the bid should stand at six and a half company lift.(49)

As a result of Stage II costings produced after the July 1967 Defence Review, a further half company lift was deleted from the post-1975 requirement which therefore stood once again at six company lifts, two of which were to be provided by the Royal Navy.(50) At the same time the Finance Branch (F6) noted an improved planned wastage rate for the SA-330 and caused some consternation by recalculating the requirement as 43 instead of 48 aircraft.(51) These two setbacks were followed swiftly by the announcement in November 1967 of the intention to withdraw completely from East of Suez by December 1971 and to reorientate our strategy towards NATO and Europe. The whole helicopter exercise had to be done again.

It had already been accepted that any forced cuts in the previous plans were to be felt mainly in the heavy lift helicopter field (Chinook) rather than in the air portable support helicopter capability.(52) This latest news, coupled with the fact that the whole of the proposed Chinook force was to be located in the Far East, ensured the cancellation of that programme.

In February 1968 AUS(AS), after mentioning defence budget reductions of £110M in 1969/1970 and £210-£260M in 1972/1973, observed with surprise that attempts were being made to justify the same size of Support Helicopter Force as before the East of Suez decision was taken. He suggested 25 SA-330s might be enough. VCAS refused to accept that elements of the front line could be specifically identified with the East of Suez strategy, adding that this was not how we used air power.(53) In spite of this we had lost the Chinook and there could be no case for reducing the numbers of SA-330s. There had been a change of strategy and it was appropriate that the matter should be re-examined under a Central Staffs Chairman. Air portability was now more important; training areas were widely separated; the Allied Command Europe Mobile Force had to be supported; NATO required increased mobility and the Harrier would need considerable helicopter support. Nevertheless, the number of SA-330s he was defending had shrunk further from 43 to 40.(54)

In January 1968 the Army and Air Force Departments had agreed a position based on the following assumptions:

- a. BAOR would remain at a strength of six Brigades of which one would be deployed in the UK.
- b. The strategic reserve Division would be assigned to NATO in a mobile role but would retain some internal security commitments outside Europe.
- c. The amphibious force would remain in being with a role on the flanks of NATO.

The two-company lifts to be provided by the Royal Navy would normally be embarked in the Commando ships. If as was assumed these were given a role on the flanks of NATO, the number of support helicopters available for the Army would be reduced to a four-company lift.(55)

In 1966 the Chiefs of Staff noted that HQ BAOR had stated an operational requirement for the equivalent of a ten-company lift for fighting the Corps battle in general war. In view of the low probability of war in Europe they did not consider it realistic to provide this number but they did state that a two-company lift was the absolute minimum general purpose support helicopter force for BAOR.

A study approved by the Chiefs of Staff was examining the earmarking of the Third Division (the strategic reserve) for Allied Command Europe with one Brigade in the central sector in an air mobile role, and another in North Norway requiring a three-company lift and a half company lift respectively. Relating this to the 1966 assessment the deployed commitment would be:

- a. Strategic reserve—three and a half company lifts.
- b. Six other BAOR Brigades—two company lifts.

To this must be added a Squadron to be provided for the Air Mobile Force (Land), half of which would be provided by the UK.(56) The incipient formation of a six aircraft squadron in Hong Kong was known about, but the prolongation of No 103 Squadron in Tengah with the ANZUK Force (see Chapter 12) until 1974 could not have been foreseen at that time. The irreducible minimum therefore stood at the six company lift already planned. The air mobility of a proportion of this force to meet internal security operations in Dependant Territories as well as its load lifting capability in the absence of the Chinook was adduced to support the bid for 40 SA-330s. As an insurance against future degradations of these figures in the event of further changes in defence policy, it was argued that any possible future surplus of helicopters would be absorbed by diverting up to one company lift worth of Wessex into the training and SAR roles so that there would have to be a reduction to below a three and a half company lift for the Army before there would be a serious risk of surplus helicopters, and as that would be below the acceptable minimum for NATO support operations, the order for 40 SA-330s was justified.(57)

The conclusion that, whether on the criteria used to establish the requirement in 1966 or on the strategy likely to result from the forthcoming Defence Review in 1968, the planned SH Force of six company lifts (two by SA-330s) was still necessary, set the scene for Phase 4 for the Support Helicopter Force in the 1970s.

Anglo French Helicopter Package

As already mentioned, the Helicopter Sub Group of the Anglo French Aircraft Working Group had been working since 1964 in preparation for future collaboration following the formulation of a joint operational requirement, and by 1966 was making a detailed study of the SA-330—the aircraft in which the RAF was primarily interested. Joint Franco/British configuration, joint production, possible use of the Gnome engine, a version for the Royal Navy and costs for various sizes of order were discussed.(58) A long study of air portability was undertaken which succeeded in establishing the need for as many SA-330s as could be afforded, rather than the Wessex, to go with our transport fleet of Hercules and the very few Belfasts.

The expression 'utility' helicopter had first been used in the early 1960s to denote the type of rugged simplicity thought to be appropriate for the front-line battlefield troop-carrying but also multi-purpose helicopter envisaged as a replacement for the Whirlwind. By the mid-1960s it was becoming clear that the trooping role could not be readily mixed with the anti-tank rocket, cannon and machine-gun-firing helicopter envisaged by the Army, and the term 'utility helicopter' came to be used to describe the latter. It was at least partly euphemistic since the role of the ground

attack helicopter, which was what was really meant, was not yet fully accepted. (Policy for the armed helicopter is discussed later). The SA-330 seemed likely to meet the needs of the RAF in the trooping and resupply role, but it was by no means a simple and rugged ground attack aircraft, although it was rather too large for the Royal Navy which also had a role for the attack helicopter. The Westland WG-13 appeared to fill the attack torpedo role and, still known as the utility helicopter, became the Anglo element of the joint Anglo-French Package. The RAF interest was limited to training and possibly communication work for the WG-13.

The third part of the trio now being jointly discussed was a much smaller machine filling the existing Army role of Light Observation Helicopter (LOH) and for this the SA-340 was proposed—the RAF and Royal Naval interest being confined to training and special liaison roles.

By October 1976 the RAF had calculated its bid for SA-330s as 68, to provide three squadrons of thirteen—that is a three company lift. It was recognised, as previously explained, that the third company lift might have to await a more favourable financial climate, and so while 68 was the initial bargaining figure, 45 or 48 was seen as the realistic requirement initially.

In January 1967 the LOH (SA-340), Utility Helicopter (WG-13) and Support Helicopter (SA-330) were discussed jointly with the French as a complete package. Estimated quantities were as follows:—

- a. LOH-UK 620 (Army 550, RN 50, RAF 20)
France 100 (all Army)

- b. Utility
UK 374 (Army 250, RN 100, RAF 24)
France 230 (Army 150, Navy 80)

- c. Support
Helicopter
UK 48 (RAF)
France 130 (Army)

Of the UK figures in this assessment, those for the Support Helicopter were by far the firmest.(59)

The Secretary of State endorsed this package deal, a Ministerial agreement was signed on 16 January 1967 to allow development planning to start and in February 1967 a Memorandum of Understanding for the Joint Anglo-French Helicopter Programme reached the final stage of ratification.(60) The RAF version of the SA-330 was to be the same as the French except for British communications and

navigation equipment, instrument panel, improved air portability and a UK paint scheme. Deliveries were planned to take place between 1970 and 1973. The RAF proportion of the order was too small to justify arguments for using the British Gnome engine.

During the second half of 1967 and throughout 1968 the by now absolutely standard and apparently inevitable progression of alarms and crises were generated by the nevertheless unexpected rises in both costs and aircraft weight, the latter causing a reduction in promised performance. The RAF requirement for a load of 4000 lbs at 5000 feet altitude, ISA plus 20° temperature, and 200 feet per minute vertical climb at take-off, was for a radius of action of 75 nautical miles. 55-47 nautical miles now seemed to be the figure being offered.(61) Pressure on the French to upgrade the engines or otherwise restore the performance was demanded, but as the Deputy Director of Operational Requirements pointed out, we had tied the French to the WG-13 and the RAF was now tied to the SA-330. Eventually, the French were able to offer a radius of action in the stated conditions with a guaranteed minimum 57 nautical miles, a possibility of 69 nautical miles, with a 95 per cent probability of 63 nautical miles.(62) This was accepted.* There was a brief drama when the RAF order for 48 SA-330s was reduced to 43 as already described. The French found out about it prematurely and there was a sharp argument between the Ministry of Technology and the Air Force Department of MOD as to who had weakened our bargaining position,(63) but all in all, with its awkward supply and technical problems and the complicated financial adjustments, the whole deal went through comparatively smoothly.

At the end of 1968, the RAF reviewed its training and communications policy in respect of the SA-340 and WG-13 requirements, and concluded that the surplus Whirlwinds being thrown up by the withdrawal from FEAF were a better source of communications aircraft to replace the ageing and obsolete Sycamores still in use (five in the Metropolitan Communication Squadron and due for retirement in 1971) than the expensive and small SA-340. In the training pattern it was decided to replace the Sioux (Bell 47) in the basic phase by the SA-340, but then to progress

*in 1983 a calculation based on a particular but typical Puma at Odiham considered as it would have been in 1971, that is prior to the subsequent increases both in basic aircraft weight and permissible all-up weight, showed that a radius of action in these conditions would have been about 55 nautical miles. A later increase in basic weight due to modifications, coupled with a rise in permissible all-up weight would have increased the figure to 65 nautical miles, while the introduction of the more efficient plastic rotor blades in the early 1980s together with a further increase in the permissible maximum all-up weight resulted in a radius of action in these conditions of about 90 nautical miles. Any further increases in maximum permissible all-up weight could extend this range still further.

in the advanced stage to the readily available Wessex instead of the expensive WG-13 which could then be deleted from the intended RAF inventory. This left the RAF interest in the Anglo-French Package as a total number of SA-330 now reduced to 40, and a very small number of SA-340s.(64)

Names For The Anglo-French Helicopters

Choosing names for the three helicopters in the Anglo-French Package was taken quite seriously in that in January 1968 all the staffs of the Ministry of Defence Air Force Department were invited at Director level to submit proposals. The names were to be short, similar in both French and English, appropriate to the operational use of each aircraft and not already in use.(65) The Secretariat issuing the direction set the tone for what was clearly going to be a popular word game by pointing out, for example, that 'Discorde' with or without an 'e' would be a non-runner. The response was enthusiastic and two months later it was possible to issue what was described as a summary of 69 suggestions received, although since there were only very few duplicated proposals, what was offered was more in the nature of a summarily chosen list:—

For the SA-330:— Atlas, Machete, Mistral;

For the SA-340:— Vedette, Lynx, Hirondelle;

For the WG-13:— Guillemot, Cormorant, Sirocco.

The Air Force Board opted out of selecting names for the WG-13 and SA-340 because they had only a minority interest and preferred to leave it to the Army and Navy to choose, but agreed on Machete with Atlas and Mistral as alternatives for the SA-330. In July 1968 all three were opposed by the Ministry of Technology on the grounds that Machete had different pronunciations, was irrelevant to aviation and in any case was claimed by the Army to be a piece of Army equipment. In August the deputy Chief of the Air Staff then offered Normandy and Consort with Brigand, Carosse, Gauntlet and Warrior as alternatives, adding that none seemed fully appropriate and that the French suggestion of Puma was more suitable for a ground attack aircraft. In September the Air Force Board considered Normandy and Consort and in October settled on Normandy. But the French said Puma for the SA-330 and Gazelle for the SA-340, and so it was.(66) The WG-13 was later named Lynx.

The Armed Helicopter

With the support helicopters being occasionally shot at in Aden and Borneo and in the light of evidence from the Americans in Vietnam, the Senior Air Staff Officer in FEAF declared in December 1963 that operational helicopters needed two pilots, both partly protected by fixed seat armour, that all crew members should wear

armoured torso protection and that at least an emergency portion of the fuel should be in self-sealing tanks (see Chapter 9). Shortage of SH lift precluded heavier equipment as well as further SS-11 guided missile fits. (The RAF had four Whirlwinds equipped for SS-11 firing—see Chapter 9. The Royal Navy had several more). On 14 January 1964 the Deputy Chief of the Air Staff issued the basic policy for armed RAF support helicopters based on the premises that helicopters would not intentionally be committed to an opposed assault unless fixed-wing ground attack aircraft were available; and that the SH lift capability would not be significantly degraded. Consequently fixed armour protection would be provided for first pilots only (although two pilots would be carried on operations), free-mounted guns would be carried for prophylactic fire and to respond to unexpected attack, crews would wear armoured vests and self-sealing tanks would protect at least emergency fly-out fuel supplies.(67)

This policy, reiterated as an order to all Commands and Groups in October 1964,(68) remained the unchanging RAF attitude during all the subsequent turmoil surrounding the steadily mounting pressure throughout the late 60s to enhance the fighting ability of the military helicopters. The first attempt to introduce change, drawing on the practice of France and the United States, sought to provide extensive armament and armoured protection to a small proportion of the SH Force which could then act as escort to the troop-carrying SHs. This was resisted on grounds of shortage of existing SH lift which, as already stated, was not to be reduced. It should be noted here that while it was not intended to launch SHs against known opposition, the possibility of meeting enemy defensive fire was, as far as the RAF was concerned, to be countered by the 'availability' of fixed-wing ground attack aircraft, and this highly orthodox if somewhat entrenched response was also maintained throughout later arguments.

What followed looked sometimes like a simple Army/RAF inter-Service chauvinistic dispute and while there may inevitably have been some elements of such a natural response on both sides, in the early stages at least the discussions and proposals were conducted against the background of real fighting in two overseas theatres with a perilously small but absolutely vital transport helicopter force. Thus, the RAF refused resolutely to accept a policy which would allow any SH to be committed where there was a high risk of encountering enemy fire, so attempts to increase offensive or defensive armour in helicopters beyond the 1964 policy were automatically opposed. At a more theoretical level was the conviction that if offensive air action was needed, firstly it was a Royal Air Force responsibility to provide it and, secondly, it should be carried out by fixed-wing aircraft or, later perhaps, by some entirely new variant, but never by helicopters as then understood.

The Army on the other hand was acutely aware, particularly in Borneo, of the impracticability of summoning fighter ground attack aircraft to deal with any type of fleeting targets including those unexpectedly encountered during SH trooping

operations, and quite naturally sought to fill what they saw as a gap in the low speed short-range, quick response air capability by adding some offensive role to the aircraft already at their disposal, that is anti-personnel bombs and bomb sights in Beavers, and machine guns, 2-inch rocket launchers and anti-tank guided weapons (SS-11) in Scout helicopters. The bombing equipment for the Beavers was proposed by the Deputy Chief of the Imperial General Staff—Lieutenant General Sir John Hackett—in February 1964, saying it was purely for Beavers to use in the course of normal reconnaissance sorties or counter-insurgency operations in Borneo, while the anti-tank weapons were to be merely a mobile reserve at Unit and Brigade level. He emphasised that nobody need fear that the Army Air Corps was building up a massive ground attack capability.(69)

The response in the Air Ministry Policy Branch was one of outrage—engagement of armour from the air was a Royal Air Force or Royal Naval responsibility. What may well have been an entirely logical Army response to a real situation nevertheless appeared to the RAF to be the cynical fulfilment of a long predicted power bid. Sir Dermot Boyle, chief of the Air Staff in 1959, was quoted as warning that further encroachment by the Army Air Corps could be expected after the bid to exceed the agreed 4000 lb weight limit in order to obtain control of the Beaver. The then War Minister (Mr Soames) was quoted as saying there was no intention to use them outside the liaison role—there was no need for anxiety that they ‘might hang bombs on the aircraft and turn them into a fighting platform’. Now they were asking for a bomb sight to be fitted. RAF Twin Pioneers would be fitted with bomb racks but if the requirement was for counter-insurgency operations as opposed to armed SRT operations, the RAF must be seen to be ready and willing to provide support. In this case the addition of a few armed piston Provosts into FEAF would be preferable to allowing the Army Air Corps to acquire a new role recognised by Ministers.(70)

Air Staff advice was not from one direction only. In February 1964 the Director of Air Staff Briefing, Air Commodore le Cheminant, commented that the 1956 agreement that the Army would be responsible for ‘unarmed aircraft used solely in the AOP and Light Liaison roles with a maximum all-up weight of 4000 lb’, had been followed by a progression through a planned front-line of 21 Beavers and 21 Scout helicopters (unarmed) to the present proposal (February 1964) for 285 light helicopters and offensive armament for the Scout/Beaver component. At each stage (on formation of the AAC—no wish to exceed 4000 lb all-up weight; on exceeding 4000 lb weight—no intention to arm the aircraft; now on proposing to arm certain aircraft, there was no intention to build up a ground attack capability) the War Office had assured the RAF that there was no intention of straying outside the AOP/light liaison role.(71) On the face of it the RAF seemed to have good reason to believe that the Army was deliberately moving step-by-step towards development of their own fighter ground attack substitute. At this stage the rockets and anti-tank guided weapons (SS-11) proposals had not been mentioned, although they

were to be only two months later. Air Commodore le Cheminant felt that Army development of armament for the helicopters could not be opposed in principle and could ultimately be helpful to the RAF, but bombs on Beavers was a different matter. He suggested that if the RAF established a squadron of Beavers in FEAF, AFME and No 38 Group for offensive support work the question of Army control of the Beavers could be re-opened.(72)

In the ensuing Air Staff discussion the decision was, and remained so in subsequent crises when the demands for armed helicopters became acute, not to appear unwilling to co-operate but to pass the problem for detailed study by a Joint Service Committee, in this case charging the Assistant Chief of the Air Staff (OR) to ensure that the Assistant Chief of the Defence Staff (OR) did not proceed unilaterally but in full consultation with the Joint Warfare Committee. The Chief of the Air Staff replied to the DCIGS merely that the clearance and provision of machine guns for the Army Air Corps Scout helicopters in the Far East was being actioned and that the other requirements would be studied by the Joint Warfare School.

In April 1964 the Chiefs of Staff Committee (73) discussed a report from Headquarters FEAF which listed the three Service practices in respect of armed helicopters:

- a. Royal Navy—Hiller helicopters—no armament.
Wasp (Naval version of Scout)—primary anti-submarine role only.
Wessex—side firing machine guns plus two fixed forward firing guns—50 per cent of aircraft with fixed fittings for SS-11 missile and 50 per cent with fixed fittings for launching 2-inch rocket projectiles—emergency fly-out fuel protection, seat pan armour and flak vests for crews.
- b. Army—The offensive support role is not supported except for suppressive fire for success in the primary role, that is reconnaissance and light liaison. Nevertheless equipment to allow attacks on opportunity targets or engagement of tanks with SS-11 guided missiles should be provided for both Scout and Unit light helicopters. Armour for pilot seats is regarded as an unacceptable weight penalty, but armoured vests for the crews was agreed. Emergency fuel protection is being examined.
- c. RAF—SRT aircraft are not hazarded in an offensive role. Any armament or armour has to be capable of being fitted in 15 minutes. Fixed forward firing machine guns have no value in this context but all helicopters should have provision for mounting operator aimed waist guns. Torso armour for crews, emergency fuel protection and armour for the first pilot seat are all required.

The Chiefs of Staff concluded bafflingly that there was nothing in the paper to require alteration of the single-Service policies for arming helicopters, but then implied a special case for Borneo operations by disagreeing in principle with the offensive role for the small number of helicopters in Borneo which might suffer high losses.

At this point a highly embarrassing mistake was made in Borneo (Operation BLUNT) when a purely offensive helicopter operation was mounted on 31 March 1964 without prior approval being sought from the Commander-in-Chief Far East. The Air Task Force Commander and Director of Operations Borneo approved a plan by the Commander Western Brigade and the Forward Air Commander to mount an assault on an enemy camp in a good defensive position on the top of a mountain ridge on the Indonesian border south of Simanggang, using artillery and SS-11 firing helicopters in support. The helicopters concerned were Royal Naval Wessex but could equally well have been RAF Whirlwinds. Six SS-11 missiles were fired and the position was taken with one of the enemy dead. During the withdrawal there was further enemy contact and the helicopters were again committed, firing two more SS-11 missiles and fixed front and cabin mounted machine guns. One more of the enemy was killed. The operation was successful and no aircraft were lost, so there was no need for public recriminations. The point was noted, however, that this was undoubtedly an offensive air action and would have been even if the helicopters had carried troops. In fact they were not used in the transport role at all. It was feared that a dangerous precedent had been set but appropriate apologies were made, the Air Task Force Commander admitted he should have sought prior approval of Commander-in-Chief Far East, and it was confirmed that FEAF was maintaining the previously agreed policy.(74) There was no significant change in this position in the remaining life of FEAF. The next moves were made in the United Kingdom about two years later—in 1966.

The SH force in the United Kingdom for most of Phase 3 consisted of 72 (Wessex) Squadron at Odiham in No 38 Group—part of Transport Command with Headquarters at Upavon. The Squadron responded to bids for SH participation in exercises from the Army Headquarters at Salisbury. The Army Air Corps Centre at Middle Wallop was close by. It was therefore natural that No 38 Group and Transport Command should be acutely conscious of Army thinking in respect of SH development and it was the Commander-in-Chief of Transport Command, Air Chief Marshal Sir Kenneth Cross, who warned in March 1966 that the Army was thinking in terms of Short Range Transport armed assault and promising a policy proposal soon.(75) In the following month it duly appeared and called for a change in the existing (1964) policy to allow support helicopters to take part in the assault role or to escort other helicopters in that role. He advised urgent action to provide fixed fittings for both armament and protective armour.(76) The same month VCAS discussed with CAS the Army intention to submit a paper to the Joint Warfare Committee about the arming of helicopters, and as a result the Army was persuaded

to withdraw it in favour of initiating a much broader study by the JWC on the Army/RAF offensive support requirements including the P-1127 (Harrier), Jaguar and armed helicopter, thus avoiding precipitate decisions.(77) In March 1967, the new C-in-C Transport Command (soon to be re-named Air Support Command), Air Marshal Sir Thomas Prickett, complained that in spite of his predecessor's efforts there was still no advance on the 1964 policy and drew attention to a recent meeting between Flag Officer Naval Flying Training, General Officer Commanding No 3 Division and the Air Officer Commanding No 38 Group after which the latter urged provision for a forward fixed gun firing capability for the RAF support helicopters to establish compatibility with the RN practice.(78) At that operational level the RAF seemed ready to concede the Army case for moving away from the purely defensive posture for the SH.

In June 1967 the JWC spoke after a full and detailed study. The four conclusions did not seem especially contentious but the meeting (79) was momentous in that it formally initiated the role for the Army helicopters to carry and use offensive armament. The conclusions were:

- a. The offensively armed helicopter would in no way affect the validity of other existing forces (ie the RAF need not fear that the fighter ground attack roles would be superseded by this new facility).
- b. It was agreed that there was a need for helicopter mounted point defence during transport operations as well as for prophylactic area fire to protect support helicopters.
- c. The Army needed the facility to attack special small targets and to provide ground convoy protection, especially when there was no time to summon RAF fighter ground attack support.
- d. The Royal Navy required to mount attacks on enemy surface ships, there being no question of availability of RAF fighter ground attack for this task.

The Air Force Department accepted these conclusions with considerable misgivings.(80) The usefulness of helicopter mounted light machine gun fire in internal security operations or in the later stages of airborne operations after fighter ground attack aircraft had withdrawn, was the limit of their support. They did not agree with the Army case for attacking opportunity targets and thus for armed reconnaissance sorties, nor for anti-tank guided weapons (ATGW) roles which seemed likely to lead to specialised armed attack helicopters which would not be cost-effective. The helicopter was a bad weapons platform and the result would be a loss of flexibility in other SH roles.

It seemed that the thin edge of a dangerous wedge had been driven home although it was recognised that it was important not to appear reactionary. The Air Staffs were concerned that a new branch of aviation seemed to be opening up without proper guidance—there would shortly be more advanced derivatives of the helicopter offering a variety of armed roles with important implications not least in command and control, and it would be wrong to allow a fixed wing/rotary wing split to develop between the Services since both would be required in future generations of aircraft; moreover, the effect of training costs and careers in having more than one flying service in a cost limited force structure should be considered. If it was then proved that rotary wing aircraft were valid for ground attack and close support weapon systems, the initiative should be taken and an Air Staff requirement should be drawn up. Meanwhile the Army should reappraise their policy for obtaining large numbers of helicopters for uneconomical deployment down to Unit level. AUS(AS) added that Army helicopter figures should be subject to the same strictures as were applied to the RAF order for the SA-330s, and not regarded as immune because of the device of treating helicopters as an item of unit equipment akin to three ton lorries.(81)

In September 1967 the Air Force Department commented on the conclusions of the Joint Warfare Committee in JWC 9/67, now endorsed by the Chiefs of Staff, as follows:

‘It is the Air Force Department’s view that RAF SH should have button-on (ie easily and temporarily fitted) armament fit to provide suppressive fire power on those occasions when the operational situation so demands. The question of whether or not the armament should be fitted for a particular operation would be at the discretion of the Air Commander. The ability of the SH to carry out its primary task is of overriding importance.’

All Wessex and Whirlwind squadrons were to be scaled with free-firing General Purpose Machine Guns (GPMG) using standard 7.62 mm ammunition.(82)

During the closing weeks of 1967 the Army enthusiasm for creating an instant new ground attack Air Force reached a climax, was partially defused, and settled down into a more cautious rational examination of practical and cost-effective courses of action. In December 1967 the Army Department stated that they could not live with the RAF limitation of having only ‘button-on’ armament as they needed a turret-mounted gun for range and accuracy and so wanted 30 WG-13s in the fully armed role as offered to the French. At an Army Board meeting on 15 December it was claimed that the agreement by the Chiefs of Staff to the recommendations in JWC 9/67 for the Army to operate armed helicopters cleared the way for obtaining a purpose-built helicopter for the offensive armed role with a turret-mounted gun. However this turned out to be more than even the Army Board could swallow. It was pointed out that the versatility of the general purpose

helicopters in Borneo was indisputable and, furthermore, the turret-mounted gun was useless against tanks—an early indication of the new thinking which was to crystalize the policy for the offensively armed helicopter as an anti-tank weapon for the next decade and beyond. At the same time the Army Aviation policy of scattering helicopters across the board down to Unit level was refined to one where centralised control could be operated over squadrons allotted at Corps, Division and Brigade levels.(83)

Meanwhile the C-in-C Air Support Command (still Air Marshal Sir Thomas Prickett), like his predecessors acutely aware of practical pressures arising from the close liaison between Army authorities in Salisbury and the AOC No 38 Group, returned to his previous argument now stating a requirement for a 250 knot helicopter, providing two hours airborne Fighter Air Controller at a radius of action of 75 nautical miles, able to fire SNEB rockets, 30 mm cannon, 7.62 light machine guns, grenades and ATGWs. It was to carry two pilots with dual controls, be robust and air portable. He opined that if it were not proposed by the RAF, it would be demanded by the Army. He was also concerned that all air-to-air and air-to-ground support, reconnaissance, parachute assault, resupply and logistic support must be co-ordinated under one Air Commander exercising the proven principle of central theatre control for maximum flexibility and economy for all air power functions.(84) But Whitehall had moved beyond this stage in respect of the specialised armed helicopter, and the Air Force and Army Departments together were preparing to study in much greater depth the longer term developments which might be both practical and appropriate. The reply by VCAS to the C-in-C Air Support Command in January 1968 summed up the considered Air Force Department view on the whole subject then and in subsequent years, and so is quoted here in full:

‘Thank you for your letter of 20 December outlining a requirement for a supplementary, less sophisticated, means of delivering air-to-ground weapons to augment our planned offensive support aircraft.

We are aware that, although the quality of our close support capability will be much improved with the introduction of the Phantom and the Harrier, the Army fear that there may still be a gap in the spectrum of close support weapons. Last month the General Staff came out in an Army Board Paper with a firm requirement for an armed version of the WG-13 which they had intended to table in the ORC (Operational Requirements Committee). However, the Army Board, approaching the problem rather cautiously, invited DCGS (Deputy Chief of the General Staff) to make a more detailed study of the need for a specialised armed helicopter and to report back about mid-1968. We shall be keeping a careful watch on this study as, to our way of thinking, a specialised armed helicopter would be of little use outside the fire support role and would thus not be very cost-effective. That is why we favour button-on armament for a helicopter which could then have the usual range of roles when not required for fire support.

On a more positive note our Future Operational Requirements Evaluation Committee has been speculating on the basic conflict between the need for speed as a protection against ground defences and the advantages of slowness when acquiring and aiming at targets. They believe that we should study the tactical advantages which might result from an aircraft which could fly economically, and with good manoeuvrability, throughout the speed range, from moderately high tactical speeds down to, and including, vertical or short take-off and landing. Such a performance range might be achieved in the future by high speed rotor craft but there may be several other technological possibilities including the addition of high lift devices to a fixed-wing aircraft. This might allow speed and height to be freely exchanged to suit a wide variety of levels of warfare and different tactical situations and might be a particular advantage in hilly terrain (including jungle) and at night in bad weather. It is of course very uncertain what performance bracket could be achieved (and by what date), nor is it in any way certain that a wide speed range aircraft would be more cost effective than separate slow and fast aircraft, each providing V/STOL. However, we believe that the prima facie case warrants further examination and we are therefore seeking technological advice from the Ministry of Technology with the aim of raising an Air Staff Target. At the same time we propose to conduct tactical trials in the low-slow corner of the flight envelope using both helicopters and slow flying fixed wing aircraft on a comparative basis.

The trials will involve comparing results achieved by the Hunter, representing the high speed aircraft, with those of representative current helicopters against an inconspicuous target. Both the frequency and speed of target acquisition and exposure time to ground fire will be recorded and the results compared. Although there are obviously limitations to such an investigation we are convinced that some practical work of this kind must be undertaken urgently. We have therefore invited the General Staff to join us in sponsoring this trial with which your Command will shortly be tasked in co-operation with Southern Command. I personally hope that we shall be sufficiently fortified by the results to state, at least, an Air Staff Target.'

It will be seen that the RAF was once more acting in its traditional and inevitably unpopular role in the helicopter world of mitigating fierce enthusiasm for a short term albeit highly exciting development, in favour of a realistic widely based professional assessment of real alternatives. Just as the Air Staff opposed enthusiasm for the Air Horse in 1947 (see Chapter 4), and the Rotodyne in 1960 (see Chapter 9), so now they urged caution in dedicating expensive and vulnerable helicopters exclusively to the ground attack role. This time, however, there were two crucial differences:

- a. Something new had to be done to oppose the vast tank forces of the Warsaw Pact powers poised to sweep across Europe.

b. 'Button-on' armament might seem to preserve the flexibility of the helicopter, the implication being that it could easily be unbuttoned, but the technical advances and target acquisition, laser range finding, infra-red and low light television equipment and others, were to specialise the armed helicopter to such a degree that they were to become almost totally dedicated to the ground attack role as a matter of inevitable fact.

The consequence was that while the RAF successfully 'won the game' in preventing the acceptance of the fully dedicated ground attack helicopter, they inevitably 'abandoned the match' (at least for the time being) by ensuring that only the Army Air Corps would develop the ground attack armed helicopter, while the RAF adhered primly to its purely transport role with light machine guns carried at times of danger.

The reply by VCAS to the C-in-C Air Support Command did not mention command and control aspects which were to be left for later discussions when the development possibilities were properly identified. Meanwhile, the Future Operational Requirement Evaluation Committee had already been tasked (October 1967) with considering the long term trends in the offensive support role—ie after the Phantom.(85)

The series of trials promised by VCAS took place in 1968 and 1969 to establish the viability of the helicopter in the offensive support role both in respect of target acquisition and, in particular, vulnerability—the targets by this time having become almost exclusively tanks, no doubt influenced by the late 1967 decision on withdrawal from East of Suez and the consequent increased concentration on the possible land battle in Europe. They were in four phases and were conducted under the titles HELTANK and SPARROWHAWK. Regardless of these trials, the Army Department was fully convinced that the helicopter was an essential weapon in dealing with the Russian tank threat in Europe, and in February 1968 the Chief of the General Staff proposed to the Secretary of State that there was an immediate and urgent need to equip 30 Scouts with SS11 missiles for anti-tank defence. He added that a GSR (General Staff Target) for the next generation of anti-tank helicopter weapons would follow shortly. From this time on, the Army Department conducted the argument in terms not of whether to arm helicopters with ATGW but which missile to choose.

By July 1969 the Operational Requirements Committee had provisionally approved the General Staff Requirement for Anti-Tank Guided Weapons for the WG-13 and SA-340 (Lynx and Gazelle), subject to review of further information on the vulnerability studies still in progress (HELTANK and SPARROWHAWK). Both the Army and the Royal Navy were showing signs of irritability with the Air Force Department's continuing concern about helicopter vulnerability, and were locked into highly complex discussions with the Ministry of Technology about suitability, timescale and price of various missile options.(86) VCAS declined to participate in

a 'presentation' to the Minister because the Air Force Department felt that studies had not yet shown that arming of helicopters was an effective way of carrying out the tasks due to their vulnerability both from the ground and the air.

In October 1969 the Assistant Chiefs meeting recorded that recent studies (particularly SPARROWHAWK) had not yielded conclusive evidence on the kill rate for armed helicopters. Although there was not a firm case to support helicopter-borne ATGW, they nevertheless decided to accept the requirement in principle and allow development of SWINGFIRE (the current favourite missile) to proceed, while adding that further studies were needed to establish the facts.

At the end of 1969 the SPARROWHAWK and HELTANK reports were analysed in detail. As might be expected the results were largely inconclusive showing both that helicopters could hit tanks with guided missiles, and could themselves be shot down both from the ground and air. There were too many variables on which assumptions had to be made to establish firm predictions, but some especially dangerous situations could be identified. Thus, ATGW helicopters should not be committed to attack static concealed defensive positions, but in a mobile situation, committed 'with prudence', they could make a 'useful contribution to anti-tank defence'. Insofar as specific calculations could be made, it was tentatively calculated that six tanks could be destroyed per helicopter lost. The Operational Requirements Committee accepted that 'the ATGW helicopter could make a useful contribution to anti-tank defence', and endorsed the General Staff Requirement (3431) for the Lynx and Gazelle on 18 December 1969.(87)

The Air Force Board was only marginally concerned with the detailed discussions which went on during the next two years with the Ministry of Technology and Finance Branches about which ATGW missile should be ordered, how many and when, so long as they counted as button-on armament and did not lead to a specialised ground attack armed helicopter. Similarly, when in July 1970 the Royal Navy proposed a study of helicopter vulnerability in attacking gun-defended Fast Patrol Boats, the RAF replied merely that as they did not propose to use helicopters to attack FPBs, there was no need to co-sponsor that study. The final step in this phase of development concluded in September 1971 when a joint Army/RAF Working Party on the Specialised Armed Helicopter issued its report which concluded:—

- a. That a purchase of Specialised Armed Helicopters cannot be justified at the present time.
- b. That the identified primary offensive task of Army helicopters—the destruction of armour—can be performed satisfactorily by Utility or light helicopters fitted with ATGW systems.

c. That the Joint Helicopter Tactical Development Committee should be invited to task the Joint Helicopter Tactical Development Unit to periodically review the requirement for Specialised Armed Helicopters and to take account of any changes that may occur in the circumstances in which they would be provided and operate.

These conclusions were duly agreed by the Air Force Board, who demonstrated their unchanging adherence to previous doctrine by adding:

'In leading the RAF participation in this study, the Director of Air Plans has made it clear to the Army Department that the Royal Air Force is interested in considering any weapon system, even with a performance less than its present or projected aircraft, which might be viable in a Priority 1 situation. Thus, for example, the Royal Air Force would wish to consider fixed-wing aircraft such as the NJT (New Jet Trainer—Hawk) rather than Specialised Armed Helicopters.'

The Chief of the General Staff gave his support to the conclusions and recommendations of the Report.(88) And so the RAF remained exclusively with its Search and Rescue and Support Helicopters but with fittings for free firing machine guns in the Support Helicopters.

Colonel John Everatt-Heath writing in 'NATO's 15 NATIONS'—an independent review of economic, political and military power—October/November 1982, Volume 7, No 5, comments regarding the place of the helicopter on the battlefield:

'... after an initial period of scepticism (the helicopter) is now appreciated and every nation that can afford them already has combat helicopters.'

and later:

'The NATO combat helicopter is regarded as equipment of the ground forces operating in a ground environment as part of an all arms formation ...'

Even at the time of writing (1983) there exists a considerable divergence of views on the precise point, if there is one, where helicopter support ceases to be an RAF responsibility and belongs more properly with the Army, but it is clear that at the outset of the development of the combat helicopter, the Air Force Department saw no role for itself and deprecated that specialisation.

References to Chapter 14

- 1 J Banks.
- 2 ID9/941/11.
- 3 Ibid.
- 4 Wing Commander Dowling.
- 5 Munro.
- 6 J Banks.
- 7 Ibid.
- 8 Munro.
- 9 Wing Commander Dowling.
- 10 No 26 Squadron ORB.
- 11 Banks.
- 12 No 26 Squadron ORB.
- 13 Flight Lieutenant Perratt.
- 14 No 66 Squadron ORB.
- 15 Ibid.
- 16 Wing Commander Austin.
- 17 No 66 Squadron ORB.
- 18 ID9/941/9.
- 19 Ibid.
- 20 Ibid.
- 21 Ibid.
- 22 Ibid.
- 23 ID9/941/11.
- 24 ID9/F5-42.
- 25 ID9/941/11.
- 26 Ibid.
- 27 Ibid.
- 28 AFB 11(65).

- 29 ID9/F5-41 Pt 1.
- 30 ID9/F5-42.
- 31 Ibid.
- 32 ID9/F5-43.
- 33 ID9/F5-41 Pt 1.
- 34 ID9/F5-46.
- 35 ID9/F5-43.
- 36 ID9/F5-42.
- 37 Group Captain Ramsden.
- 38 Ibid.
- 39 COS 49(66).
- 40 ID9/F5-42.
- 41 ID9/F5-41 Pt 1.
- 42 ID9/F5-41 Pt 2.
- 43 ID9/F5-70 Pt 1.
- 44 ID9/F5-41 Pt 2
- 45 Ibid.
- 46 ID9/F5-70 Pt 1.
- 47 COS 22;/66.
- 48 ID9/F5-41 Pt 2.
- 49 Ibid.
- 50 ID9/F5-70 Pt 1.
- 51 Ibid.
- 52 ID9/F5-41 Pt 2.
- 53 ID9/F5-70 Pt 1.
- 54 Ibid.
- 55 Ibid.
- 56 Ibid.
- 57 Ibid.
- 58 ID9/F5-70 Pt 1.
- 59 Ibid.

- 60 ID9/F5-72.
- 61 Ibid.
- 62 ID9/F5-70 Pt 2.
- 63 ID9/F5-70 Pt 1.
- 64 ID9/F5-70 Pt 2.
- 65 ID9/F5-73.
- 66 Ibid.
- 67 ID9/941/12.
- 68 AF/F4-5 Pt 3.
- 69 ID9/941/12.
- 70 Ibid.
- 71 Ibid.
- 72 Ibid.
- 73 COS 136/64.
- 74 ID9/941/12.
- 75 Ibid.
- 76 AF/F4-5 Pt 3.
- 77 Ibid.
- 78 ID9/941/12.
- 79 JWC 9/67.
- 80 AF/4-5 Pt 3.
- 81 Ibid.
- 82 ID9/941/12.
- 83 Ibid.
- 84 AF/F4-5 Pt 3.
- 85 ID9/941/12.
- 86 Ibid.
- 87 Ibid.
- 88 Ibid.

APPENDIX 1 A DETAILED DESCRIPTION OF THE CHARACTERISTICS OF THE SYCAMORE

The Sycamore played a prominent role in all theatres where helicopters were used, for practically the whole period covered in this history. Its handling characteristics were quite unique and so was its appearance. Some of the reasons for these qualities require explanation.

The Sycamore was a completely individual development by the Bristol Aeroplane Company, not derived from any previous production helicopter, and it displayed characteristics which reflected specific personal convictions of its designer—Mr Raoul Hafner. One of the most significant of these features concerned the manner in which control forces were balanced and compensated in the rotor system, thus permitting easy manual control at all weights and speeds, and eliminating totally any requirement to fit hydraulic assistance as was becoming necessary in the Sikorsky helicopters. This feature had a considerable influence later and is referred to in relation to the control system of the Sycamore's successor—the Belvedere.

It is not intended to give here a study of all the engineering innovations involved in the Sycamore beyond referring to the use of tie-bars to carry blade centrifugal forces rather than the flapping hinges. Hafner himself regarded this as the most productive and important modification to previous helicopter design. What is offered rather is a brief explanation of the unusual handling characteristics experienced by the pilots and the reasons for them. The only seriously objectionable modification was not put there by Hafner or the Bristol Aeroplane Company.

BASIC AIM: Basically, Hafner wanted a fast manually controlled helicopter which cruised and stood on the ground with the fuselage substantially level. The manual control was dealt with by rotor blade design and the tie-bars just mentioned. The fuselage was streamlined to produce a sleek, low drag shape with a short rotor pylon and an extremely compact rotor head. The determination to have a level fuselage in the cruise and when standing on the ground produced some handling problems during take off and in the hover, but these were acceptable on the grounds that the helicopter spent only a minute fraction of its time in the take off and hover, and the cruise condition should be the one on which to concentrate.

SOLUTION: It seemed reasonable to arrange for the fuselage to be level in the cruise with the cyclic stick substantially central, instead of the stick forward nose down attitude normal to other helicopters in forward flight. This was achieved by tilting the rotor head forward about 5 degrees. The inevitable consequence was that in take off to the hover, which was the normal sequence for getting airborne, the Sycamore which sat in the conventional level attitude when on the ground, had to

assume a nose up attitude (about 5 degrees) immediately on leaving the ground. In other words, the pilot had to hold the cyclic stick aft of the central position before leaving the ground if he wished to avoid taking straight off into forward flight.

Secondly, in pursuance of the same principle, the control system was arranged so that the lateral movement of the stick towards the advancing side of the rotor disc which was necessary in other helicopters as forward speed increased was eliminated in the Sycamore so that the disc tilted fore and aft as the stick was moved fore and aft at cruising speed rather than in the hover. The designer's aim was achieved in that the stick was thus central both fore and aft and laterally in the steady cruise condition, rather than forward and slightly to one side as was the requirement in the Sikorsky helicopters where the stick was central in the hover. The consequence was that during take off to the hover, the Sycamore pilot not only had to hold the stick back to avoid moving forward, but this action also tilted the disc to the left (because there was no airspeed) and had to be compensated by displacement of the stick to the right to achieve a vertical take off.

The stick trim controls were by comparatively powerful springs tensioned by two wheels, one for fore and aft and one for lateral forces. These wheels were set before take off to balance the stick forces in the correct position for hovering flight, but as the aircraft was level when at rest and had to assume a nose up attitude on leaving the ground, the pre positioning of the stick aft and to the right had to be done against the pressure of the springs. If the pilot failed to find the correct position, he was made immediately aware of an error in the fore and aft sense because he could see and correct any tendency for the aircraft to move forward or backwards.

Insufficient right pressure on the stick was more difficult to detect because sideways motion was resisted by the non-castering main undercarriage wheels. In this case if power was increased slowly (and the ground effect was comparatively powerful beneath the unusually low rotor disc) the aircraft could pivot in the rolling plane on its port wheel quite rapidly before achieving take off power, and if this movement was not corrected in time, the main rotor would disintegrate on contact with the ground and the aircraft would fall on its left side.

If the stick were correctly positioned before take off, or if the 'unstick' was performed reasonably smartly there was no danger. Both precautions were part of the basic technique and only if both were omitted was there any risk. All the pilots were taught these techniques and for several years there was virtually no trouble. One or two incidents gave rise to the general impression that the Sycamore had some sort of inbuilt tendency to roll to the left on take off, but it was not until February 1966, when CFS had three such accidents in one month, that it was concluded that the aircraft must be at least partially at fault and the occasion was

taken after ten years service to hasten their withdrawal from the training scene in favour of the Sioux.

It can be seen clearly in retrospect that this was a case of an important technique losing significance by usage over the years. The Sycamore continued however to be used for VIP communication flying for six years afterwards.

Central Collective Lever

The control peculiarities described above were no particular problem to pilots once they had become accustomed to them. Of much more concern was the fitting of a shared central collective lever in the Mark 14 Sycamore.

The earlier Sycamores (Mark 10 and Mark 11) had been built in the days when helicopter first pilots sat on the left side of the cockpit simply because that was the side used by fixed-wing pilots. By the time the Mark 14 Sycamore appeared, the more sensible position in the right seat had become the norm. The main reason was because the pilot could not relinquish his hold on the cyclic stick even for an instant without going out of control, and the cyclic stick was normally held in the right hand. The collective lever could be released for short periods (not for long because of the manual rotor speed control) and so the left hand was partially free to operate switches, radio, trimmers and instruments as required, and these facilities had to be mounted centrally. A further benefit of moving the first pilot to the right-hand side was to remove the left-hand collective lever from the port side doorway for operations. The requirement should have been to mount a removable collective lever to the left hand side for use in training sorties but unfortunately in the Mark 14 Sycamore the opportunity was taken to mount a single collective lever between the two seats, ostensibly for use by either pilot. Thus the pilot in the left seat would have to operate the cyclic stick with his left hand and the collective and throttle lever with his right hand—ie the reverse of the usual arrangement. In addition, in order that the pilot in the left seat would be able to operate the throttle with his right hand, the twist grip had to be turned through a right angle so that it was presented athwartships on the end of the lever.

This regrettable aberration produced the most serious and only really thoroughly objectionable feature of the Sycamore. It was directly responsible for the total write off of several aircraft involving one fatality and very numerous incidents or near accidents, as well as extending the instructor's course on the aircraft by at least ten hours for each pilot (ie 30%) and often more. At the same time it made it impossible for Squadron or Flight Commanders to perform dual checks on their pilots unless they happened to have completed the CFS instructors course themselves, which was rarely the case. The fact was that only the helicopter pilots who had tried it knew how difficult it was to change hands on the controls and how

frequently the aircraft would very nearly crash while attempting to manoeuvre near the hover or in transitions to hover while flown from the left seat.

Confusion could occur at any stage of flight, particularly in moments of stress, but the most common effect was felt in the hover where any tendency to sink or move backwards was likely to be instinctively answered by an upward and backward movement of the left hand and a simultaneous forward pressure by the right hand. From the left hand seat of the Mark 14 Sycamore, the effect would be to accelerate the movement of the aircraft backwards and downwards. If it struck the ground before this response could be corrected, the aircraft would crash tail rotor first quite slowly but very completely, with considerable danger to bystanders. Very few realised how much practice would be needed for an experienced pilot to become fully competent (even if never at ease) in handling the aircraft in all manoeuvres from the left hand seat and the problem was not recognised in the Air Ministry where there were no helicopter pilots at that time. When this unfortunate error was recognised it was too late to reverse it. The Staff Officers who allowed it had no reason to suppose there was any greater problem involved than in changing hands to operate central throttles while flying in right or left hand seats in most fixed wing aircraft. When they were told by CFS that the problem was of a different order they did not believe it because it seemed to be an unsupported assertion. There was no comment from A & AEE.

The Sycamore was not different from other early helicopters in that control at or near the hover was almost entirely achieved by means of carefully acquired conditioned reflexes in the pilot, but not all helicopter pilots were aware of this fact. It needed a psychologist to explain that if that were so, then changing hands on the controls would produce a permanently dangerous condition. Unfortunately, the need to obtain psychological advice in this respect was not realised at the time. It was later learned that this condition had been experienced in America some years previously where a similar mistake was made (and expensively corrected) with the original Hiller 360 and before that in the Sikorsky R4. The effect on the pilot was known to the US Naval Institute of Aviation Medicine psychologists as 'retroactive inhibition'. The condition was recognised in theory by the IAM at Farnborough as 'negative transfer'. Both agreed it was a situation to be avoided, but it was too late when this evidence was discovered during a visit by the Central Flying School to the USA in 1955, for a change to be made to the Mark 14 Sycamore. The consequence was that almost the only pilots who ever flew the Mark 14 Sycamore from the left seat were those who had undergone the Instructor's course at the Central Flying School.

APPENDIX 2 CFS HELICOPTER FLYING TRAINING SYLLABI

1. Three syllabi are included—that for the Skeeter ab-initio helicopter pilot training (1957) is derived directly from the original Dragonfly and Sycamore sequences planned for 50 hours and formulated in 1956.
2. The second specimen syllabus (1959) consists of the complete ground and air sequence up to the start of operational training.
3. The third syllabus is a 1967 refinement and expansion of the 1959 syllabus to 60 hours and assumes the previous completion of a basic stage on the Sioux.

APPENDIX 2 Annex 1

APPENDIX to CFS/C.9/40/15/Air
dated 26th June, 1957

ROYAL AIR FORCE SYLLABUS FOR AB INITIO HELICOPTER PILOT
TRAINING—SKEETER

DUAL SOLO

PART A—PRE-SOLO

Ex. 1 Familiarisation with Helicopter Type

- (a) Explanation of aircraft
 - (i) Externally
 - (ii) Internally
- (b) Cockpit layout
- (c) Controls
- (d) Aircraft systems
- (e) Drills and desirability of systematic checks

Ex. 2 Preparation for Flight

(Before Flight)

- (a) Clothing and flying equipment
- (b) Aircraft acceptance and authorisation
- (c) External Aircraft check
- (d) Cockpit check
- (e) Clearance for starting
- (f) Starting and warming up
 - (i) Normal
 - (ii) High Winds
- (g) Cockpit checks and run up
- (h) Take off checks

(After Flight)

- (a) Running down
 - (i) Normal
 - (ii) High Winds
- (b) Leaving the Helicopter

	<u>DUAL</u>	<u>SOLO</u>
Ex. 3	<u>Air Experience</u>	
Ex. 4	<u>Effect of Controls</u> (translation flight)	.15
	(a) Cyclic stick	
	(b) Collective pitch, throttle and rudder	
	(c) Engine handling	
	(d) Further effect of cyclic stick due to	
	(i) Airstream	
	(ii) Disc loading	
	(e) Further effect of collective pitch—throttle closing— autorotation	
Ex. 5	<u>Power and Speed Changes</u>	.30
	(a) Handling of cyclic stick with reference to:—	
	(i) Stability	
	(ii) Attitude and airspeed	
	(b) Handling of collective lever, throttle and rudder, practice in:—	
	(i) Power changes with constant RPM	
	(ii) Correction of RPM with constant power	
	(c) Handling of all controls, practice in:—	
	(i) Straight and level flight	
	(ii) Climbing and descending (with medium turns) at recommended power	
	(d) Reference to instruments	
	(e) Engine handling	
	(f) Look out	
Ex. 6	<u>Autorotation</u>	.30
	(a) Look out	
	(b) Entry and development of autorotation	
	(c) Control of speed and RPM	
	(d) Recovery of powered flight	
	(e) Verbal warnings	
Ex. 7	<u>Hovering</u>	.30
	(a) Effect of controls in hovering flight, both separately and inter-related	
	(b) Hovering, cyclic stick only	

PART B—POST-SOLO

Ex. 13	<u>Sideways and Backwards Flight</u>	.15	.15
	(a) Sideways flight, with particular reference to power, height and directional corrections required due to translation (Heading into wind)		
	(b) Backwards flight, as above		
	(c) Combination of sideways and forward and backward flight		
	(d) Look out		
Ex. 14	<u>Turns on the Spot</u>	.15	.30
	(a) Hovering across wind and downwind		
	(b) Turns on the spot through varying degrees up to 360°		
	(c) Assessment of wind strength and control during turns on the spot		
Ex. 15	<u>Taxying</u>	.15	.15
	(a) Use of controls, and control of forward speed		
	(b) Taxying over rough ground with reference to ground resonance		
	(c) Use of brakes		
	(d) Taxying out of wind		
Ex. 16	<u>Engine-Off Landings</u>	3.00	1.30
	(a) Autorotation to 50 feet, re-engagement and overshoot		
	(b) Engine-off landings at low forward speed		
	(c) Verbal instructions and acknowledgements		
Ex. 17	<u>Vortex Ring State</u>	.15	
	(a) Demonstration		
	(i) Symptoms and characteristics		
	(ii) Methods of recovery		
	(iii) Recommended method		
	(b) From vertical descent with power		
	(c) From engine re-engagement during autorotation		
	(d) From powered approach downwind		

	<u>DUAL</u>	<u>SOLO</u>
Ex. 18 <u>Forced Landing</u>	1.00	1.30
(a) Autorotation at different air speeds		
(b) Controlling angle of descent by		
(i) Changing airspeed		
(ii) Changing RPM		
(c) Autorotation into fields after simulated engine failure, showing different height lost in left and right turns		
(d) Manoeuvre margins		
(e) Steep turns in autorotation		
(f) 'Spot' engine-off landings		
Ex. 19 <u>Low Flying</u>	.45	1.00
(a) Familiarisation of low-flying training area		
(b) Use of controls with reference to speed and height		
(c) Effect of wind with constant ground speed fast and slow		
(i) Into wind		
(ii) When turning		
(iii) Downwind		
(iv) Across wind		
(d) Low flying in bad visibility		
(e) Steep turns		
(f) Slow flying in restricted areas		

PART C—APPLIED FLYING

Ex. 20 <u>Advanced Manoeuvres</u>	2.15	2.15
(a) Steep turns, including max-rate		
(b) Out of wind take-off and landing		
(c) Downwind transitions		
(d) Sideways and backwards flight heading out of wind		
(e) Transitions from the hover to the hover		
(f) Quick stops		
(g) Turns on the spot in min. radius		
(h) Clearing turns		
(j) Hovering at height		

	(k) Vertical climb at 200'		
	(l) Vertical descent from 200'		
	(m) Approach from confined spaces		
	(n) Take-off and landings in confined spaces		
	(o) Take-off and landings in confined spaces		
	(p) Loading and unloading in the hover		
	(q) Advanced co-ordination exercises		
Ex. 21	<u>Pilot Navigation</u>	1.00	1.00
	(a) Map reading		
	(b) Calculating fuel requirement, with reference to loading and C of G		
Ex. 22	<u>High Altitude Simulation</u>	.45	.30
	(a) Running take-off and reduced power (Demo)		
	(b) Running landing from engine-assisted approach at reduced power		
	(c) Demo. Jump take-off with reduced power		
Ex. 23	<u>Flying at Loading and C of G Limits</u>	.45	.15
	(a) Take-off at max. AUW		
	(b) Transitions at max. AUW		
	(c) Circuits and landings at max. AUW		
	(d) Take-off and landing at max. forward C of G Limit		
	(e) Take-off, circuit and landing with rearward C of G		
Ex. 24	<u>Flight at High Altitude</u>	.30	.30
	(a) Effect on control in basic manoeuvres		
	(i) Cyclic		
	(ii) Collective		
	(iii) Throttle		
	(b) Autorotation		
	(c) Limitations		
Ex. 25	<u>Instrument Weather Procedure</u>	2.00	

	<u>DUAL</u>	<u>SOLO</u>
Ex. 26 <u>Night Flying</u>	2.00	.30
(a) Cockpit checks		
(b) Lighting of landing area		
(c) Take-off and transition to climb		
(d) Circuit		
(e) Approach and hover		
(f) Landing		
(g) Going round again		
(h) Use of landing lamp		
	<u>TOTAL</u>	<u>18.45 11.15</u>

APPENDIX 2 ANNEX 2

CFS ORB
March 1959

Royal Air Force Helicopter Pilot Conversion Ground Training Syllabus

Foreword

Introduction

1. This syllabus covers the ground training required for student pilots who have obtained their flying badge on fixed wing aircraft and who require conversion to helicopters.

The Aim

2. The Aim of the syllabus is to accompany the flying training so as to give a basic understanding of the principles of flight pertaining particularly to helicopters, the technical knowledge required to operate the aircraft being used for flying training, and the special problems of airmanship involved.

The Syllabus

3. The syllabus is designed to parallel the flying conversion syllabus, which extends in scope up to, but not including, operational training. It is divided into three parts:—

- (a) Part I Principles of Flight.
- (b) Part II Technical Subjects.
- (c) Part III Airmanship and Navigation.

Co-ordination with Flying Syllabus

4. It is recommended that the flying instructor should personally deal with Part III at least on the ground training syllabus, and should have completed sections 1 and 2 before the time for first solo has been reached. By the same time Part I section 1 to 5 inclusive should have been covered, and Part II sections 1 to 5 inclusive.

Helicopter Pilot Conversion
Ground Training Syllabus Part I

Principles of Flight

Aim

The aim is to give the student a clear, simple, but sound understanding of the principles of flight involved in rotary wing flight as compared with fixed wing flight.

<u>Section</u>	<u>Subject</u>	<u>Hours</u>
1.	<u>Introduction</u> Definitions Comparisons with Fixed Wing Creation of Thrust Freedom of Movement Directional Control Different Configurations	1
2.	<u>Controls</u> Collective Pitch Lever Linkage with Throttle control Hand Throttle Cyclic stick Tail Rotor-drift, -side force-roll Manual/Serve controls Flapping, Feathering, Dragging Phase lag and advance angle	2
3.	<u>Hover and Transition</u> Hovering—ground effect Transition to forward flight Translational lift Aerodynamic forces affecting rotor rpm and Lift Transition to hover Power required curve Overpitching Take off and landing Effect of altitude/temperature/humidity	2
4.	<u>Vortex Ring</u> Cause Occasions in Practice Recovery action	1

<u>Section</u>	<u>Subject</u>	<u>Hours</u>
5.	<u>Forward Flight</u> Dissymetry of lift Limits of forward speed and effect of altitude Stability—angle of attack and speed Stick forces in manual	1
6.	<u>Ground resonance</u> Definition Sources of resonance Conditions causing resonance Corrective Action	1
7.	<u>Control on the Ground</u> Taxying Running take off and landing Blade sailing	1
8.	<u>Centre of Gravity and Loading</u> Positioning of C of G and method of calculating Limits of movement C of G compensation Use of fuel Effect on controls Max AUW	1
9.	<u>Autorotation</u> Method of obtaining Autorotation Effective blade section—L/D curve Effect of varying rotor RPM Effect of varying airspeed Effect of aircraft AUW Effect of altitude Effect of flare Engine off landings Speed/height range for safe engine off landings	2
10.	<u>Range and Endurance</u>	1

Helicopter Pilot Conversion
Ground Training Syllabus Part II

Technical Subjects

Aim

The aim is to give the student a basic understanding of construction of the helicopter he is flying and the function of its main components, together with a general knowledge of the inspection cycles, and a detailed knowledge of the daily servicing.

<u>Section</u>	<u>Subject</u>	<u>Hours</u>
1.	<u>General Description</u> Configuration and Construction Landing gear Flying Controls—layout and operation Leading particulars and dimensions Rotor hubs Rotor blades	2
2.	<u>Power Unit</u> General description and installation Engine starting and stopping Engine ground checks Limitations and engine handling	1
3.	<u>Transmission</u> Clutch Gearboxes and free wheel unit Universal couplings and drive shafts Rotor starting and stopping	1
4.	<u>Fuel and Oil</u> Feul—Installation and position of components Management of fuel system Consumption and grade of fuel Oil —Installation and position of components Management of system Consumption and grade of oil	1

<u>Section</u>	<u>Subject</u>	<u>Hours</u>
5.	<u>Ancillary Equipment</u> Electrical system Vacuum system Brakes C of G compensation system Rescue hoist	1
6.	<u>Servicing</u> Cycle of inspections Daily Inspections in detail—theory and practice	2

Helicopter Pilot Conversion
Ground Training Syllabus Part III

Airmanship and Navigation

Aim

The aim is to enable the student to make full use of the special abilities of the helicopter as opposed to a fixed wing aircraft, whilst appreciating its limitations and the precautions to be taken.

<u>Serial</u>	<u>Subject</u>	<u>Hours</u>
1.	<u>Emergencies</u> Action in the event of fire—in the air—on the ground Action in the event of engine failure Action in the event of tail rotor failure Engine and handling for engine off landings and autorotation practice Types of vibration and possible causes Ditching	2
2.	<u>Air Traffic Control</u> Circuits and approach and departure systems at base airfield Procedures to adopt when visiting other airfields	1
3.	<u>Navigation</u> Particular problems of pilot navigation arising from slow, low level flight	2

<u>Serial</u>	<u>Subject</u>	<u>Hours</u>
4.	<u>General Considerations</u> Selection of cruising height for X-country flights Bad weather procedures Considerations when landing away from airfields Technical kit required for operating away from base	2

- (d) Further effect of cyclic stick due to:—
 - (i) Airstream
 - (ii) Disc loading
- (e) Further effect of collective pitch—throttle closing—
autorotation

Ex. 5 Power and Speed Changes .45

- (a) Handling of cyclic stick with reference to:—
 - (i) Stability
 - (ii) Attitude and airspeed
- (b) Handling of collective lever, throttle and rudder,
practice in:—
 - (i) Power changes with constant RPM
 - (ii) Correction of RPM with constant power:—
- (c) Handling of all controls practice in:—
 - (i) Straight and level flight
 - (ii) Climbing and descending (with medium turns)
at recommended power
- (d) Reference to instruments
- (e) Engine handling
- (f) Look out

Ex. 6 Autorotation .45

- (a) Look out
- (b) Entry and development of autorotation
- (c) Control of speed and RPM
- (d) Recovery to powered flight
- (e) Verbal warnings

Ex. 7 Hovering .45

- (a) Effect of controls in hovering flight, both separately
and inter-related
- (b) Hovering, cyclic stick only
- (c) Hovering, using collective lever, throttle and rudder
only, correcting for inaccuracies resulting from
translation
- (d) Hovering, using all controls
- (e) Demonstration of ground cushion effect
- (f) Effect of variations in wind strength
- (g) Slow forward, sideways and backwards flight in the
ground cushion.

	<u>DUAL</u>	<u>SOLO</u>
Ex. 8 <u>Take-off and Landing</u>	.45	
(After explanation of ground resonance)		
(a) Landing, using cyclic stick only		
(b) Landing using collective lever, throttle and rudders only		
(c) Landing using all controls		
(d) Take-off using cyclic stick only		
(e) Take-off using collective lever, throttle and rudders only		
(f) Take-off using all controls		
(g) Conditions favourable to ground resonance		
(h) Mislanding		
(j) Overpitching		
Ex. 9 <u>Transitions</u>	.30	
(a) Transition from hover to forward flight and climb		
(b) Transition from approach to hover		
(c) Overpitching		
Ex. 10 <u>Circuits</u>	1.00	1.30
(a) Recommended circuit pattern, with reference to proximity of fixed wing a/c		
(b) Going round again		
(c) Action in event of engine failure in circuit		
(d) Circuit in manual control from downwind position		
Ex. 11 <u>Demonstration of Engine Off Landing</u>	.15	
Ex. 12 <u>First Solo</u>		.15

PART B—POST-SOLO

Ex. 13 <u>Sideways and Backwards Flight</u>	.45	1.30
(a) Sideways flight, with particular references to power, height and directional corrections required due to translation. (Heading into wind)		
(b) Backwards flight, as above,		
(c) Combination of sideways and forward and backwards flight		
(d) Look out		

	<u>DUAL</u>	<u>SOLO</u>
Ex. 14 <u>Turns on the Spot</u>	.45	1.30
(a) Hovering across wind and downwind		
(b) Turns on the spot through varying degrees up to 360°		
(c) Assessment of wind strength and control during turns on the spot		
Ex. 15 <u>Taxying</u>	.15	.15
(a) Use of controls, and control of forward speed		
(b) Taxying over rough ground with reference to ground resonance		
(c) Use of brakes		
(d) Taxying out of wind		
Ex. 16 <u>Engine-Off Landings</u>	3.00	1.30
(a) Autorotation to 50 feet, flare, re-engagement and overshoot		
(b) Engine-off landings at low forward speed		
(c) Verbal instructions and acknowledgements		
(d) Dangers		
Ex. 17 <u>Vortex Ring State</u>	.15	
(a) Demonstrations		
(i) Symptoms and characteristics		
(ii) Methods of recovery		
(iii) Recommended method		
(b) From vertical descent with power		
(c) From engine re-engagement during vertical autorotation		
(d) From powered approach downwind		
Ex. 18 <u>Forced Landing</u>	1.30	3.00
(a) Autorotation at different airspeeds		
(b) Controlling angle of descent by		
(i) Changing airspeed		
(ii) Changing rpm		
(c) Autorotation into fields after simulated engine failure, showing different height lost in left and right turns		

	<u>DUAL</u>	<u>SOLO</u>
Ex. 21 <u>Pilot Navigation</u>	1.00	2.00
(a) Map-reading		
(b) Calculation of fuel requirements, with reference to loading and C of G		
Ex. 22 <u>High Altitude Simulation</u>	.45	.30
(a) Running take-off with reduced power (Demo)		
(b) Running landing from engine-assisted approach at reduced power		
(c) Demo. Jump take-off with reduced power		
Ex. 23 <u>Flying at Loading and C of G Limits</u>	.45	.15
(a) Take-off at max. AUW		
(b) Transitions at max. AUW		
(c) Circuits and landings at max. AUW		
(d) Take-off and landing at max. forward C of G limit		
(e) Take-off, circuit and landing with rearward C of G		
Ex. 24 <u>Flights at High Altitude</u>	1.00	1.00
(a) Effect on control in basic manoeuvres		
(i) Cyclic		
(ii) Collective		
(iii) Throttle		
(b) Autorotation		
(c) Limitations		
Ex. 25 <u>Instrument Weather Procedure</u>	1.30	2.00
Ex. 26 <u>Night Flying</u>	1.00	2.00
(a) Cockpit checks		
(b) Lighting of landing area		
(c) Take-off and transition to climb		
(d) Circuit		
(e) Approach and hover		
(f) Landing		
(g) Going round again		
(h) Use of landing lamp		

APPENDIX 2 ANNEX 3
HELICOPTER PILOT TRAINING SYLLABUS
WHIRLWIND STAGE—60 HOURS/12 WEEKS

<u>Exercise</u>	<u>Dual</u>	<u>Solo</u>	<u>TOTAL</u>
Conversion, GH and Revision	10.30	8.15	18.45
Instrument Flying	7.15		7.15
Approach, Landing and Take-off from Confined Areas	1.45	1.30	3.15
Night Flying	2.30	1.45	4.15
High Altitude Flight	.45	—	.45
SRT—Load carrying in formation to confined areas } S & R—Wet Winching }	1.00	1.00	2.00
Winching	3.45	3.45	7.30
Trooping	.45	.45	1.30
Tactical Low Flying	1.15	1.15	2.30
Mountain Flying	4.15	.30	4.45
Load Carrying	.45	.45	1.30
Homing Techniques	.45	.45	1.30
Exercise (SRT or S & R)	1.30	1.00	2.30
Tests	2.00	—	2.00
TOTALS:	<u>38.45</u>	<u>21.15</u>	<u>60.00</u>

HELICOPTER PILOT TRAINING SYLLABUS
WHIRLWIND STAGE
60 hrs/12 weeks
SEQUENCE OF FLIGHT INSTRUCTION

<u>Sortie No</u>	<u>Exercises</u>	<u>Dual</u>	<u>Solo</u>	<u>Total</u>	<u>Outline of Sortie</u>
1	3-7 16	1.00		1.00	Effect of controls, attitude and Power changes, level flight climbs, descents, turns, autos, engine off landings (2)
2	7-11 16	1.00		1.00	Autorotations, hovering, take off and landing, transitions circuits. Engine off landings (2)

<u>Sortie No</u>	<u>Exercises</u>	<u>Dual</u>	<u>Solo</u>	<u>Total</u>	<u>Outline of Sortie</u>
3	7-11 16 12	1.00	.15	1.15	As above, Engine off landing (2) First Solo
4	13-15 revise 7-11	1.00		1.00	Sideways backwards flight, spot turns, taxiing circuits
5	11 13-15		1.00	1.00	As above
6	16-18	1.00		1.00	Forced landings, engine off landings
7	18		.45	.45	Forced Landings.
8	18		.45	.45	Forced Landings
9	16	.45		.45	Engine off landings (primarily full flare and constant attitude)
10	24	1.00		1.00	Marginal power operations
11	24		1.00	1.00	As above
12	22 23	1.00		1.00	Landing on sloping ground and out of wind, downwind transitions quick stops, emergency turns.
13	22 23		1.00	1.00	As above
14	16	.45		.45	Engine off landings (primarily full flare and constant attitude)
15	7-11 13-15 18 22-24		.45	.45	Revision
16	7-24 (as req)	1.00		1.00	Conversion Test
17	25	.45		.45	Instrument indications, scanning techniques, changing speed, attitude power climbs, descents, turns, autorotation
18	25	.45		.45	As Sortie 17+QGH—Comp. 'in'
19	25	.45		.45	As Sortie 17 including I/F take offs and QGH—Comp. 'cut'
20	25	.45		.45	As Sortie 19 except QGH to be speechless and including GCA—Comp. 'in'

<u>Sortie No</u>	<u>Exercises</u>	<u>Dual</u>	<u>Solo</u>	<u>Total</u>	<u>Outline of Sortie</u>
21	26	.45		.45	Approach to, landing in and take off from a confined area.
22	26		.45	.45	Approach to, landing in and take off from a confined area
23	17 28	.45		.45	High altitude to 10000' and vortex ring
24	Underslung loads	.45		.45	Pallet and netted standard loads
25	As above		.45	.45	As above
26	27	1.00		1.00	Night circuits and landings, schermuly firing
27	27		1.00	1.00	Night circuits and landings
28	27	.45		.45	Night underslung loads
29	27	.45		.45	Night circuits and landings QGH
20	27		.45	.45	Night circuits & landing. QGH
31	Trooping	.45		.45	Hover jump, roping
32	Trooping		.45	.45	As above
33	Tact low flying	1.15		1.15	X-country to Valley
34	As above		1.15	1.15	As above
35	29	1.00		1.00	Tactical formation to a confined area
36	29		1.00	1.00	As above
37	26	1.00		1.00	Approach to, landing in and take off from a confined area
38	26		.45	.45	As above
39	25	.45		.45	IF take off, autos, Emergencies, unusual attitudes, speechless QGH Comp. 'out'
40	25	.45		.45	As above
41	25	1.00		1.00	GCA approaches Comp. 'in' and 'out'

<u>Sortie No</u>	<u>Exercises</u>	<u>Dual</u>	<u>Solo</u>	<u>Total</u>	<u>Outline of Sortie</u>
42	25	1.00		1.00	Consolidation, let downs & standby horizon
43	25	.45		.45	Instrument rating test
44	7-11 13-15 22 24 26		.45	.45	General handling
45	As above		.45	.45	As above
46	Dry winching	.45		.45	Single, double & stretcher lifts
47	As above		.45	.45	As above
48	As above	.45		.45	As above
49	As above		.45	.45	As above
50	Drum winching	.45		.45	Single lifts
51	As above		.45	.45	As above
52	Wet winching	.45		.45	Single and double lifts
53	As above		.45	.45	As above
54	Deck winching	.45		.45	Single and double lifts
55	As above		.45	.45	As above
56	Decca homing	.45		.45	Use of Decca and Sarbe equipment
57	Sarbe homing		.45	.45	As above
58	Mountain flying	1.15		1.15	Wind finding & initial approaches
59	As above	1.15		1.15	Approach to spurs and pinnacles
60	As above	1.15		1.15	Approach to ridges and bowls
61	As above	.30		.30	Revision
62	As above		.30	.30	Approaches as briefed
63	16	1.00		1.00	Engine off landings (primarily gentle flare)
64	16		.30	.30	Engine off landings (gentle flare only)

<u>Sortie No</u>	<u>Exercises</u>	<u>Dual</u>	<u>Solo</u>	<u>Total</u>	<u>Outline of Sortie</u>
65	7-26	1.00		1.00	General handling
66	18 22 24 26		0.45	0.45	As above
67	7-26	1.00		1.00	Final handling test
68	Tactical Exercise	1.30		1.30	Exercise in all aspects of specialisation at end of course
69	As above		1.00	1.00	As above
Total		38.45	21.15	60.00	

SAR Students do two hours extra winching instead of Sorties numbers 35 and 36.

APPENDIX 3 EMERGENCY OPERATING PROCEDURE—
MULTI-LIFT-HOIST

1. The procedure for recovering persons from a hover height of more than the 50 foot winch cable was called the Multi-Lift Hoist or Multi-Tape system.

2. The sequence is complicated to describe, so the HQ FEAF operating procedure is repeated here in full. It provides a vivid example both of the ingenuity and determination of the helicopter crews, as well as of the failure to pay adequate attention to the urgent recommendations from FEAF in the mid-1950s that helicopters in the Far East Theatre should have winch cables at least 200 feet in length.

EMERGENCY OPERATING PROCEDURES

HELICOPTER EMERGENCY MULTI-LIFT HOIST

Introduction

1. Helicopters may be required to recover live loads whilst hovering at a height greater than the length of the winch-hoist cable. This may be achieved by using a multiple tape system in conjunction with the winch-hoist.
2. This method may also be used to lower personnel into confined areas eg medical or rescue teams, however, the ABSEIL methods for lowering loads from helicopters are generally more appropriate for this purpose.
3. The multiple tape procedure requires a high degree of concentration and skill on the part of the helicopter crew for long periods at the hover. For this reason and because of the hazards associated with the jettison of loads under these conditions, the procedure is to be used only in emergency circumstances. Under normal circumstances, the clearing should be enlarged or the load positioned at an alternative pick-up point where a landing or direct winch-hoist recovery may be effected.
4. The Emergency Operating Procedure listed hereunder details the equipment to be used and the operating technique to be adopted when recovering loads by means of the Multiple-lift Hoist method.

Personnel

5. The following personnel are required:
 - a. Pilot.
 - b. Winch Operator.
 - c. Winchman. (Descends on winch cable to link up tapes).
 - d. Crewman. (Assists winch operator).
 - e. Medical/Rescue staff as required.

Equipment

6. The following equipment is required.

- a. Helicopter with a serviceable winch and cable cutters and with a MONO RAIL fitted.
- b. Multi lift equipment consisting of:
 - (1) 4×50' tapes (LONG TAPE)
 - (2) 1×5' tape (SHORT TAPE)
 - (3) 2×BOSUN'S CHAIR
 - (4) 1×WINCHING STROP
 - (5) 1×NEIL ROBERTSON STRETCHER
 - (6) 1×SHARP KNIFE TO CUT TAPE
 - (7) 200' ABSEIL TAPE AND ROLLERS FOR MEDICAL OFFICER
 - (8) 200' ABSEIL TAPE FOR EMERGENCY USE

Pre-Flight Checks

7. The Authorising Officer is to ensure that:

- a. The level of emergency justifies the use of this equipment.
- b. The Captain and crew are competent to carry out the task.
- c. The Captain and crew understand this EOP.
- d. The crew is properly constituted.

8. The Captain of the aircraft is to ensure that:

- a. His crew understands this EOP
- b. The equipment is complete and fully serviceable.
- c. The medical officer, if carried, understands the EOP.
- d. The medical officer understands Abseiling Drills.
- e. The medical officer is briefed on the use of the bosuns chair.

- f. The medical officer is briefed on the Neil Robertson stretcher.
- g. The emergency procedures are understood.

9. The Captain is to ascertain:

- a. That the medical officer realises that once he is lowered he may not be recovered immediately into the aircraft at heights in excess of 100 feet.
- b. What equipment the medical officer requires to be lowered with him, eg Stretcher, bosuns chair, strop.

Operation

10. Standard winching patten is to be used throughout the operation. When the captain positions the aircraft at the hover over the selected clearing the winchman is to confirm that the ground is visible and that the secondary growth is not a hazard which may snag the tapes.

11. The hover must be established for about 30 seconds before the tape is lowered, to ensure that light foliage will not be blown over the clearing by the down-wash.

12. If a medical officer is lowered, he is to be in a bosuns chair and is to carry all his equipment with him.

13. If no man is to be lowered the tapes are to be connected and lowered one by one until they touch the ground.

14. Details of lowering and raising are contained in Paras 21 and 22.

15. One lowering or raising sequence to 250 foot extension can be expected to require a five minute hover.

Emergencies

16. General. On no account is a cable or tape, which is snagged on a tree, to be freed by raising the aircraft.

17. Empty Tape. If a tape should snag a tree with no one on the end, the following procedure is to be followed:

- a. The winch operator informs the captain.
- b. The winch operator attempts to free the tape by hand.

- c. The Captain gives the order 'CHOP THE TAPE'.
- d. The tape is cut. (By the winch operator or by the crew man when directed by the winch operator).

18. Tape with Man Attached. If the tape should snag a tree with a man attached, the following procedure is to be followed:

- a. The winch operator informs the Captain.
- b. The winch operator lowers the winchman who attempts to free the tape.
- c. The winchman is lowered with 200 foot Abseil tape which he secures to a tree and lowers the remainder past the man on the end of the tape and thence to the ground.
- d. The man on the tape secures himself to the Abseil tape.
- e. The winchman is winched into the aircraft.
- f. The Captain gives the order 'CHOP THE TAPE' three times.
- g. The tape is cut. (By the winch operator or by the crew man when directed by the winch operator).

Notices

1. Personnel or casualties left in the tree after the tape is cut will become the subject of a further recovery operation which may take some considerable time to effect.
2. Because of the weight limitation on the Winch-Hoist (450 lbs) only one person at a time may be recovered at heights requiring more than one extension tape.
3. Attention is drawn to the cycling limitation on the Winch Hoist ie, 5 complete cycles followed by a 10 minute cooling period.
4. The duties of the Crewman may be undertaken by the medical officer in circumstances where he is not required to be lowered.

19. The following is a description of the procedure to be carried out and list of terms used in lowering a medical officer and raising a casualty using the Emergency Multi Lift Hoist.

20. List of terms.

- a. Captain—Pilot of aircraft.
- b. Winch Operator—Man operating the winch.
- c. Winchman—Man on the winch cable.
- d. Crewman—Man assisting the winch operator.
- e. Medical officer—Man to be lowered to the ground.
- f. Casualty—Man to be raised from the ground.
- g. Cable—Winch cable.
- h. Short tape—5 feet tape with ring on upper end, a hook on the lower.
- j. Long tape—50 feet tape with ring on upper end, a hook on the lower.
- k. First tape—First long tape to be lowered out of the aircraft.
- l. Second Tape—Second long tape to be lowered out of the aircraft.
- m. Third Tape—Third long tape to be lowered out of the aircraft.
- n. Fourth Tape—Fourth long tape to be lowered out of the aircraft.

Description of Method

21. Lowering (if the medical officer cannot abseil to the ground).

- a. The ring of the Short Tape is attached to the monorail.
- b. The ring of the FIRST LONG TAPE is attached to the hook of the SHORT TAPE.
- c. The Medical officer's BOSUN'S CHAIR is attached to the hook of the long tape.
- d. The Winch Operator lowers the winchman and medical officer until the medical officer is supported by the First Long Tape.
- e. The crewman pays out the First Long Tape.

- f. The Winchman unhooks the medical officer from the cable and is winched back in.
- g. The medical officer is now 50' below the aircraft, supported by the First Long Tape and the Short Tape attached to the Monorail.
- h. The Winchman is winched up until he is level with the ring (TOP) of the first tape.
- j. The ring of the First Tape is attached to the cable.
- k. The Winchman is raised, releasing the load from the Short Tape.
- l. The hook of the Short Tape is unhooked from the ring of the First Tape and the Second Tape introduced.
- m. The ring of the Second Tape is attached to the hook of the Short Tape.
- n. The hook of the Second Tape is attached to the ring of the First Tape.
- o. The Winchman is lowered whilst the crewman pays out the Second Tape until the weight of the medical officer is supported by the Second Tape.
- p. The Winchman removes the cable from the ring of the First Tape and is winched up.
- q. The medical officer is now 100 feet below the aircraft, supported by the First Tape, the Second Tape and the Short Tape attached to the Monorail.
- r. The Third and Fourth Tapes are introduced in the same way until the medical officer reaches the ground.
- s. The maximum length of lowering is 250 feet made up of First, Second, Third and Fourth Tapes plus 50 feet of cable.

22. Raising. Assuming that the medical officer has been lowered on four tapes, or that four tapes have been lowered to the ground on the end of the winch cable, the following procedure is to be used:—

- a. The ring of the Short Tape is attached to the monorail.
- b. The casualty is attached to the hook (LOWER) end of the First Tape.

- c. The cable is raised until the ring (TOP) of the Fourth Tape is level with the hook of the Short Tape.
- d. The ring of the Fourth Tape is attached to the hook of the Short Tape and the cable winched out until the weight of the casualty is supported by the Short Tape. The cable is removed from the ring of the Fourth Tape.
- e. The casualty is now supported 200 feet below the aircraft by four long tapes and the Short Tape attached to the monorail.
- f. The Winchman is lowered until he is level with the ring (TOP) of the Third Tape.
- g. The Winchman attaches the cable to the ring of the Third Tape and is winched up until he is level with the hook of the Short Tape. The Crewman collects and rewinds the incoming tape.
- h. The Fourth Tape is removed from the Short Tape and the ring of the Third Tape.
- j. The ring of the Third Tape is attached to the hook of the Short Tape.
- k. The Winchman is winched out until the weight of the casualty is supported by the Short Tape.
- l. The cable is removed from the ring of the Third Tape.
- m. The casualty is now supported 150 feet below the aircraft on three tapes and the Short Tape attached to the monorail.
- n. The Winchman is winched out until level with the ring (TOP) of the Second Tape and the procedure is repeated twice more to recover the Second and First Tapes.
- o. The casualty is then level with the cabin door.

STANDARD OPERATING PROCEDURE
WINCHING INTO JUNGLE CANOPY

Introduction

1. Due to the density of the jungle canopy it may be impossible for troops to be roped, winched or abseiled to the ground.
2. This SOP lays down the procedure to be carried out when winching troops into the jungle canopy; the troops carrying equipment to enable them to make their own way to the ground.

Equipment

3. The following equipment and personnel are required:
 - a. Whirlwind with serviceable winch.
 - b. Winching strop.
 - c. Pilot and Winch Operator trained in winching.
 - d. Troops equipped with abseil equipment or lowering ropes.

Pre-flight checks

4. Before flying the Captain of the aircraft is to ensure that:
 - a. He and the crewman understand this SOP.
 - b. The winch is serviceable.
 - c. The winch cable cutter is loaded.
 - d. The troops understand the signals to be used by them.
 - e. The troops understand the emergency procedure if the cable is fouled or jammed.

- f. The troops are briefed on standard helicopter procedures.
- g. The troops are equipped with and understand the use of their own lowering equipment.

Winching

5. Having checked that sufficient power is available to manoeuvre outside ground effect the pilot is to come to the hover over the desired area. The winch operator is to select a part of a tree which, in his opinion, will bear the weight of the soldier. He is then to use standard voice marshalling to bring the aircraft overhead the selected point. The Stick Leader is then to be winched down in a strop, followed by the rest of the stick in turn.

Hand signals (troops)

6. The following hand signals are to be used by the man in the strop:

<u>Message</u>	<u>Signal</u>
Winch Down	One arm extended, Palm Down repeatedly moved downwards.
Winch Up	One arm extended, Palm Up repeatedly moved upwards.
Stop	One arm extended horizontally.
Firm Footing Obtained	
Give me slack cable	One arm 'Thumbs Up'
Secure to Tree	Strop removed and held at arm's length

Winching precautions

7. The following precautions are to be observed during winching:
- a. The man in the strop is to secure himself to the tree before removing the strop.
 - b. The winch operator is to keep the strop in sight at all times during the operation.
 - c. The Captain should not leave the area until he is satisfied that the troops can reach the ground.

Fouling of the cable

8. The following procedures are to be carried out if a cable becomes fouled and no attempt is to be made to free the cable by raising the aircraft.

a. Empty Strop. The winch operator is to attempt to free the strop and cable by hand but if necessary the cable is to be cut.

b. With a man in the strop. The man is to try and gain a firm foothold and then discard the strop, the winch operator is to attempt to free the strop and cable by hand but if necessary the cable is to be cut. If the man is unable to gain a firm foothold then he is to secure his abseil gear to the hook and abseil as rapidly as possible to the ground. When the man has reached the ground the winch operator is to attempt to free the strop, cable and tape by hand but if necessary the cable is to be cut.

c. If the winch operator loses sight of the man or a fouled cable he is to winch out and maintain slack for at least one minute, before attempting to free the cable.

Jamming of the winch

9. If the winch should jam with a man suspended in the strop, the procedure outlined in para 8b is to be adopted.

Note (1) the event of a winch failure the operation may be continued by using the abseil technique.

(2) In certain circumstances consideration may be given to fly the man out while suspended and proceed to a cleared area.

APPENDIX 4 SELETAR HELICOPTER NIGHT APPROACH PATTERN
(SHNAP)

1. Later referred to as the 'Support Helicopter Night Approach Pattern' the tri-Service agreed pamphlet authorising the use of the SHNAP in the Far East area is self-explanatory and is therefore included complete.

2. It should be noted that the four Chapter layout was only used to make the universal usage of the SHNAP easier to envisage. In practice, Chapter 1 was the only one issued to MAOTs and troops and Chapters 2, 3 and 4 were only used where permanent installations were needed. Chapters 5 and 6 were no business of the troops.

RESTRICTED

SELETAR

HELICOPTER

NIGHT

APPROACH



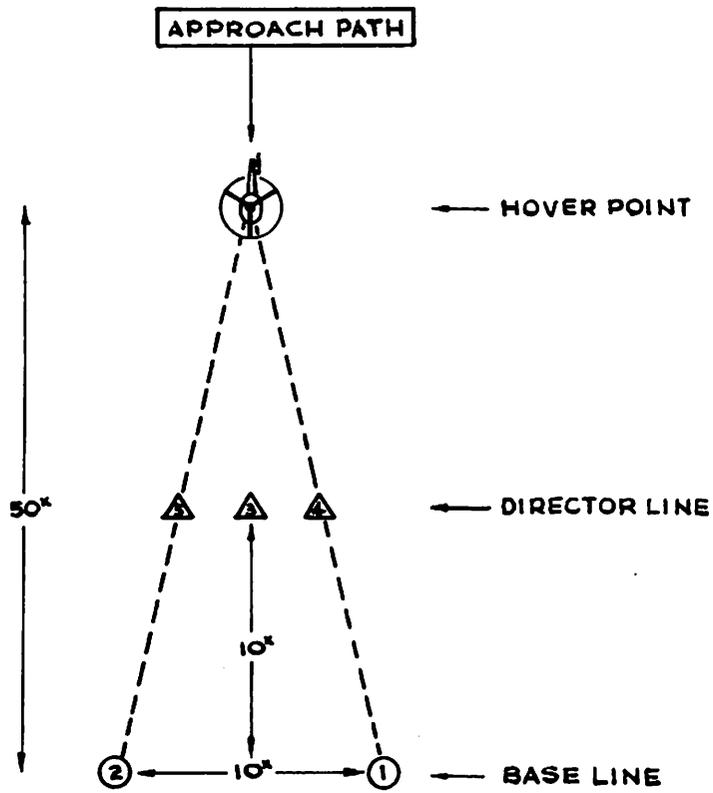
PATTERN

RESTRICTED

SELETAR HELICOPTER NIGHT APPROACH PATTERN

Chapter One	...	Laying the Pattern
Chapter Two	...	Levelling the Pattern
Chapter Three	...	Checking the Approach/Take Off Paths
Chapter Four	...	Ground Clearance Checks
Chapter Five	...	Operation of SHNAP
Chapter Six	...	Pilot Procedure

FIGURE 1



Chapter One

CONSTRUCTION OF THE PATTERN

Requirements

Five torches

Three poles 5' 6" high

One piece of string (10 yards long)

Laying the Pattern (Figure 1)

1. Select the desired hover point which should be hard and flat enough to permit the helicopter to land if that is required. Mark it with a man or pole. This is the "HOVER Point".
2. Select the widest and flattest approach path. If the area offers a large choice of open approach paths, the following criteria should be borne in mind as advantages:
 - a. The approach path should, ideally, be "into wind" for the aircraft. If a wind of any strength more than light is experienced from any direction behind the aircraft on the approach, it may not be safe to continue the descent.
 - b. If possible, an approach path should be chosen which has a take-off path in line with it, that is, approximately the same compass heading as the approach.
3. Turn about with the back towards the approach path and move 50 paces from the hover/landing point on the same compass heading as the approach path and turn about to face up the approach. Move to right or left to bring the Hover Point marker in line with the centre of the approach path. Mark the position. This is the centre of what is called the "BASE LINE".
4. From the centre of the Base Line, facing the Hover Point fold the 10 yard string and measure five yards right and mark position one. Place a torch on the ground pointing unobstructed up the approach path. Measure five yards left from the centre position and mark position two. Place a torch on the ground pointing up the approach path. Check that positions one and two are ten yards apart on a line at right angles to the approach path. This is the completed Base Line.
5. Measure accurately 10 yards forward from the centre of the Base Line, towards and in line with the Hover Point. This is position three and requires a torch 5' 6" above the ground pointing back up the approach path. Mark it with a man or pole. This is also the centre of what is called the "DIRECTOR LINE", and is a key position.

FIGURE 2

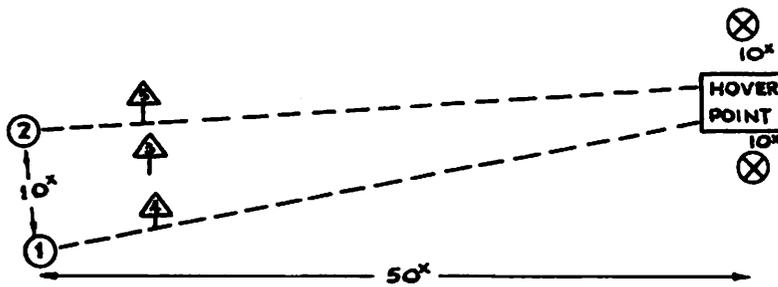
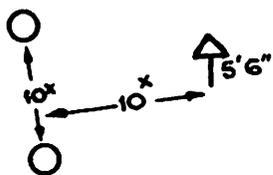


FIGURE 3



PILOTS VIEW

- | | | |
|---|---|---------------------|
| ○ | △ | ○ CORRECT |
| ○ | △ | ○ HIGH
(GO DOWN) |
| ○ | △ | ○ LOW
(GO UP) |

6. Using the 10 yard string, mark a line parallel to the Base Line through position three. This is the Director Line.

7. Facing up the approach path, move right along the Base Line to position one and site a man or pole on the Director Line exactly in line with the Hover Point. This is position four and requires a torch at a height of 5' 6" similar to position three.

8. Move left along the Base Line to position two and site a man or pole on the Director Line exactly in line with the Hover Point. This is position five and requires a torch at a height of 5' 6" similar to positions four and three. Check that positions four, three and five are in a straight line and the torches are at the same height. This defines the Director Line.

9. If the ground is suitable and lights are available, place a light each side of the Hover Point and 10 yards away, i.e. 20 yards apart. (This is helpful but not essential - see Figure 2).

10. Ensure that all lights are firmly secured in order to withstand the violence of the helicopter downwash.

11. Stand at the Hover Point and ensure that the lights on the Base Line at positions one and two are unobscured and clearly visible from that position.

12. The SHNAP is now ready for checking.

Emergency SHNAP

13. In emergency, with an approach path 45 degrees wide, clear to a range of approximately two miles, the SHNAP can be laid and flown with positions one, two and three only. This is called the EMERGENCY SHNAP and can be laid by one man alone. It does not define a Hover Point and the aircraft will land a few yards in front of position three. (Figure 3).

Colour of Lights

14. There must be a clear colour contrast between the lights on the Base Line and those on the Director Line and it is desirable that all lights appear with approximately equal intensity. If there is a difference in brightness after applying the colour contrast, it is important that the Base Line should not appear less bright than the Director Line. If it cannot be avoided, it is acceptable for the Base Line to be rather brighter than the Director Line.

FIGURE 4

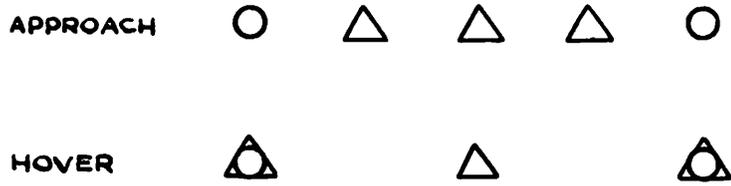
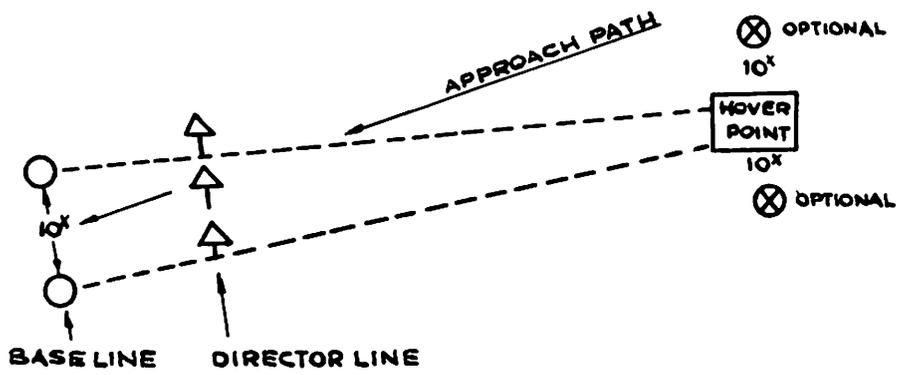


FIGURE 5



Chapter Two

LEVELLING THE PATTERN

1. The pilot flies the SHNAP by positioning the aircraft on the approach path which he finds by adjusting his height until the Director Line appears to be level with the Base Line, thus putting the aircraft on the 10 degree slope, and then moving laterally until the Director Line appears between the two Base Line lights without overlapping them. The approach path is thus defined both vertically and laterally.

2. As the pilot approaches the hover point, the Director Line will appear to get wider, and when the outer two Director Line lights appear coincident with the two Base Line lights, he knows he is the measured 50 paces from the SHNAP and is over the Hover Point which has been selected. (Figures 4 and 5).

3. When the pilot has achieved a position in which all the lights appear in a straight line, the line itself provides him with a representation of the horizon, so it must be approximately level. Further, if it has proved impossible to find a level piece of ground on which to construct the SHNAP, some adjustment must be made to ensure that the approach path has not been made too steep. The method for correcting for sloping ground is now described.

a. The Base Line must first be levelled. In the absence of special levelling equipment, the following method is recommended :

- (1) Take the 10 yard string and stretch it taut between the Base Line Lights.
- (2) Hold level with the string a mess tin or similar container filled with water and observe the direction of the slope.
- (3) Raise the lower one of the Base Line lights as necessary to make the string level.
- (4) The new centre of the Base Line must be marked.

b. The slope, if any, between the Director and Base Lines must now be checked and the measurement should be made between the centres of each line. If it is downwards from the Base Line to the Director Line, the vertical angle of approach will be reduced, and provided the vertical clearance checks described later are still satisfactory, the approach will be flatter and therefore easier for the pilot, and no further adjustment need be made.

c. If there is a slope upwards from the centre of the Base Line to the centre of the Director Line, the approach path will be steepened and an adjustment must

be made to reduce the approach angle to the standard 10 degrees by raising both the Base Line lights until the slope is cancelled. The position three light at the centre of the Director Line will now be a true 5" 6" above the Base Line and will indicate a true 10 degree approach path.

d. The outer two Director Line lights must be adjusted if necessary to make the Director Line horizontal using the centre light as a height datum.

FIGURE 6

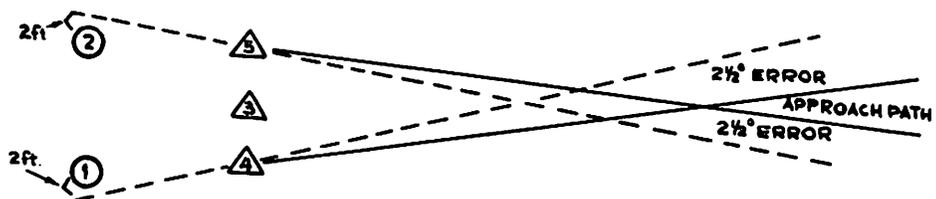
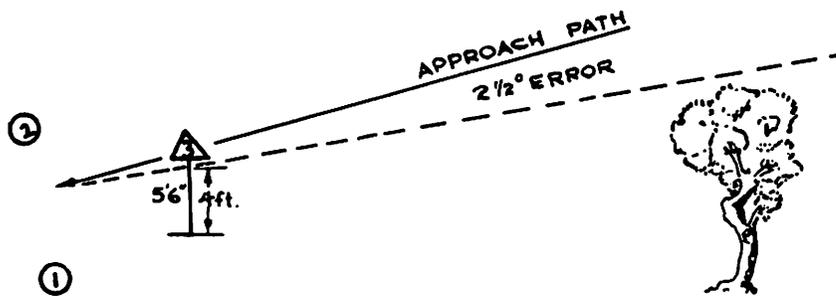


FIGURE 7



Chapter Three

CHECKING THE APPROACH AND TAKE OFF PATH DEFINED BY THE SHNAP

Checking the width of the Approach Path and Noting Obstructions (Figure 6).

1. Stand at position 2 and sight through position 5. This line defines the edge of the approach path to your right.
2. Move two feet to your left (this allows the pilot a 2½ degree error outside the approach path) and note the highest obstruction which appears to the left of this line through position 5, up to a range of about two miles in an arc of about 45 degrees left.
3. Stand at position 1 and sight through position 4. This line defines the edge of the approach path to your left.
4. Move two feet to your right and note the highest obstruction which appears to the right of the line through position 4, up to a range of about two miles in an arc whose righthand limit has been defined by the previous sighting.

Checking the Approach Vertical Clearance above Obstructions (Figure 7)

5. Sight from a point level with the lights on the Base Line through a point 18 inches below the light at position 3 towards the highest obstruction noted in the previous observations from positions 1 and 2. This line defines the lowest edge of the approach path (being 2½ degrees below the 10 degree slope and must pass above the highest obstruction observed in the approach path.
6. If this line does not pass above the obstruction, the light at position 3 may be withdrawn towards the Base Line, a maximum distance of three yards, making its distance from the Base Line a minimum of seven yards. This steepens the approach angle to 14 degrees approximately. Do not steepen the approach path unnecessarily.
7. It should be noted that if this procedure has to be followed, the lights at positions 4 and 5 should not be similarly withdrawn towards the Base Line. These positions are used for ranging by the helicopter pilot, and the amount by which they appear below positions 1, 3 and 2 (which should appear to him in a straight line), is an indication to him of how far you have been obliged to steepen the approach path to clear the obstruction. They also serve as a constant height indication at the hover point when they are aligned with positions 1 and 2.

8. If after moving position 3 the full three yards towards the Base Line, the sighting line from a point level with the lights on the Base Line, through the point 18 inches below the light at position 3 still does not pass above the obstruction, the approach is not acceptable for use in darkness.

9. Record the compass heading of the approach path measured from the Hover Point towards position 3. The pilot must be informed of this.

Checking the Take Off Path

10. Where there is a take off path available in line with the approach path so that the helicopter does not have to turn round and take off in the reverse direction up the approach, the same lateral and vertical clearances should be measured by constructing a landing pattern, for sighting purposes only, at the hover point and facing the take off path. The take off path may be back up the approach path if necessary, but as this requires the helicopter to turn round over the hover point, more cleared space is required. (See Chapter Four).

11. Record the compass heading of the take off path measured from the hover point. The pilot must be informed of this.

12. Remove the hover point marker. The lighting pattern is now ready for use.

FIGURE 8

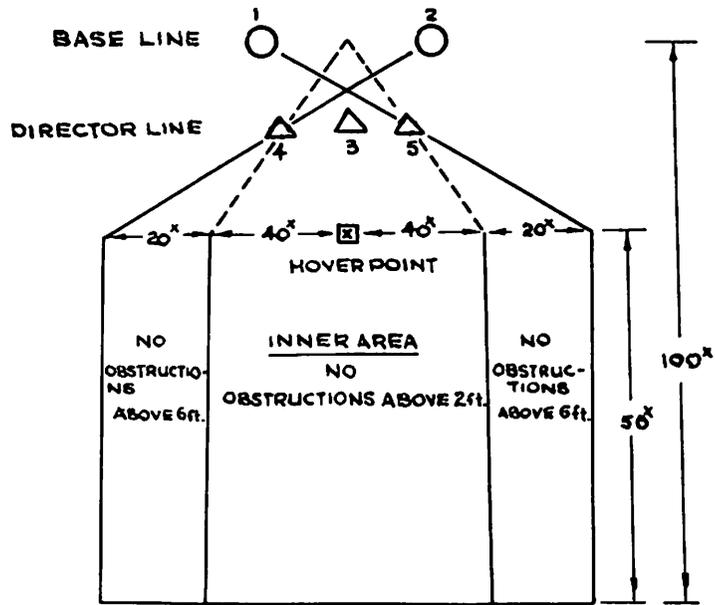
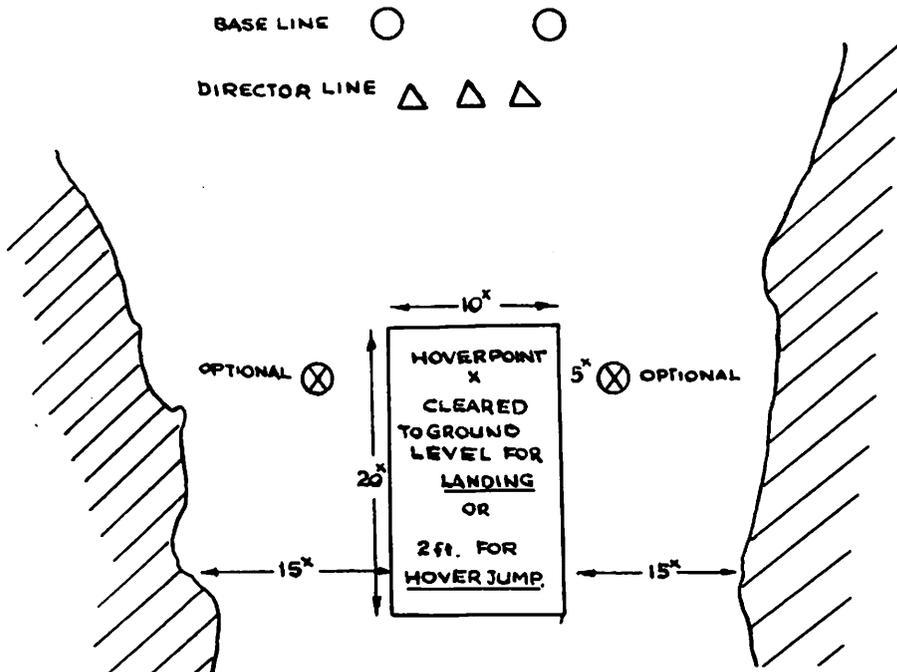


FIGURE 9



Chapter Four

GROUND CLEARANCE CHECKS FOR HELICOPTER NIGHT OPERATIONS

Clearing the Hover Point for a Confined Area having only a Single Approach/Take Off Path (Figure 8).

1. If it is required to land a helicopter at the hover point, the edges of the area which it is necessary to clear completely to ground level are defined by two lines sighted from the centre of the Base Line through positions 4 and 5 respectively to a distance of 70 yards (i.e. about level with the hover point which is 50 yards from the Base Line) thence parallel to each other a further 50 yards. The furthest edge of the cleared area is thus 100 yards distance from the Base Line. It is 40 yards wide from the distant edge to the hover point, thence narrowing to 0 at the centre of the Base Line.
2. A further space outside cleared area should have no this obstructions above six feet and its edges are defined by lines sighted through positions 1 and 5, and 2 and 4, to a position level with the hover point, at which distance they are 80 yards apart. Thence parallel to each other for a further distance of 50 yards. This area cleared to a maximum of six feet obstructions thus extends 20 yards sideways outside the fully cleared area.
3. If it is not necessary to land the helicopter, the area defined by these outer lines should be cleared to six feet height, and the inner area should have no obstruction higher than two feet.

Clearing the Hover Point for a Site having an Open Take Off Path Approximately in Line with the Approach Path. (Figure 9).

4. In this case it is assumed that the same lateral and vertical angles of clearance provided for the approach path as defined by the lighting pattern, are available on the take off path. That is, that the helicopter is not required to turn round over the hover point in order to face the approach path for take off.
5. If it is required to land the helicopter, the completely cleared area needs to be 10 yards wide, and 20 yards long, in line with the approach and take off paths. There should be no obstruction above six feet for a further 15 yards on either side of the hover point, (i.e. total width 40 yards).
6. If it is not necessary to land the helicopter, the hover point should be an area 10 yards wide by 20 yards long, in line with the approach and take off paths, with no obstruction higher than two feet. There should be no obstruction above six feet for a further 15 yards on either side of the hover point (i.e. total width 40 yards).

Chapter Five

OPERATION OF THE SHNAP

Information needed by the Pilot

1. The pilot needs to know the following facts before he can begin his approach; and this information must be transmitted in advance :

- a. The Grid Reference of the Landing Site and its height above sea level.
- b. The compass heading of the approach path.
- c. The compass heading of the take off path.
- d. Whether the site is suitable for landing or is only prepared to permit hovering. (See Chapter 4).
- e. Circuit direction right or left, having regard to local terrain.

2. If radio contact can be made with the aircraft, this information should be repeated by that means, together with a statement of the current wind conditions in the following form :

- a. Wind light and variable.
- b. Wind light from the North, South, East or West (or North West, South East, etc).
- c. Wind moderate from.....direction as above.
- d. Wind strong from.....direction as above.

Chapter Six

PILOT PROCEDURE

General

1. Before joining the pattern, the following information must be checked :

- a. The Grid Reference of the Landing Site and its height above sea level.
- b. The compass heading of the approach path.
- c. The compass heading of the take off path (in case an overshoot is necessary).
- d. Whether the site is suitable for landing or is only prepared to permit hovering. (See Chapter Four).
- e. Direction of the circuit.

2. The safe circuit includes an area of one mile to one side and two miles on a reciprocal of the SHNAP direction. The standard night circuit will thus be within the limits of one mile laterally and two miles "downwind" of the SHNAP.

3. All aircraft will approach the landing site aiming to arrive overhead at Safe Circuit Height. Safe Circuit Height is 700 feet above the SHNAP or 300 feet above ground in the circuit, whichever is the higher. If overhead at above the Safe Circuit Height, i.e. Transit Safety Height, standard night circuit procedure will be flown, reducing height at 400 feet per minute until the Safe Circuit Height is reached.

4. If required, the safety of the SHNAP both vertically and laterally may be checked by observing the continuity of the presentation while crossing the Safe Approach from one side to the other on the lower edge of the indicated approach path but without descending below a chosen safe height. If, for example, 700 feet is chosen as the lowest safe altitude for checking a particular SHNAP, it may be done by finding the Safe Approach Sector at a height of 1000 feet (i.e. at a range of 2000 yards, the slope being 10 degrees) and then descending to 750 feet and crossing the approach from side to side while seeing the pattern remains unobscured by obstructions. For this particular case, it is necessary to ensure that there are no obstructions above 500 feet within a range of two miles in line with the approach path, but suitable heights/ranges for carrying out this check may be selected to suit the particular terrain surrounding the Landing Site concerned.

Downwind

5. On reaching the Safe Circuit Height overhead the SHNAP, a 10 second cross wind leg is flown before turning on to the downwind leg.
6. On completion of the turn, fly 1000 yards downwind at 70 knots (30 seconds approximately in nil wind) then commence a Rate One turn to the base leg.

Base Leg

7. Reduce speed on the base leg to 50 knots. Height must be maintained until the SHNAP is visible.
8. If the indication is "HIGH", height is to be reduced until the lights are in line, or to 500 feet, whichever is the higher. Height of 500 feet in the Safe Approach Sector will place the aircraft 1000 yards from the SHNAP.
9. If on reaching 500 feet, the indication is still high, the aircraft is too close and must overshoot.
10. If the indication is "LOW" at 700 feet, the aircraft is at too great a range downwind. 700 feet must be maintained and the aircraft turned towards the SHNAP until the height indication is correct. The aircraft should then resume the base leg heading unless the safe azimuth indication for the approach has already appeared, in which case the approach may be continued by turning finals.

Finals Leg

11. When the aircraft enters the Safe Approach Sector, i.e. the Director Line lights just inside the Base Line lights, the aircraft turns finals, reducing speed to 40 knots and commences a rate of descent of 400 feet per minute. Speed is reduced at about 10 knots per 100 feet of height until the hover point is reached.

NOTE. Regardless of what colour combinations are provided, the pattern is capable of interpretation by its shape alone. The Director Line is unbroken and central in the Safe Approach path and must be thought of as an obstruction over which the pilot is required to fly.

INDEX

Names

Alexander, Tunis Earl of: 105
Amery, Julian: 193
Arkell, Sqn Ldr, Basil: 5, 6, 12
Arthur, Sir Geoffrey: 309
Asquith: 16
Atcherley, AVM: 159, 176
Bamberger, Flt Lt: 138
Banks, Mr: 296, 314, 354, 386
Bannister, Fg Off: 285, 287
Bartlett, Flt Lt, C: 169, 172
Bates, Fg Off, R: 259
Begg, Adm Sir Varyl: 237
Bernard, Fg Off, FA: 134, 136, 137, 183
Birch, Nigel: 106
Bond, Sqn Ldr, PR: 335
Boothman, ACM: 117
Boucher, Flt Sgt: 134, 137, 175
Bousher, M Plt: 285, 286, 290
Bourne, Gen: 77
Bowman, Sgt: 43
Boyce, AVM, CDC: 144
Braybrook, Sqn Ldr, F: 299
Breguet: 1
Brennan, Louis: 1
Brie, Wg Cdr RAC: 2, 4, 12
Briggs, Sir Harold: 28
Bright, Henry: 1
Brooke, Sir James: 318
Brookeborough, Lord: 193
Butler, RA: 193
Cable, Flt Lt, 'Jeep': 5
Cable, Sqn Ldr: 5, 6
Cameron, Lt: 50
Cayley, Sir George: 1
Chamberlain, Austen: 15, 17
Chittenden, Flt Lt: 290
Churchill, Winston: 104
Cierva, de la, Juan: 2
Clarke, Flt Lt, AJ: 28, 59, 172, 371
Clay, Flt Lt: 138
Clelland, Flt Lt: 287
Corbishley, Wg Cdr J: 179
Cowdray, Lord: 16
Cox, Master Pilot: 59
Coyle, Lt Col, DW: 161
Creasy, ADM: 117
Cross, AVM, Sir Kenneth: 241, 408
Curzon, Lord: 16
Darling, Maj Gen, KT: 147
Derby, Lord: 16
Denny: 1
Dowding, Lord: 104, 107, 108, 112, 133, 188
Dowling, Wg Cdr, John: vii, viii, 260, 354
Dowling, Flt Lt, JR: 6, 28, 59, 142, 169, 366
Duffield, Flt Sgt: 291
Dyce, Brigadier: 306
Eden, Sir Anthony: 25, 173
Edinburgh, HRH Duke of: 107, 110, 159, 184, 366, 368, 392
Edwards, Fg Off: 326
Eisenhower, Gen: 178
Elizabeth II, HRH: 258, 270
Evans, Flt Lt, C: 170
Everatt-Heath, Col, John: 415
Fahy, Flt Lt: 140, 141, 142, 143, 173
Feeley, Sgt: 68
Fielden, Sir Edward: 107, 367
Focke: 1
Foot, Sir Hugh: 147
Fraser, Mr Hugh: 288
Freer, Gp Cpt, RWG: 334, 336
Fry, Flt Lt, K: 6, 28, 59, 298
Gibson, Gp Capt, OI: 170
Gloucester, HRH The Duke of: 262, 366
Glubb, Gen: 152
Gow, Capt, N: 6, 157
Gurney, Sir Henry: 54
Hackett, Lt Gen Sir John: 406
Hafner, Raoul: 3, 12, 210, 235, 369
Hagerty, Mr: 178
Harding, ACM, Sir Peter: vii,
Harding, Gen, Sir John: 45, 125, 141, 142, 147
Hare, Sir John: 166
Harland, Sqn Ldr, LL: 87
Harrison, Flt Sgt: 140
Hart, Sqn Ldr: 267, 284-290, 292, 296
Head, Anthony: 109, 110
Henderson, Sqn Ldr, DRC: 59
Hill, AM, Sir Roderic: 4
Hogan, Air Cdre: 159
Hosegood, DTD, Mr: 12
Hull, Lt Gen, Sir Richard: 60
Humphrey, AVM: 301, 306
Ireland, Flt Sgt: 391
Isacco, Vittorio: 2
Ivers, Gp Capt: 173
Jacques, Flt Lt, GL: 59
Jackson-Smith, Sqn Ldr, NH: 86
Kearns, Flt Lt, DC: 194
Kerr, Lt, RM: 367
Kent, Duke & Duchess: 270
Kitchener, Lord: 15
Kyle, AVM: 175
Laing, & Sons Ltd, J: 257
Langfield, Alex: 67
Lee, Fg Off, AJ: 6, 28, 59, 169, 366
Lee, Sir David: 273, 302
LeCheminant, AVM: 349, 408
Le Fanu, Adm: 301, 306
Liversidge, Flt Lt, J: 170

Lloyd George, David: 16
 Low, Mr: 106
 Lyster, Wg Cdr: 159
 Macdonald, Malcolm: 45
 Macmillan, Harold: 116, 178
 Makarios, Archbishop: 147, 148
 Marsh, HA (Alan): 2, 4, 5
 Martin, Flt Lt: 284, 287-289
 McCrea, Flt Lt JE: 152
 McClements, Mr: 315
 Minifie, Flt Lt, JIG: 183, 184
 Monckton, Sir Walter: 118
 Moore, Sqn Ldr, PDM: 296, 297
 Moss, Flt/Sgt: 43
 Mountbatten, Lord: 118
 Munro, Flt Lt: 314, 354
 Nisbet, M Plt: 286
 Panter, Flt Lt, KV: 170
 Parsons, Sir Charles: 1
 Paul, Air Cdre, GJ: 170
 Phillips, WH: 1
 Pinner, Flt Lt: 172
 Prickett, AM Sir Thomas: 409, 410
 Princess Margaret, HRH the: 137, 169, 170, 175, 365
 Profumo, John: 105
 Radley, Sqn Ldr, RS: 170
 Ramshaw, Plt Off: 330, 331
 Reid, Ken: 158
 Repton, Maj: 157, 158
 Ross, Wg Cdr: 324
 Sandys, Duncan: 232, 287
 Saunders, Hilary St George: 15
 Shafe, Flt Lt, A: 170, 172
 Sharples, Flt Lt, A: 170
 Shinwell, Emmanuel: 25
 Sikorsky: 4
 Slessor, Sir John: 184
 Smith, Capt, R: 11
 Smith, Flt Lt WS: 285, 286, 288, 294
 Smuts, Gen: 16
 Spinks, Flt Sgt: 326
 Spittal, Lt Col, J: 12
 Spittal, Capt: 157, 158
 Spreadbury, Lt Cdr EC: 174, 366, 367
 Spreadbury, Flt Lt: 291, 292
 Sproule, Lt Cdr RN: 198
 Suthers, Lt Cdr J, RN: 27, 59
 Symons, Wg Cdr, C: 298, 302
 Todman, Flt Lt, DAW: 325
 Toon, Sqn Ldr, D: 193
 Templar, FM, Sir Gerald: 18, 45, 53, 54, 59, 76, 77, 83, 142, 173, 239, 319
 Thomas, Sqn Ldr: 262
 Thompson, CG, Mr: 82
 Thorneycroft, Peter: 238, 239
 Timbers, Sqn Ldr: 310
 Trenchard, MRAF, Sir Hugh: 16
 Trubshaw, Flt Lt, EB: 6, 27
 Tuttle, AM, Sir Geoffrey: 160
 Vicary, David: 67, 68, 152

Watson, Sqn Ldr: 264
 Watts, M Plt: 290-292
 Weir, C & J Ltd: 3
 West, Sqn Ldr: 262
 Wheatly, Flt Sgt: 285, 290
 Whitehead, Sgt GA: 294
 Wilding, Mr: 259
 Williams, LAC: 68
 Williams, Wg Cdr, WR: 59
 Williamson, Fg Off, JI: 183
 Wilson, Capt, P: 11
 Woodcock, Flt Lt: 284, 285, 288-290, 294
 Wright, Bros: 1
 Wykeham, AM, Sir Peter: 241, 242, 260
 Yew, Lee Kuan: 82

Aircraft Types:

Agusta 205: 397
 Air Horse (Cierva W11): 3, 5, 102, 228, 412
 Alouette: 92, 232, 269, 316, 351
 Anson: 195, 199, 200, 375
 Argosy: 151, 248, 295, 324, 350
 Armstrong-Whitworth 660: 226
 Auster: 6, 31-33, 39, 44, 48, 50, 51, 63-66, 75, 85, 157, 160, 194, 195, 197, 244, 255, 278, 324, 341
 B-66: 197
 Beaver: 109, 110, 406, 407
 Belfast: 239, 270, 308, 352, 353, 361, 398, 401
 Belvedere Trials Unit: viii, 127, 209, 212-215, 217-221, 228, 229, 253, 254, 293, 314
 Beverley: 91, 164, 165, 226, 248, 249, 256, 266, 268, 279, 282, 286, 295, 300, 317, 320, 322, 324, 336, 339, 347
 Brigand: 46, 64
 Bristol 173: 55, 79, 94, 101, 103-106, 108, 109, 111, 118, 120, 160, 161, 188, 199, 209, 220, 235
 Bristol 191 (Belvedere): 118, 120-123
 Bristol 192 (Belvedere): xi, 3, 91, 93, 94, 106, 111, 114, 118, 120-122, 124-126, 151, 175, 186, 205, 207, 209-221, 225-236, 238, 240, 247, 248, 253-258, 260, 261, 263-269, 271, 273-285, 290-300, 313-316, 319-324, 327, 329-331, 335, 336, 338-340, 344, 345-350, 359-362, 364, 380, 384-398
 Bristol 214: 236
 Britannia: 267, 279
 Canberra: 150, 151, 194, 215, 317, 327, 369
 Caribou: 227-229
 C6 Autogiro: 2
 C30 Autogiro: 3, 4
 C40 Autogiro: 3, 4
 Chinook: vii, xi, 221, 228, 230, 231, 235, 236, 255, 348, 349, 383, 386, 388, 389, 392-401
 Chipmunk: 195, 255
 Cierva W11 (see Air Horse):
 Comet: 68, 279

Dakota: 41, 50, 256
 Fairey (ultra light helicopter): 203
 Frelon: 395
 Gazelle: 373, 403, 404, 413, 414
 Gnat: 379
 Gyrodyne: 25, 26, 27, 99, 102, 211
 H 19: 256
 Harriers: 364, 365, 371, 394, 396, 397, 400, 409
 Harvard: 74
 Hasting: 226, 248, 282, 324, 377
 Hawk: 415
 Hercules: 327, 350, 394, 398, 399, 401
 Heron: 151
 Hiller 360: 115, 173, 174, 194, 195, 407
 Hornet: 50, 64, 65, 66
 Hoverfly: c, 4, 5
 Hunter: 151, 178, 215, 248, 275, 281, 283, 294,
 300, 303-305, 327, 328, 346, 412
 Hurricane: viii
 Iroquois: 92, 316
 Jaguar: 409
 Javelin: 151, 215, 315, 328
 Lancaster: viii
 Lightning: 151, 351
 Lynx: 18, 202, 402, 403, 404, 410, 411, 413, 414
 Meteor: 139, 157, 185, 194, 212, 253
 Oxford: 195
 PA 39 Autogyro: 4
 Pembroke: 139
 Phantom: 394, 413
 Pioneer: 65, 76, 92, 109, 122, 148, 225, 234, 247,
 248, 250, 262, 279, 294, 295, 298-300, 324,
 328, 383, 406
 Piston Provost: 169, 406
 Provost: 197
 Puma: xi, 18, 45, 236, 239, 240, 254, 262, 271,
 360, 362, 364, 369, 385, 394, 397-404, 410
 Rota autogyro: 4
 Rotachute rotary wing glider: 3
 Rotodyne: 94, 104, 105, 111, 210, 226, 227, 228,
 229, 235, 412
 SA 330 (see Puma):
 SA 340 (see Gazelle):
 Sabre: 185
 Scimitar: 276
 Scout: 203, 238, 274, 286, 300-302, 305, 309, 407
 Sea King: 204, 261
 Sea Venom: 197
 Shackleton: 139, 184, 276, 294, 327
 Sikorsky CH-53: 236
 Sikorsky R-4 (Hoverfly): 6, 27, 44, 52, 99, 157,
 169, 183, 188
 Sikorsky R-5 (Dragonfly): 5
 Sikorsky R-6 (Hoverfly 2): 5, 6, 99, 100, 157
 S51 (Dragonfly): 5, 6, 15, 19, 25-29, 31-33, 35,
 36, 39-41, 43, 46-48, 50, 51, 53-55, 59-69,
 71, 74, 76, 77, 81-83, 87, 93, 100, 103-105,
 108, 111, 112, 116, 133, 138, 140, 159,
 167-170, 172, 175, 176, 179, 186-188, 195,
 198, 230, 232, 235, 319, 359, 366, 367, 370,
 381, 395
 Sikorsky S-55: 54, 55, 59-66, 71, 73, 74, 76, 77,
 79, 83, 93, 104, 105, 108, 115, 116, 158, 167,
 187, 213, 252
 Sikorsky S-58: 121, 122, 123, 230
 Sikorsky S-61: 394
 Sikorsky S76 (Spirit): 213
 Sioux: 302, 304, 306, 359, 371-373, 403
 Skeeter: 3, 26, 52, 55, 57, 100, 101, 103, 158,
 159, 160, 171, 172, 173, 174, 175, 176, 177,
 178, 188, 203, 359, 370, 371
 Spitfire: viii, 157
 Swift: 108
 Sycamore: 3, 11, 25, 26, 52, 57, 59, 64, 66-69,
 71, 76, 77, 79-83, 85, 86, 87, 89, 90, 91, 92,
 93, 99-101, 103, 104, 108-110, 112, 114-116,
 120, 125, 126, 133-141, 143-148, 150-152,
 158-160, 162-165, 169-171, 173-176, 178,
 179, 183-1, 188, 189, 193-200, 201, 203, 205,
 207, 209-211, 219, 226, 234, 235, 247,
 249-254, 256, 261, 262, 268, 271, 273-278,
 281, 313, 316, 318-322, 327, 330, 337, 345,
 346, 350, 359, 366, 369-373, 380, 398
 Valetta: 85, 173, 256
 Valiant: 151
 Vampire: 144, 194
 VC-10: 352
 Venom: 139, 150, 194, 276
 Vertol 107 (see Chinook):
 VS 300: 4
 Vulcan: 151
 W1, 2, 3, 4, 5, 6, Autogyro (G & W Weir): 3
 Walrus: 145
 Warwick: 145
 Wasp (naval version of Scout): 203, 407
 Wessex: vii, xi, 18, 45, 121-123, 151, 161, 166,
 207, 209-211, 216, 222, 226-240, 243, 248,
 254, 255, 261-263, 269, 274-276, 281, 282,
 284, 293, 296-309, 313, 320, 329, 339, 352,
 353, 359, 360, 361, 364, 365, 368, 369, 378,
 380, 383, 384, 387, 391-399, 401, 404, 407,
 408, 410
 Wessex Trials Unit: 233, 269
 Westminster: 228, 235
 WG 1: 235
 WG 13 (see Lynx):
 Whirlwind: vii, xi, 15, 54, 55, 57, 66, 71, 73-77,
 79-89, 92-94, 100, 103, 109, 111-116, 123,
 125-127, 133, 139, 144, 148, 150-152, 161,
 163-169, 171, 172, 175-180, 187-190, 193,
 195, 197-203, 207, 210, 212, 218, 220,
 225-231, 233-238, 240, 243, 247, 249-256,
 260, 261, 262, 263, 264, 266, 268, 269, 270,
 271, 274, 276, 293, 300, 303, 313, 316,
 320-323, 325, 327-330, 333-340, 344, 346,
 347, 350-352, 359-361, 363-373, 375, 376,
 378-381, 384, 387, 390-393, 395-396, 398,
 401, 405, 410
 York: viii,
 YR-4 (see Hoverfly):

Flights:

1310: 269, 270, 329
1448 Rota Autogiro Flight: 2
1448 Rota Calibration Flight: 4
1563 SAR: 149-151, 207, 263, 359
1564 SAR: 149, 151, 152, 268, 276, 359
1901 AOP Flight: 6, 157, 183, 186
1903 AOP Flight: 55
1906 AOP Flight: 11, 19, 44, 52, 100, 101, 104,
107, 108, 134, 141, 157-160, 168, 175, 369
Casualty Evacuation Flight: xi, 28, 32, 33, 36,
43, 44, 46, 47, 51, 53, 55, 59, 66, 67, 86, 92,
99, 138, 140, 158, 169, 172, 213, 240, 298, 315,
319
Gulf Comms. Flight (COMSAR): 307
Khormaksar Helicopter Servicing Flight: 299
King's Flight, The: 6, 169
Levant Communications Flight: 142, 145
Nicosia Helicopter Flight: 366
Queen's Flight, The: xi, 57, 107, 108, 112, 116,
120, 157, 160, 167, 168, 169, 170, 188, 203,
359, 365-369, 373, 374, 390, 392

Squadrons:

1 CFS(H): 179
2 CFS(H): 179
3 (Heli. Exam Unit): 180, 370
8: 278
15 (F) (RAF Reg't): 327
18: vii, 207, 233, 236, 237, 263, 269, 329,
359-363, 365
22 (SAR): 109, 112, 115, 122, 125, 186-189, 192,
195, 197-202, 234, 264, 272, 359, 365, 372,
375-380, 392
26: 139, 151, 221, 222, 229, 233, 236, 240, 263,
264, 266-268, 273-275, 277-279, 282, 284,
292, 293, 296, 297, 322, 329, 330, 349, 364,
387, 388
28: 233, 313, 346, 349, 350, 352
33: 385
37: 290
66: 219-222, 229, 234, 240, 248, 253, 255, 260,
262-264, 271, 297, 314, 315, 327, 329, 330,
332, 335, 336, 344, 346, 348, 349, 350, 387-389
72: 207, 221, 222, 229, 255-257, 259, 262-264,
266-269, 271, 304, 359, 360-365, 368, 408
74: 351
75 (Bloodhound SAM): 327
78: 233, 275, 276, 279, 295, 299-309, 351, 360,
386
84: 138, 295, 359, 364
103: 148, 149, 151, 233, 234, 236, 240, 316,
321-323, 327, 329, 330, 332-336, 344, 345,
347, 350-353, 373, 401
105: 295
110: 89, 91, 92, 234, 240, 262, 313, 316, 318,
321-323, 325, 327, 329, 330, 332-336,
344-346, 350, 351, 373

118: 192, 193, 197, 250
120 (SAF): 351
155: 82, 86, 87, 89, 92, 170
175: 170
194: 51, 59, 60, 61, 64, 65, 67, 68, 82, 86, 87, 89,
92, 116, 170, 194
202: 359, 365, 377-380
217: 125, 192, 193, 201
225: 114, 127, 151, 167, 193, 204, 212, 234, 236,
238, 240, 243, 247, 248, 250, 253, 256, 260,
262-264, 266, 269, 322, 323, 329, 332, 338,
360, 362
228: 193, 198, 199, 234, 359, 375, 377, 392
230: 148, 150, 207, 234, 2, 237, 240, 247, 248,
250, 262, 263, 266, 269, 271, 272, 329, 330,
343, 344, 359-361, 363, 364, 371
240 (OCU): 271
249 (Venom): 152
275 (SAR): 109, 112, 115, 125, 133, 184-189,
192-198, 200-202, 380
284: 145, 147, 148, 150, 165
529 Autogyro: 4, 5, 6
651: 159, 160
656 Air OP: 31, 41, 60
657 AOP: 6, 12, 100, 101, 110, 157, 159, 183,
186
705 (RN): 27, 174, 177
815 (RN): 281
845 (RN): 163, 164, 186, 323
848 (RN): 59, 61, 77, 79, 83, 87, 263, 306, 361
5000 Airfield Construction Sqn: 280
Aden Communications Sqn: 138, 139, 153
British Utility Helicopter Sqn
CFS Helicopter Sqn: 176, 177, 178
Far East Communications Sqn: 28
Helicopter Communications Sqn: 169
Metropolitan Communications Sqn: xi, 57, 109,
157, 168, 169, 177, 188, 203, 359, 368, 369,
373, 374, 403
Middle East Communications Sqn: viii
Short Range Transport Sqn: 162, 167
Tactical Support Helicopter Sqn: 247

Wings:

303: 59, 61, 64, 65, 336
CFS Examining: 170, 172, 173, 176
CFS Helicopter Wg: 179, 370
Tactical Wg: 298
Transport Wg: 298

Groups:

11: 369
13: 193, 195
18: 187, 197, 380
19: 200, 379
23: 173

38: viii, 212, 235, 236, 240, 241, 243, 247-251,
254, 257, 260, 267, 272, 278, 321-323, 329,
332, 337, 342-344, 363, 364, 369, 390,
407-409, 411
46: 248
81: 100, 159
90: 116
205: 104
224: 87, 89, 175, 321, 331-333, 342, 346
Tactical Air Support: 248

Commands:

Air Support: viii, 352, 374, 409, 411, 413
Bomber: 116
Channel: 117
Coastal: 52, 55, 104, 107, 108, 109, 111, 112,
115, 116, 117, 118, 120, 125, 183, 187, 188,
193, 197, 204, 250, 263, 359, 371, 373-377,
379
Fighter: 55, 100, 104, 107, 109, 112, 113, 115,
116, 133, 140, 187, 188, 192, 193, 199, 204
Flying Training: 108, 116, 169, 173, 176, 190,
390
Home: 116, 117
Maintenance: 170
Southern: 248, 412
Strike: vii, 187, 248, 342, 343, 369, 380, 391, 392
Support: 342
Technical Training: 116
Transport: viii, 55, 104, 109, 111, 112, 113, 116,
120, 122, 150, 160, 161, 167, 193, 241, 248,
249, 250, 261, 277, 341, 342, 359, 371, 373,
374, 408, 409

Main Index:

Aberdeen: 6
Acklington: vii, 363, 365
Aden: 57, 104, 106, 111, 115, 124, 127, 133, 134,
137, 138, 139, 140, 150, 151, 173, 175, 188,
195, 197, 203, 214, 221, 222, 225, 226, 228,
229, 231, 233, 234, 237, 238, 239, 240, 248,
255, 263, 267-269, 271, 273-275, 277, 278,
281, 282, 284, 292, 294-309, 314, 322, 329,
330, 333, 336, 345, 349, 351, 359, 360, 364,
374, 379, 384-388
Admiralty: 4, 15, 16, 17, 25, 27, 53, 79, 105, 107,
109, 117, 118, 204, 207, 238, 243, 367
Advanced Air Headquarters: 32, 33, 64
Aeronautical Department: 16
Africa: 225, 236, 238, 247, 251, 281-283, 315,
322, 360
Airborne Forces Experimental Establishment
(AFEE): 6, 27, 28
Airfield Surface Movement Indicator: 6
Air Board: 16, 394, 404, 414, 415

Air Council: 16, 55, 103, 106, 109, 112, 122, 123,
128, 160, 168, 188, 225, 231, 232, 242, 366
Air Forces Middle East (AFME): 221, 281, 282,
297, 298, 300, 315, 349, 360, 385, 386, 388,
392, 407
Air Headquarters Malaya: 32, 44, 55, 65, 87, 96,
97
Air Historical Branch: viii
Air Ministry: viii, 1, 2, 3, 4, 16, 17, 18, 25, 26,
46, 52, 53, 60, 69, 79, 87, 89, 99, 100, 101,
102, 103, 108, 109, 110, 111, 113, 114, 116,
117, 124, 125, 5, 136, 137, 140, 145, 147, 160,
161, 166, 172, 177, 178, 187, 188, 189, 190,
193, 205, 220, 227, 235, 236, 238, 241, 242,
243, 244, 314, 321, 369, 406
Air Ministry Aircraft Servicing Development
Party: 36
Air Ministry Aircraft Establishments
Committee: 116
Air Plans: 219, 220, 227, 228, 394, 396, 415
Air Staff: 104, 106, 107, 108, 109, 110, 111, 112,
115, 118, 121, 122, 123, 205, 211, 220, 231,
241, 242, 243, 334, 396, 405-407, 410, 412
Air/Sea Warfare Development Unit: 6, 52, 103,
104, 107, 108, 109, 111, 112, 115, 118, 120,
122, 183, 184, 185, 186, 188, 200, 201
Air Transport Movement Control Centre
(ATMCC): 249
Akrotiri: 144, 145, 150, 164, 207
Al Adem: 267
Aldergrove: 267
Algeria: 116, 242
Amman: 133, 152, 155, 175
Ampleforth College: viii
Anglo-Jordanian Treaty: 152
AOC Cyprus: 141
AOC Malaya: 44, 77, 98
AR 111 Construction (Hafner Gyroplane)
Company: 3
Aden: 232
Arabian Peninsula: 124, 225, 247, 273
Arizona: viii
Armament Practice Camp: 109, 150, 188
Armstrong Siddeley: 126
Army/Air Transport Org: 162
Army Air Corps: 17, 20, 110, 113, 114, 160, 177,
188, 205, 237, 238, 243, 244, 269, 270, 274,
300, 301, 304, 306, 342, 344, 359, 369, 373,
381, 383, 406-408, 413
Army Aviation Organisation: 11
Army Council: 160, 164
Army Headquarters, Malaya District: 32
Australia: 115, 348
Austria: 3
Autogyro Company of America: 4
Balmoral: 6
Battersea: 110, 178, 213
Battlefield Air Support Operations Control
(BASOC): 249
BEA: 55, 102, 104, 105, 106, 111, 162, 175, 227
Beaulieu: 6, 157

Belfast: 175
 Belgium: 54, 69
 Belize: xi
 Bell Rock Lighthouse (Collision): 198
 Belum valley: 47, 48
 Benghazi: 151
 Berlin riots: 44
 Berlin Air Lift: viii
 Biawak: 244
 Bingley Report: 113, 114, 123, 161, 225
 Birmingham: 41
 Bomba: 151
 Borneo: viii, xi, 18, 89-93, 106, 124, 126, 127, 149, 152, 207, 214, 221, 225, 226, 229, 234-238, 240-243, 247, 248, 261, 263, 268, 269, 279, 313-315, 317-323, 327-334, 337, 339-347, 359, 360, 374, 379, 389, 406, 408
 Boscombe Down: 67, 101, 165, 171, 184
 Boston: 50
 Briggs Plan, The: 28, 44, 46, 47
 Bristol Aircraft Company: 18, 21, 67, 68, 99, 105, 111, 118, 126, 138, 145, 152, 174, 183, 232, 235, 254, 369
 Bristol Siddeley: 238
 British Air Commission: 4
 British Guiana: 159, 207, 269, 270
 British Military Hospital: 69, 151
 Brize Norton: 6, 157
 Brunei: 316-320, 321, 324, 331, 332, 344, 348, 352
 Brunei Revolt: 91, 229, 313, 316, 319
 Buckingham Palace: 107, 110, 168
 Bukit Timah: 82
 Burton Court (Chelsea): 110
 Butterworth: 31, 86, 89, 90, 91, 92, 234, 262, 313, 316, 321, 322, 330, 337, 345, 346, 350, 351, 373
 Canada: 172, 194
 Canal Zone: 133
 Central Flying School: 15, 107, 108, 112, 137, 138, 157, 159, 167, 169, 170, 171, 172, 174, 175, 176, 177, 178, 179, 186, 188, 195, 196, 207, 248, 250, 342, 359, 360, 368-375
 CFS 'Special Flights': 372
 CFS Training Syllabus: 421-428
 CFS Ground Training: 429-434
 CFS Conversion Training: 435-456
 Ceylon: 86
 CFS Helicopter Unit: viii, xi, 57, 90, 91, 100, 116, 133, 136, 137, 141, 142, 160, 168, 169, 172, 173, 174, 177, 178, 180, 188, 195, 202, 205, 219, 262, 271, 341, 366, 373
 CFS Helicopter Development Unit: 169
 Changi: 31, 32, 33, 3 39, 40, 50, 64, 84, 350, 351, 387
 Chesapeake Bay (USA): 4
 Chatham: 217
 Christmas Islands: 57, 115, 125, 187, 188, 192, 201
 Cierva Autogiro Company: 2, 3
 Cierva Autogiro Training School, 5
 Cierva Flying School: 2
 Council of the Royal Aeronautical Society: 1
 Coventry Cathedral: 256-260, 266, 339, 345
 Culdrose: 177, 205, 367
 Cyprus: xi, 45, 71, 86, 99, 112, 114, 115, 125, 133, 134, 138-140, 142-145, 147-150, 152, 161, 162, 164-166, 173, 174, 195, 197, 203, 207, 225, 226, 228, 231, 234, 236, 238, 263, 269, 270, 375, 276, 302, 329, 351, 359, 361, 363, 364, 379, 396
 Daghestan: 5
 Daily Mail Air Race: 178
 Defense Research Policy Committee: 99, 102, 106, 121, 122
 Defford: 6
 de Havilland, 126, 127
 Desert Rescue Teams: 84
 Director of Operational Requirements: 230
 Dunkirk: 4
 Duxford: 4
 East Anglia: 50
 Eastleigh: 134, 135, 136, 137, 153, 175, 256
 Egypt: 54, 267, 274, 275, 294, 306
 Egyptian Air Force: 152
 El Adem: 133, 139, 146, 148, 149, 150, 151, 152, 155, 203, 207, 248, 249, 256, 268, 269, 276, 277, 279, 359, 360, 373, 4
 Empire Mersey: 4
 Exercise Blind Mouse: 255, 264, 266
 Exercise Bersatu Padu: 365
 Exercise Cross Channel: 267
 Exercise Crowning Glory: 348
 Exercise Deep Express: 365
 Exercise Falltrap: 266
 Exercise Kangaroo Tail: 342
 Exercise Sky Warrior: 255
 Exercise Stardust: 361
 Exercise Starlight: 248, 249, 250, 268
 Exercise Triplex West: 265, 268, 322, 360
 Exercise Winged Coachman: 264, 266
 Exmouth: 159
 Fairey Aviation Ltd: 18, 21, 99, 101, 105, 227, 232
 Falkland Islands: xi
 Far East: viii, xi, 25, 26, 27, 28, 31, 32, 40, 46, 53, 57, 62, 69, 77, 89, 92, 133, 138, 151, 152, 161, 169, 170, 172, 173, 174, 175, 201, 203, 207, 209, 213, 215, 219, 220, 221, 226, 228, 229, 231, 232, 233, 234, 236, 237, 238, 252, 257, 263, 268, 269, 271, 300, 313, 314, 320-322, 331, 332, 342, 346, 348, 352, 353, 365, 373, 374, 381, 384, 390, 395-398, 407, 408
 Far East Air Force Jungle Rescue Team: 84, 85, 90
 Far East Land Forces (FARELF) Jungle School: 39
 Far East Parachute School: 84
 Farnborough: 167, 173, 211, 219, 253
 Feltwell: 160
 Fijians: 33

Filton: 80, 158, 174, 183, 186, 369
 Fiume Italian cruiser: 2, 4
 Fleet Air Arm: 16, 17, 110, 117, 203
 Floyd Bennett Field (USA): 5
 Fort Legap: 51
 Forward Airfield Supply Org: 163
 France: 2, 4, 15, 21, 54, 116
 Fraser's Hill: 39, 54
 French Air Force: 242, 372
 Gatwick: 175
 Germany: 6, 109, 116, 158, 159, 160, 161, 168, 169, 188, 207, 226, 228, 231, 233, 234, 236, 237, 238, 244, 248, 251, 253, 255, 261, 262, 264, 265, 266, 271, 314, 329, 343, 344, 359-363, 365, 379
 German Air Force: 69, 395
 Gosport: 27, 28, 146, 266
 Grik: 45, 47, 48, 50, 389
 Ground Radar Carriage: 339
 Gurdkha: 33, 40, 47, 87, 323, 325, 326, 331, 342, 343, 345
 Gutersloh: vii, 150, 253, 262, 264, 269, 363
 Hafner Gyroplane Company: 3
 Halton: 4
 Hamble: 174
 Hanworth: 2, 5, 6
 Helicopter Development Unit: 380, 381, 415
 Heli. Short Range Transport Force: 193, 226-232, 234-236, 239, 241, 243, 247, 248, 250, 252, 254, 255, 261, 262, 264, 266, 268, 269, 270, 271, 277, 360, 370, 374, 379, 383
 Hendon: 109, 160
 HMS Albion: 139, 152, 237, 238, 268, 276, 278, 282, 297, 300, 320, 321, 323, 329
 HMS Ark Royal: 276
 HMS Bulwark: 139, 237, 238, 240, 269, 300
 HMS Centaur: 165, 237, 274, 281, 282, 284, 291, 329
 HMS Devonshire: 269
 HMS Eagle: 164, 300, 306
 HMS Fearless: 302, 306
 HMS Hermes: 300, 319, 347
 HMS Implacable: 159
 HMS Intrepid: 275, 306
 HMS Ocean: 163, 164, 165
 HMS Perseus: 59
 HMS Theseus: 163, 164
 HMS Triumph: 240, 269, 329, 346
 HMS Victorious: 282
 HMS Warrior: 201
 Holland: 159
 Home Office: 192
 Hong Kong: 83, 233, 313, 316, 320, 345, 346, 350, 352, 353, 374, 390, 391, 396, 401
 Hong Kong Aux. Air Force: 180, 373, 374
 Horn of Africa: 124
 Hounslow Heath: 3
 House of Commons: 16, 25
 House of Lords: 104
 Huddersfield: 51
 Imperial General Staff: 100, 113
 Indonesia: 318, 324, 325, 327, 328, 408
 Inskip Committee: 117
 International Civil Aviation Organisation (ICAO): 189
 Iraq: 54, 104, 232
 Irish Guards: 302
 Isle of Wight: 248
 Johore Bahru: 31, 39, 40, 45
 Johore (S): 327
 Johore Straits: 32
 Joint Committee of Helicopter Pilot Training: 177
 Joint Experimental Helicopter Unit (JEHU): 18, 57, 112-115, 117, 120, 122, 123, 128, 157, 160, 161, 162, 163, 164, 165, 166, 167, 181, 188, 193, 203, 212, 234, 247, 248, 362, 380
 Joint Force HQ: 149
 Joint Naval/Air Staff Target: 235, 236, 239,
 Joint Operations Centre: 87, 249
 Joint Services Amphibious Demonstration: 165, 166
 Joint War Air Committee: 16
 Joint Warfare Est: 342, 381
 Joint Warfare Staff: 243
 Jordan: 104, 112, 133, 152, 203
 Journal of the Royal Aeronautical Society: 12
 Kallang: 44
 Kampong Kuala Aur: 50
 Kelantan: 41
 Kenya: 71, 112, 133, 134, 135, 136, 137, 140, 159, 175, 188, 203, 207, 228, 231, 238, 256, 282
 Khormaksar: 138, 139, 273-281, 285, 286, 288-291, 294, 295, 297, 300, 301, 303-306, 373, 387, 388
 King's African Rifles: 33
 Klang river: 61
 Kluang: 87
 Korea: 40, 55, 59, 94, 158
 Kota Bharu: 41, 45
 Kroh: 45, 91
 Kuala Lumpur: 31, 32, 36, 39, 40, 41, 45, 48, 50, 54, 59, 61, 63, 64, 65, 67, 68, 69, 85, 86, 87, 89, 90, 99, 173, 175, 352, 373
 Kuala Pilah: 61
 Kuantan: 50
 Kuching (Sarawak): 91, 297, 317, 318, 320, 321, 323-325, 328, 330, 331-333, 336, 337, 342, 344, 345, 386, 389
 Labuan: 91, 240, 269, 313, 318, 320, 323-325, 329, 330, 332-334, 337, 339, 344, 345
 Land/Air Warfare Committee: 99, 101, 114, 226, 228
 Land/Air Warfare Policy Statements: 52, 100, 102
 Land/Air Warfare Transport Sub-Committee: 102
 Lee-on-Solent: 174
 Libya: 219, 247, 248, 265, 268
 Light Cargo Force: 248, 255
 London: 16, 25, 28, 81, 107, 110, 148, 168, 178, 227, 236, 349

Mafrag: 133, 152
Malaya: xi, 15, 18, 19, 25-29, 31, 33, 36, 40, 41, 46-48, 53-55, 57, 59, 63, 65, 66, 68, 69, 71, 73-77, 79-83, 85, 86, 89, 91-93, 99, 100, 102-104, 107, 108, 111, 114, 115, 120, 125, 133-135, 138, 142-144, 148, 158, 161, 164, 172, 174, 187, 188, 194, 197, 199, 200, 203, 207, 225, 230, 232, 239, 247, 252, 260, 263, 269, 270, 302, 313, 315-319, 322, 323, 325, 327, 328, 331, 332, 337, 340, 344, 345, 348, 351, 353, 361, 389
Maldives: 91
Malta: 150, 163, 164, 360
Manston: 190, 191, 194, 202, 267, 268, 375, 379
Martlesham Heath: 200, 201
Mau Mau (Kenya): 112, 134, 136, 137
Mediterranean: 2, 145, 149, 151
Middle East: 84, 87, 89, 104, 107, 112, 115, 116, 133, 134, 135, 138, 140, 150, 161, 172, 175, 203, 209, 237, 273, 360, 373, 389
Middle Wallop: 100, 107, 157, 159, 160, 169, 177, 205, 248, 381, 408
Ministry of Aircraft Supply: 16, 215
Ministry of Civil Aviation: 105, 110, 189, 190, 215, 219, 227, 231, 232
Ministry of Defence (MOD): viii, 105, 106, 261, 392, 394, 403, 404
Ministry of Munitions: 16
Ministry of Supply: 18, 25, 26, 52, 69, 73, 76, 77, 79, 99, 100, 101, 102, 105, 106, 111, 121, 122, 123, 124, 135, 157, 162, 215
Ministry of Technology: 395, 403, 412, 414
Mobile Air Operations Teams (MAOTS): 63, 146, 249, 267, 341
Mountain Rescue Teams: 84
Nairobi: 115, 133, 134, 136, 139, 173, 256, 273
NATO: xi, 54, 79, 110, 167, 213, 236, 237, 341, 343, 363, 383, 399-401, 415
Newcastle: 41, 45
New York: 5
New Zealand: 90, 348
Nicosia: 141, 142, 145, 146, 148, 149, 150, 151, 152, 165, 173, 207, 373, 374
Night Flying: 340-344
Northern Ireland: xi, 5, 187, 188, 191, 192, 193, 197, 203, 204, 250, 264, 266, 363, 365
Northolt: 52, 103, 109, 169, 203, 207, 369, 374
Old Sarum: 3, 166, 381
Oman: xi, 307, 309
Operation Black Mac: 146
Operation Blunt: 408
Operation Breakfast (Intragon): 309
Operation Commodore: 63
Operation Cyclone: 66
Operation Firedog: 98
Operation Flair: 91
Operation Flamingo: 274, 283-285, 291, 293, 294
Operation Grapple: 201
Operation Habitual: 50
Operation Haylift: 186
Operation Helsby: 47, 48, 50, 83
Operation Hill Climb: 346
Operation Hive: 50
Operation Musketeer: 145, 162
Operation Noel: 45
Operation Nomad: 146
Operation Nutcracker: 273, 274, 281-283
Operation Oak Tree: 328
Operation Pennant: 277, 278
Operation Pilchard: 50
Operation Sandflight: 277
Operation Spine: 152
Operation Wellington II: 61, 63, 164, 302
Operation White Horse: 270
Operation Zipper: 139
Operational Requirements Committee (ORC): 111
Otterburn: 255
Paratrooping: 83, 84
Paris: 213
Penang Island: 90
Pensiangan: 243
Perak: 87
Percival: 21, 105
Persian Gulf: 307, 309, 398
Pirbright: 107
Port Said: 162, 164, 165
Portsmouth: 238, 269
Port Swettenham: 61, 62
Pratt and Whitney: 54, 74, 125, 126, 233, 366
Public Accounts Committee: 123
RAAF: 69, 86, 89, 92, 316
Radfan Ops: 273-309
RAF Abingdon: 157
RAF Andover: 6, 157, 248
RAF Benson: 169, 366, 374
RAF Biggin Hill: 178, 194
RAF Chivenor: 191, 197, 202, 365, 375
RAF Cotishall: 194, 197, 198, 365, 375
RAF Cranwell: 175, 241, 242
RAF Filton: 170, 172
RAF Helicopter Training School: 6
RAF Leuchars: 194, 197, 198, 365, 375
RAF Linton-on-Ouse: 107, 170, 184, 185, 193, 195
RAF Little Rissington: 176
RAF Lyneham: 201
RAF Odiham: vii, 185, 194, 207, 209, 212, 219, 221, 222, 233, 236, 247, 250, 252, 253, 255, 256, 259, 262, 263, 267, 268, 269, 270, 271, 277-279, 304, 307, 314, 322, 323, 329, 330, 332, 336, 337, 347, 349, 352, 360, 363-365, 368, 374, 396, 403, 408
RAF Shawbury: 169
RAF St Mawgan: 107, 183, 192, 201, 202, 375, 376, 379, 392
RAF Tengah: 59, 64
RAF Ternhill: 169, 179, 180, 267, 370, 371, 373
RAF Valley: 191, 201, 267, 365, 370, 371, 375, 379
RAF Wittering: 364
Rear Airfield Supply Org: 163

Refuelling: 340
 Roe, A V Ltd: 2
 Rolls-Royce: 127, 238
 Royal Air Force Museum: 240, 329, 348
 Royal Aircraft Establishment (RAE),
 Farnborough: 2
 Royal Aircraft Factory: 15
 Royal Australian Navy: 69, 216
 Royal Canadian Navy: 120
 Royal Celon Air Force: 175, 180
 Royal Engineers: 217
 Royal Flying College: 108
 Royal Flying Corps (RFC): 15
 Royal Malayan Air Force: 89, 92, 316, 351, 373,
 374
 Royal Marines: 165, 281, 282, 284, 320
 Royal Naval Air Service (RNAS): 15
 RN Helicopter Training Unit: 194
 RNAS Abbotsinch: 185
 RNAS Donibristle: 184
 RNAS Lee-on-Solent: 186
 RNLI: 191, 192, 196, 375
 SABRE: 199, 270, 309, 326
 Sakai Aborgines: 51, 66
 Salisbury Committee: 117
 Salisbury Plain: 73, 158
 Saunders Roe Company: 18, 105
 School of Army Co-operation, Old Sarum: 3
 Search and Rescue (SAR): xi, 5, 6, 19, 20, 53,
 55, 57, 67, 79, 83, 8 89, 91, 92, 100, 103-105,
 107-109, 111-113, 115, 120, 125-127, 133,
 137-140, 143, 144, 146, 148-152, 170, 172,
 177, 183-185, 187, 189-196, 199-204, 207,
 233, 234, 236, 240, 248, 263, 264, 273-277,
 281, 293, 305-307, 316, 321, 322, 329, 339,
 346, 347, 351, 353, 359, 365, 368, 370, 371,
 373-380, 390, 392
 Search and Rescue Aerial Homing (SARAH): 86,
 143, 199, 201
 Sea/Air Warfare Committee: 117
 Secretary of State for Air: 103, 104, 107, 108,
 110, 118, 193, 232
 Secretary of State for War: 109, 114, 160, 166
 Segamat: 40
 Seletar: viii, 36, 77, 81, 89, 91, 92, 240, 260, 269,
 314, 316, 319, 321-323, 327, 329, 330,
 332-336, 338, 346, 348-350
 Seletar Night Approach: 457
 Sembawang: 59, 64, 65, 87, 314, 351
 Seremban: 31
 Sherburn: 6, 50
 Short: 21, 175
 Siew Hoong: 61, 62
 Singapore: viii, 19, 31, 32, 36, 40, 41, 44, 45, 50,
 51, 53, 59, 60, 65, 67, 68, 82, 83, 86, 90, 149,
 175, 240, 260, 263, 264, 268, 269, 284, 313,
 314, 316, 319-323, 327, 329, 331-333, 341,
 345-349, 351, 353, 360, 374, 379, 389, 391,
 398
 Singapore Air Force (SAF): 351
 Singapore Cold Storage: 46
 South Cerney: 138
 Special Air Service Regiment (SAS): 46, 47, 48,
 51, 69, 84, 85, 253, 288, 301, 304, 307, 309,
 319, 320, 326, 328, 329, 389
 Stafford: 48
 St Austell: 184
 St Mawgan: 6
 STOL: 226, 228
 Sud Aviation: 21
 Suez: 18, 104, 115, 152, 161-164, 281, 360, 362,
 395, 396, 398, 399-401, 413
 Sungei Tinggi: 48
 Sycamore Servicing Demonstration Party: 145
 Sylt: 57, 109, 112, 170, 172, 188, 197, 203
 Tactical Air Transport Support: 248
 Tactical Transport Helicopter Unit: 160
 Taiping: 31
 Tengah: 64, 233, 316, 335, 351, 352, 401
 Territorial Army: 165
 Termerloh: 31, 39
 Thorney Island: 170, 186, 190, 191, 195, 200,
 201, 202, 375, 379
 Tobruk: 150, 151
 Transport Command Development Unit: viii,
 157
 Treasury: 16, 18, 111, 112, 116, 160, 168, 187,
 191, 210, 226, 227, 395
 Ulu Langat: 69
 United Nations: 150
 United States of America: 2, 4, 6, 21, 54, 55, 74,
 79, 106, 109, 115, 116, 172, 235, 394, 405
 Upper Culham Farm (Henley on Thames): 4
 USS Princeton: 86
 Vertical Take Off and Landing (VTOL): 1, 19,
 40, 94, 114, 161, 228, 232, 384, 412
 Vietnam: 62, 404
 Vortex Ring: 30, 33, 196
 War Office: 15-17, 25, 52, 99, 101, 102, 105, 109,
 111, 113, 123, 162, 163, 210, 226, 227, 230,
 243
 Warsaw Pact: 383, 412
 Warwick: 50
 Washington: 4
 Weather: 29, 30
 Weir, G&J, Ltd: 3
 West Selangor: 61
 Westland Aircraft Ltd: 18, 21, 25, 27, 53, 54,
 60, 71, 105, 110, 116, 121, 130, 138, 158, 164,
 170, 174, 186, 195, 229, 232, 238, 296, 367,
 368, 384, 385, 387, 390, 391, 395
 Weston-Super-Mare: 209, 219, 294, 296, 369, 387
 Whitehall: 103, 142, 168, 265, 342, 349, 381, 385,
 386, 411
 Wildenrath: 186, 363
 Windermere: 45
 Woolwich: 107, 175
 Yemen: 273-275, 276, 283, 394, 301, 306
 Yeovil: 170, 174, 186, 253, 368
 Yugoslavia: 54
 Zurich: 148

Restricted



Ministry of Defence

AIR HISTORICAL BRANCH (RAF)

1987

The contents are not to be released to the public and are not to be discussed with the Press, or anyone outside the three Services without the authority of MOD, AHB(RAF)

Restricted