

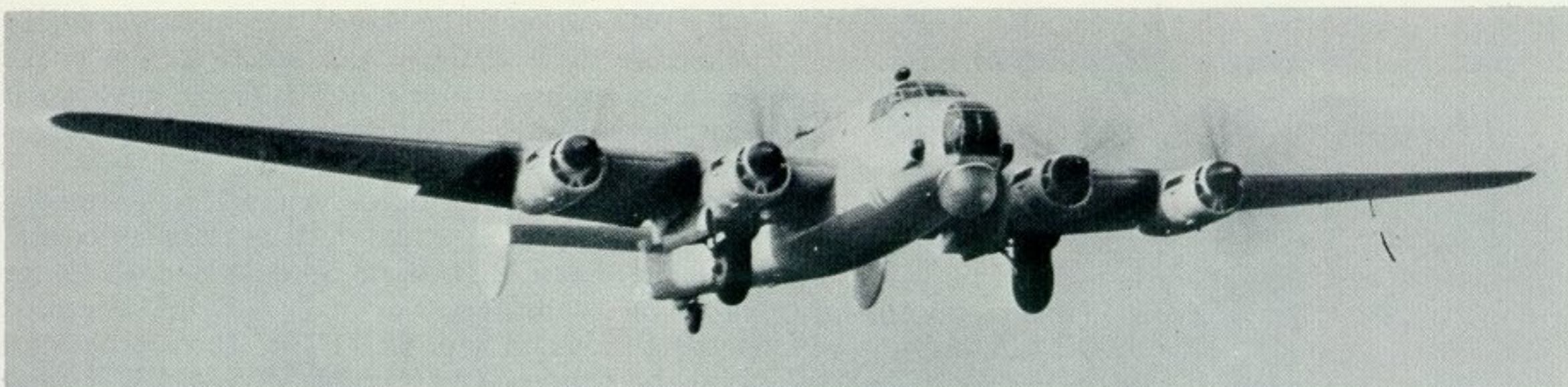
AIRCRAFT
PROFILE

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Avro (Hawker Siddeley) Shackleton Mk 1 to 4

by Peter J. Howard





Top The first flight of the prototype Avro Shackleton VW126 at Woodford on March 9th, 1949. The aircraft, piloted by Mr. Jimmy Orrell, was airborne after a 14-second run. (Photo: A. V. Roe) Bottom Another view of VW126 showing the nose turret barbettes, the tail turret, and the flight refuelling pick-up under the tail. The housing for the radio d/f loop can be seen above the cockpit roof, and the three aerials under each wingtip are for sonobuoy homing. (Photo: Harry Holmes)

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In an era of turbine-powered military aircraft, the Avro (Hawker Siddeley*) Shackleton—with the distinctive reciprocating growl of its four Rolls-Royce Griffons at full bore—is, to say the least, unusual. Yet, impressively, some three whole decades will have elapsed from the issuing of the 1946 Specification until the last “Shack” is finally pensioned-off from active service with the Royal Air Force well into the 1970s.

Prior to World War Two, long-range maritime reconnaissance was the province of flying-boats—a tradition which had its emergence during the war of 1914-18. In the early years of the 1939-45 war, once again flying-boats were to the fore. But as the German U-boats stalked their prey further and further beyond the effective patrol radius of the contemporary flying-boat, Royal Air Force Coastal Command sought to close this gap—initially in the vast-

nesses of Atlantic waters—by operating hastily-converted American Lend-Lease landplanes, in particular, the Boeing (B-17) Fortress and the Consolidated (B-24) Liberator.

In the event, the shore-based four-motor bomber impressed the military planners. The absence of the unavoidable additional weight of the flying-boat's hull was translated—for the same engine power—into greater loads of fuel and/or offensive stores. This was the beginning of the end of the big military flying-boat. For RAF Coastal Command (as it was until merged with the new RAF Strike Command on November 28, 1969), this was to be the beginning of

* Production and conversions of Shackletons extended beyond 1958 which was the year that Hawker Siddeley Aviation Ltd. emerged to administer the interests of several famous airframe companies: Avro, Blackburn, de Havilland, Folland, Hawker and Whitworth (formerly Armstrong Whitworth) Gloster Aircraft.

the second stage** of a long association with Avro-designed maritime-reconnaissance aircraft.

CHADWICK-INSPIRED ORIGINS

Roy Chadwick, the brilliant Chief Designer of A.V. Roe & Co. Ltd. did not live long enough to see this, the last of the Avro piston-engine "heavies" fly for the first time in March 1949.

Born in 1893 at Urmston on the outskirts of Manchester, young Chadwick's schoolboy heroes were all pioneer aviators and innovators; the brothers Wright, the amazing Samuel Franklin Cody and, a fellow Mancunian, A.V. Roe—later to become Sir Alliott Verdon Roe. By 1911, "A.V." had been persuaded to take him on as a draughtsman; so that his earliest contributions inevitably embraced the classic Avro 504 biplane.

By the mid-1930's, Europe's increasingly uneasy politics and warlike trends gave impetus to the need for an entirely new generation of heavy-bombers for the Royal Air Force. Thus, Chadwick became engaged on a series of "heavies" of which the Shackleton was to be in direct line of descent. There was the Avro Manchester of 1936, the Lancaster of 1941 and the Lincoln of 1944.

Ironically, it was the Lincoln, or rather its immediate post-war compromise commercial airliner development, the Tudor, which caused his untimely death. By deliberately shelving airliner development during the war, Britain was lagging far behind the United States. The Tudor series was beset with engineering snags. Chadwick, who had learnt to fly after World War One, elected to participate in one of the test flights of the prototype Tudor 2 (registered G-AGSU) on August 23, 1947. Along with the pilot, S. A. "Bill" Thorn (the Chief Test Pilot) and two others, Chadwick was killed when the Tudor 2 crashed on take-off at the company's Woodford (s.e. of Manchester) airfield.

During his lifetime, Chadwick's design achievements were honoured in many ways; not least with a C.B.E. (Commander of the Order of the British Empire) conferred by H.M. King George VI and an Honorary Master of Science from Manchester University. Seven years after the first flight of the Shackleton, the Royal Aeronautical Society (of which he had long been a Fellow) instituted the First Chadwick Memorial Lecture on March 21, 1956.

SHACKLETON EMERGES

After World War Two ended, the Lend-Lease aircraft were recalled to the U.S.A. and an anti-submarine reconnaissance version of the Avro Lincoln B.Mk.3 was projected.

In the meantime, the little-known company of Cunliffe-Owen Aircraft Co. Ltd. (which, during the war, had handled modifications to Lend-Lease and other American aircraft), had converted some late-production Lancaster B.Mk.3s for air-sea rescue duties (ASR.Mk.3) with an Airborne Lifeboat under the fuselage.

** The first stage had been with that amiable two-motor slowcoach affectionately known as "Faithful Annie", the Avro Type 652A Anson—which served with RAF Coastal Command from the mid-1930's until the early 1940s.

By 1947, however, the Royal Air Force was forced to modify some of these ASR.Mk.3s for use in the General Reconnaissance (GR.Mk.3) role until newer and more suitable maritime landplanes became available.

With such pressing needs, it is hardly surprising that Avro gained a virtual "off-the-drawing-board" order on March 21, 1946 (to Specification 42/46) for an initial production run of 29 aircraft, allocated serials VP254-268 and VP281-294. Three prototypes were also required (RAF serials VW126, VW131 and VW135).

Roy Chadwick's design team then evolved a completely new aircraft to meet the RAF requirements and a revised Specification (Spec. R.5/46) was accordingly issued on March 17, 1947. This new design was to incorporate Lincoln-pattern mainplanes and several Tudor assemblies mated to a shorter fuselage of much larger cross-section and a high-mounted tailplane with big oval-shaped, endplate twin fins and rudders. Powered by four Rolls-Royce Griffons (Mk.57s outboard and Mk.57As inboard) driving Rotol 6-blade counter-rotating propellers, Spec. R.5/46 became the Avro Type 696 Shackleton GR.Mk.1.

Engine installation trials were conducted at the Rolls-Royce Ltd. aerodrome at Hucknall (n.e. of Derby) with two modified Avro Type 691 Lancastrian IIs (VM704 and VM728) with inboard Merlins exchanged for Griffon. A former RAF wartime Mitchell pilot, 26-year old J. D. "Johnny" Baker of the Avro test pilot staff was despatched to Malta to fly with RAF Coastal Command crews flying Lancaster 3s. Their views and suggestions were to be considered in respect of the new design.

THE PROTOTYPES

When the first of the three prototypes (VW126) was rolled-out at Woodford, the nose section included a ventral radome transparency under a bluntish observation nose transparency to the rear of which and on each side of the fuselage were Boulton Paul Type L barbets for single 20-mm. Hispano cannon. A dorsal turret (Bristol Type B.17) was to house two more 20-mm. cannon while a tail turret (Boulton Paul Type D) would contain two 0.50-in. Browning heavy machine-guns. Under the tail was a Flight Refuelling Ltd. pick-up point. The capacious bomb-bay was intended to house up to 20,000 pounds of maritime stores. Accommodation was provided for 10 crew comprising two pilots, two navigators, an engineer and five crewmen to man the electronics gear, guns and visual look-out positions.

Adequate accommodation was to be an important aspect of the Shackleton design. Long hours spent in cramped, unsuitable conditions would affect crew efficiency especially as the periods to be airborne were to be of an extended nature. When designing the Lancaster, Chadwick had found that the only way to provide the navigator with an adequately-sized working table (in the narrow, restricted fuselage) was to seat him sideways to face the port wall. In the Shackleton, the same philosophy was adopted and extended so that both the navigators and the sonics-operator were seated side-by-side at a long table. The forward-facing radar-operator was positioned just aft of the sonics place so that a compact tactical team

the aircraft suffered a bird strike that smashed the radome and had a profound effect on the future design of the aircraft. During the official trials, the nose cannon barbets and the tail turrets were removed.

The third prototype, VW135, was delayed by changes to bring it up to as near production standards as possible, and flew for the first time on March 29, 1950. It was devoid of nose barbets, flight refuelling point and tail turret; also, a window at the navigation position just ahead of the port wing had been deleted. The aircraft joined the official trials at Boscombe Down in July 1950, and continued the trials until March 1954; being used mainly for armament development.

The urgency of the situation necessitated the immediate construction of production aircraft, and the first one, VP254, flew on March 28, 1950, beating the third prototype into the air by one day. VP255 flew on June 30 and took part in the R.A.F. Display at Farnborough on July 7 and 8 as a static exhibit; it then went to Boscombe Down in November for B.17 turret trials. The next to fly was VP257 on August 28, and it carried out the flying displays at the 1950 SBAC Show in the hands of Mr. Baker, and then went to the Central Servicing Development Establishment at Wittering on December 13 for four months. VP256 flew on September 18 and was the first delivered to the R.A.F., being allocated to Manby on September 28 for Pilots Notes preparation. The next two aircraft, VP258 and VP259, flew on October 13 and 24. The production aircraft were called Shackleton MR.Mk1, the designation having been changed to Maritime Reconnaissance.

SQUADRON SERVICE

Initially it was intended that the Shackleton would be the sole land-based aircraft in RAF Coastal Command, replacing the ageing Lancaster 3 and supplementing the Sunderland flying-boats. The formation of NATO in 1949 upset these plans by creating further commitments for Coastal Command, and aircraft had to be obtained quickly to cover these commitments. Fifty-two Lockheed Neptune (P2V-5) aircraft were purchased from the U.S.A. as a stopgap until sufficient Shackletons became available. It was planned that these aircraft would be used for North Sea and coastal water patrols, leaving the very long range ocean patrols for the Shackletons with their much larger weapons bay. The overall plan was that Kinloss in Scotland would be the main conversion base for Shackleton and Neptune crews, with a resident Neptune squadron for northern coastal waters cover. The main Neptune base would be Topcliffe in Yorkshire for North Sea cover, and the Shackletons would be based down the western seaboard at St. Eval in Cornwall, Aldergrove and Ballykelly in Northern Ireland, and at Gibraltar.

All 29 Shackletons of the first order under Contract 6062-4 were delivered during 1950-51, and the first unit to equip with the aircraft, starting in March 1951, was No. 120 Squadron, temporarily based at Kinloss so that service trials could be carried out in liaison with No. 236 Operational Conversion Unit which was in the process of forming there. Three early production aircraft went to the Air Sea Warfare Development Unit (ASWDU) at St. Mawgan so that weapon

development and installation trials could start. The O.C.U. received its first aircraft in May, and by the end of the year had 12 in service training crews for the new squadrons. No. 224 Squadron at Gibraltar started replacing its Handley Page Halifax Met.Mk.6s with the Shackleton in July; and was fully converted by October.

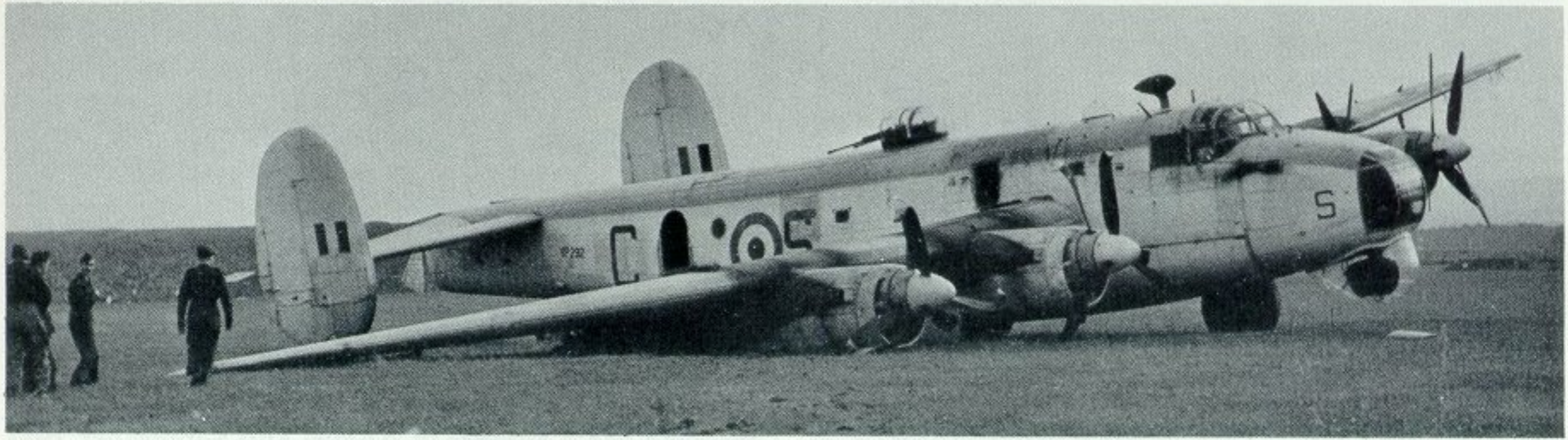
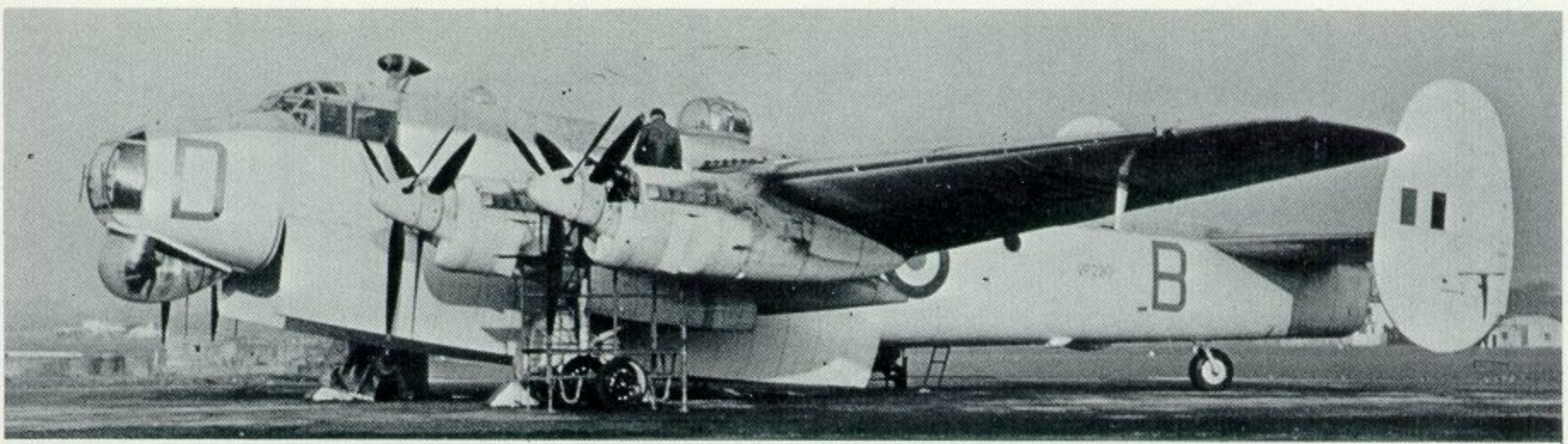
A slight redesign was made at this stage, the outer nacelles being widened to enable Griffon 57A engines to be fitted all round for standardization, and a further 58 aircraft were ordered under Contracts 3628 (WB serials) and 5047 (WG serials). The modified aircraft were called Shackleton MR.Mk.1A, and all Mk.1 aircraft were later brought up to this standard during 1955/56. All the Mk.1A aircraft were delivered by July 1952, and further squadrons were equipped as new aircraft became available. No. 220 Squadron reformed at Kinloss on September 24, 1951 and then moved down to St. Eval in November; No. 269 Squadron reformed at Gibraltar in January 1952 and then moved to Ballykelly on March 14; No. 240 Squadron reformed at St. Eval in May 1952 and then moved to Ballykelly on June 6; No. 42 Squadron reformed at St. Eval on June 28, 1952, and No. 206 Squadron reformed at St. Eval on September 27, 1952 from a nucleus of No. 224 Squadron personnel. This meant that by the end of 1952 there were seven squadrons of Shackletons in service, the Neptune was entering service, and the first part of the re-equipment plan was completed.

The Shackleton had a reasonably trouble-free development period and settled quickly into squadron service, and after completing the service trials No. 120 Squadron moved to its permanent base at Aldergrove in April 1952. It was soon discovered though that the ample soundproofing that had been such a prominent feature of the prototypes was omitted completely from the production aircraft, and although the crews enthusiastically welcomed the roomy interiors, large weapons bay, and ample power from the four Griffon engines, the interior was very noisy, and coupled with the matt-black paintwork created a depressing atmosphere in which to work.

The official trials had shown that the radar scanner efficiency was not as good as desired, and coupled with its vulnerability to damage from bird strikes in its chin position, it was decided to reposition the scanner. At the same time the opportunity was taken to streamline the nose shape and incorporate a turret, for although submarine deck guns had disappeared in the quest for more underwater speed and had thereby made aircraft "scareguns" redundant, it was anticipated that the Shackleton would be deployed in a secondary role of colonial policing and a turret would be advantageous.

SHACKLETON Mk.2

Issue 2 of Specification R.5/46, dated July 3, 1950, gave the go-ahead and the first prototype, VW126, was rebuilt during the winter of 1950-51 to incorporate the new ideas, and emerged in the summer of 1951 as the aerodynamic prototype of the projected Mk.2 aircraft. The nose had been lengthened and incorporated a dummy turret and look-out position, and the rear fuselage had been lengthened to finish in a cone shape. Twin retractable tail wheels had been fitted, and lockable rudders and toe brakes had been



added for better ground control. A dummy radome had been positioned ventrally aft of the wing. The first flight in this form was made on July 19, 1951 and the aircraft then went to Boscombe Down for trials. One of the Mk.1A airframes (WB833) was taken from the production line and rebuilt to full Mk.2 specification as the prototype aircraft. The nose incorporated a Boulton Paul Type N turret with two 20-mm. Hispano cannon and, under it, a prone bomb-aimer's position with an optically-flat screen. The tail cone was transparent to provide a prone look-out position for weapon attack assessment, and the radome was a semi-retractable "dustbin-like" affair. WB833 first flew on June 17, 1952, and went

Shackleton Mk.1 VP290/B-D of No. 224 Squadron being prepared for a 16-hour patrol at Ballykelly during Exercise Assess in 1951. Standard 1947 Coastal Command colour scheme of Medium Sea Grey upper surfaces, Glossy White under surfaces, Matt White fuselage, cowlings and spinners, Light Slate Grey serials.

(Photo: Mike Stroud)

Shackleton Mk.1 VP292/C-S of No. 236 O.C.U. after a wheel collapsed on landing at Kinloss on October 22nd, 1952. Note dirty exhaust from the nose cabin heater outlet, and also from the engine exhausts over the wings.

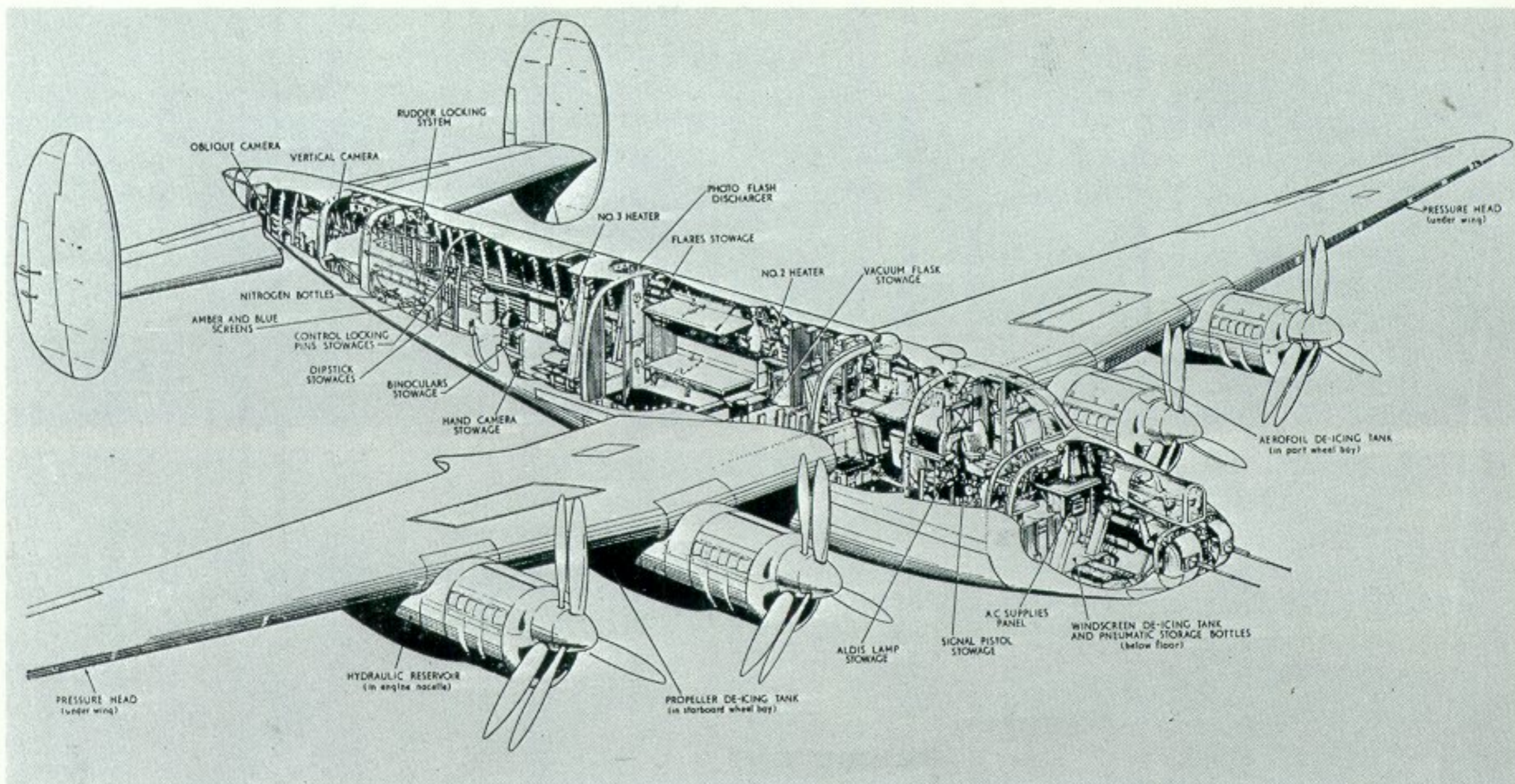
(Photo: R.A.F. Kinloss)

The first prototype VW126 rebuilt as the aerodynamic prototype of the Mk.2 aircraft with dummy nose, tail cone and ventral radome. Rudder skinning seems a little the worse for wear.

(Photo: A. V. Roe)

The prototype Shackleton Mk.2, WB833, soon after completion. Note bomb-aimers window under the front turret, and the Radio Compass aerial above the cockpit roof. Perspex tail cone can just be seen.

(Photo: Harry Holmes)



Schematic showing interior of Mk.2 aircraft with mid-upper turret removed. Seating arrangements are identical to Mk.1 aircraft, except in nose.
(Photo: D. A. C. Williams)

to A&AEE, Boscombe Down, in July for three months of engineering, handling and radio trials.

The trials proved successful, and the last 10 aircraft of the Mk.1A order were built to Mk.2 configuration instead (WG530-533 and WG553-558). This restricted the total of Mk.1 and Mk.1A aircraft to 76, and further orders for Mk.2 aircraft were placed in 1952 under Contract 6129 (40 in 'WL' series), and later under Contract 6408 ('WR' series).

The first three production Mk.2 aircraft were finished in September 1952 and were loaned to the Ministry of Aviation (as the M.O.S. had become) for trials, WG530 going to A&AEE on September 25, WG533 was the first Mk.2 delivered to the R.A.F. going to Manby in October for Pilots Notes compilation. WG532 eventually went to ASWDU in January 1953 and was fitted out for rocket-firing trials, there being four rocket rails under each outboard mainplane. The trials were not successful as the aircraft was much too heavy on the controls for rocket attack dives; so the idea was dropped.

Mk.2 IN SERVICE

The Mk.2 aircraft was not considered to be a new type, and was issued to the squadrons to be operated alongside their Mk.1 aircraft. The St. Eval squadrons were the first to receive Mk.2 aircraft, No. 42 Squadron in January, No. 206 in February, and No. 220 in March, 1953. These were followed by No. 240 Squadron in March, No's. 269 and 120 in April, and No. 224 in May, 1953. On April 13, 1953 three Mk.1 and three Mk.2 aircraft of No. 42 Squadron left St. Eval on a long overseas tour to Ceylon and South Africa for exercises, and in July the squadrons showed off their Shackletons at the Royal Review at Odiham.

As production of the Mk.2 proceeded, the next stage of the re-equipment plan was implemented, and

No. 37 Squadron and No. 38 Squadron at Malta received Mk.2 aircraft in August and September 1953 respectively. Their Lancaster 3 aircraft were ferried back to the UK, and the last operational Lancaster 3 (RF273) of RAF Coastal Command left No. 38 Squadron on February 3, 1954. The final two squadrons of the re-equipment plan were reformed during 1954, No. 204 Squadron at Ballykelly on January 1, and No. 228 Squadron at St. Eval during June, both receiving Mk.2 aircraft. The squadrons soon found that the two marks of Shackleton were vastly different to operate, and in June 1954 it was decided to standardise one type for each squadron. During the summer Nos. 120, 206, 220, 240 and 269 Squadron gave up their Mk.2 aircraft, and Nos. 42 and 224 Squadron completely re-equipped with Mk.2 aircraft. So by the end of the summer 1954 there were 11 squadrons of Shackletons providing long range cover of the Atlantic from the Arctic to the Equator, and throughout the length of the Mediterranean. These were backed-up by four squadrons of Neptunes for coastal work and three squadrons of Sunderlands—two of these in the Far East.

Development of the equipment for the Shackleton by ASWDU continued, and a Mk.2 (WL789), was fitted with an extended tail for Magnetic Anomaly Detector (MAD) trials. The airframe proved to be electronically unsuitable for the equipment, and the heaviness of the aircraft controls made effective tactical use of the equipment unobtainable. So, although the trials were extended to include overseas operation from Malta and WL789 retained the equipment, the project was dropped.

Another development by ASWDU concerned illumination for night attacks; the standard illumination equipment of the Shackleton was four six-barrelled dischargers which fired flares from the starboard beam, each flare giving three seconds illumination at 3¾ million candle power. In an effort to improve illumination, trials were carried out using rocket-fired flares called "Glow Worm"; the idea being to put the illuminants behind the target for

silhouetting. The flying technique required for proper positioning of the flares proved difficult and hazardous—even in the relatively nimble Neptune aircraft. Consequently all plans for using the idea in the projected Shackleton Mk.3 aircraft were dropped, although they were all eventually delivered with full rocket circuitry in the wings.

The lockable rudders and toe brakes of the Mk.2 aircraft made taxiing much easier for the pilots, the hand-squeeze and differential-rudder technique of the Mk.1 aircraft proving very unwieldy in a cross wind. The tailwheel unit of the Mk.2 aircraft was found to be very weak, and initially anything other than a reasonable landing caused the unit to collapse.

Maritime aircraft take a terrific pounding in service, nearly all the flights being made at low altitude where the aircraft is subjected to surface gustiness and salt water spray, leading to corrosion. Flights are normally of long duration, and the many types of exercise carried out during each flight mean that constant changes of airframe configuration and power settings are being made. The Shackleton was robust enough to stand this treatment, and as a bonus it was found that the aircraft could be almost self-supporting when away from its home base, the ground crew for servicing being carried in its capacious fuselage, with spares, etc., being carried in large panniers loaded in the weapons bay.

Consequently, Shackleton squadrons carried out many detachments to NATO countries for exercises, and were called upon to make long goodwill tours to various parts of the world. On August 12, 1954, No. 206 Squadron left St. Eval with four Mk.1/1A aircraft (VP293/A, WG510/B, WG529/F, WB832/G and WB836/H as replacement for 'F') on a 7 week Commonwealth Goodwill Tour, taking part in naval exercises at Ceylon, and visiting New Zealand and Fiji. Five Mk.2 aircraft of No. 204 Squadron visited Durban in June 1955 for exercises with South African forces, and paid a goodwill visit to the Gold Coast on the way home in July.

The Shackleton had shown from the start, by results in exercises with the Royal Navy and in

exercises with NATO forces around Europe, that it was an excellent maritime reconnaissance aircraft; but working conditions for the crew were far from ideal. Complaints from the squadrons eventually led to fatigue trials being carried out at the Royal Aircraft Establishment (RAE), Farnborough, in 1953 and 1954. As more Shackletons were soon to be required as replacements for the rapidly-ageing Sunderland flying-boats, construction of Mk.2 aircraft was terminated at WR969 in September 1954, and a complete redesign of the aircraft undertaken, improving and modernizing it as the Avro Type 716 Shackleton MR.Mk.3.

SHACKLETON Mk.3

Issue 3 of Specification R.5/46 covering the new type had been released on November 18, 1953; but work did not start until 1954. Tricycle undercarriage with twin wheels and hydraulic brakes was fitted, and this required a slight change in the nose contouring and a shortening of the weapons bay to fit in the retractable nosewheel and crew entrance hatch. The wing planform was changed by modified ailerons of greater chord to improve handling, permanently-fixed wing-tip fuel tanks were added to increase fuel capacity up to 4,248 Imperial gallons, and a fuel jettison system fitted.

The dorsal turret was deleted so that a crew rest room with full cooking facilities could be incorporated just aft of the wing rear spar, the room being sealed off fore and aft by bulkheads with access doors on their starboard side. A clear-vision perspex cockpit canopy was fitted to improve pilot vision, all equipment 'black boxes' were fitted on racks at roof level behind drop-down doors, and the whole aircraft interior was liberally soundproofed and lined in brown and cream rexine.

To increase the efficiency of the tactical team the

WB834/C-L of No. 236 OCU showing the lettering style adopted immediately after the colour scheme change of 1955.

(Photo: Arthur Percy)



The prototype Shackleton Mk.3 aircraft, WR970, seen in flight soon after completion, finished in the new standard colour scheme of High Gloss Dark Sea Grey overall. A. V. Roe motifs on nose and fin. Notice the new engine exhaust system, the centrally-mounted tip tanks, the extra fuselage windows for the crew rest room, and the I.L.S. aerial under the nose.

(Photo: Bruce Rigelsford)



table down the port wall was extended aft to the rest-room bulkhead so as to include the radar operator, and large comfortable arm chairs were fitted at all crew stations. To improve crew comfort still further, the old noisy engine exhaust stubs were replaced by a sealed unit which deflected the gases and noise under the wing. There was very little new equipment fitted in the aircraft, but account had been taken of new equipment in the design stage, and airdials and wiring had been built in for later additions.

Airborne lifeboats had been developed for Search & Rescue (SAR) use and had been a feature of the Lancaster ASR.Mk.3, and, similarly, all Shackletons were equipped to carry them. But the Lindholme Gear—a set of five rope-connected cylindrical containers with a dinghy in the middle one—was preferred. Thus, the lifeboat was never used operationally by the Shackleton in R.A.F. service.

The prototype Shackleton MR.Mk.3 (WR970) flew for the first time on September 2, 1955 and appeared at the SBAC Show in that month. Unfortunately, the aircraft suffered prolonged handling trials because of unsatisfactory stalling characteristics. A&AEE returned the aircraft to A. V. Roe in November 1956 for a modified stall warning device to be fitted before further trials. During further stall tests on December 7, control was lost and the aircraft became inverted in cloud. Although control was regained, there was no power available as the engines had oiled-up, and the windmilling propellers caused the aircraft to stall into the ground near Foolow Village in Derbyshire, destroying the aircraft and killing the four crew. The second Shackleton Mk.3 (WR971) did not fly until December 1956, so entry of the type into service was delayed. The aircraft was eventually fitted with vee additions to the leading-edge of the inboard section of the mainplane to stall that part of the wing first, thereby giving a wings-level stall.

SHACKLETON Mk.3 IN SERVICE

In August 1957, No. 220 Squadron at St. Eval started re-equipping with the new type. The squadron moved to St. Mawgan a month later as the longer runway there was more suitable for the new aircraft, and service trials commenced. No. 206 Squadron moved to St. Mawgan on January 14, 1958, partially re-equipped with Mk.3 aircraft due to the slow delivery rate, and joined in the service trials. Engine fading, because of air entering the fuel system, and hydraulic failures due to piping of insufficient strength, caused the trials to be extended. Eventually cleared of these snags, two more squadrons started re-equipping with the type, No. 120 Squadron at Aldergrove in September 1958 (moving to Kinloss in April 1959 and having previously converted to Mk.2 aircraft in October 1956), and No. 203 Squadron (ex-240, see later) at Ballykelly in December 1958. Initially 52 aircraft were ordered under the continuation of Contract 6408 (serials WR970-990 and XF700-730), but a review in 1956 cut this back to 33 aircraft terminating at XF711. A further aircraft was ordered after the loss of WR970, and this was allocated serial XF730 and delivered in June 1959.

The standard colour scheme for RAF Coastal Command aircraft had been white overall, with

Colour illustrations

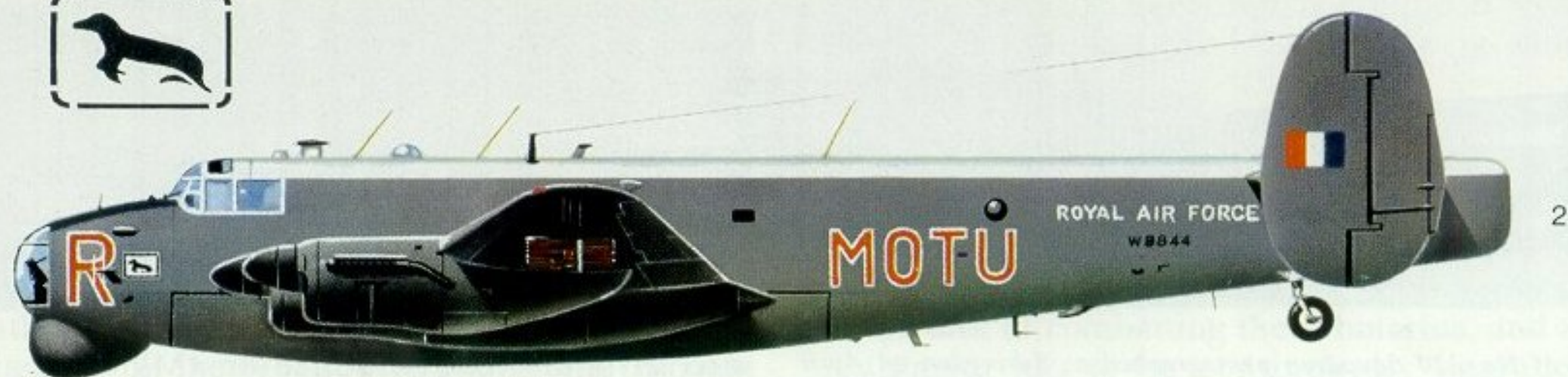
- 1 VP291 'B-C', a Mk.1 aircraft with No. 224 Squadron at Gibraltar from September, 1951 to February, 1952. Shown in the correct 1947 colour scheme for Coastal Command aircraft.
- 2 WB844, shown as modified as a T.4 training aircraft first delivered to MOTU in January, 1958 as 'X'. It was then modified to Phase 2 standard at Chester in 1960-61, and returned to MOTU to become 'R'. Eventually became ground instructional airframe 8301M at Cosford in July, 1968.
- 3 WR957 'L-U', a Mk.2 aircraft with No. 228 Squadron at St. Eval from July, 1954 to February, 1959. Shown in the pre-1955 colour scheme but with fuselage letters painted red as adopted by the squadron. Note canvas strip stuck over the flare dischargers just ahead of the roundel.
- 4 WR953, one of the four Mk.2 aircraft of No. 228 Squadron that toured South America in October-November, 1955. The aircraft carried the squadron number on the rear fuselage, although this was not officially adopted until May, 1956, and were numbered '1' to '4'. Note Union Jack on fin, and also the non-standard outline to the roundel.
- 5 WG530, a Mk.2 Phase 2 aircraft that served with No. 205 Squadron at Changi, Singapore from August, 1962 to July, 1967, and was then returned to Britain for scrapping at Shawbury. No. 205 Squadron retained the 1956 colour scheme until the unit disbanded at the end of October, 1971. The upper surface of the wing above the fuel tanks was painted white to keep the fuel cool.

medium sea grey tops to the fuselage, wings and tailplane; the fuselage letters to denote the squadron and aircraft, and the registration were light slate grey, and the underwing registration was black. Some squadrons, however, painted their fuselage lettering and propeller spinners in their own colours (see colour side views). The white aircraft proved difficult to keep clean, especially the constantly-used training aircraft. So, at the request of No. 236 OCU, a high-gloss dark sea grey overall colour scheme was introduced in 1955, and the prototype Mk.3 aircraft was painted thus. Fuselage letters painted in plain white were initially used, but a standard scheme showing the squadron number on the aft fuselage and the aircraft letter on the nose was introduced in May 1956, these being painted in red with white outlines. The military serial under the wings was similarly painted, but the fuselage serial was plain red. The fuselage roundel was centrally placed over the radome on the Mk.1/1A and Mk.2 aircraft, but on the Mk.3 it was reduced in size and placed low down above the front of the radome.

SHACKLETON T.MKs.2 & 4

In 1956 it was decided that the time had come to standardize on the Shackleton aircraft for RAF Coastal Command, and plans were made to phase out the Lockheed Neptune aircraft, and, at the same time, to reorganize the training of aircrew. Up to that time, aircrew spent 2½ months at the School of Maritime Reconnaissance at St. Mawgan flying in Lancaster 3s, and then proceeded to No. 236 OCU at Kinloss to convert onto their assigned aircraft.

In 1956, the whole training was amalgamated into one vast "empire" at Kinloss called the Maritime Operational Training Unit (MOTU), and special training versions of the Shackleton Mk.1A were ordered, called T.4, incorporating additional radar positions in the bunk area. This was possible because the mid-upper turrets had been removed from the Mk.1/1A and Mk.2 aircraft during 1955-56 to give more internal room. The first two T.4 aircraft (WB837 and WG511) entered service with MOTU in August 1957 and eventually 17 were converted. The Lancaster 3 aircraft were withdrawn from service at St. Mawgan, the last one, RF325, going on October





WB828 of No. 120 Squadron photographed at Bovingdon on April 23rd, 1956 displaying the newly-adopted standard scheme of aircraft letter on the nose, and squadron number on the rear fuselage, both in red outlined in white. Note coloured spinners.

Shackleton T.4 trainer WB831 MOTU/S seen at Bovingdon on December 19th, 1957, one month after the completion of its conversion. Notice ILS aerial under rear fuselage just aft of the roundel, and the VHF radio homing aerials on the nose immediately aft of the perspex.

Shackleton Mk.2 WR959 228/0 seen at Bovingdon in 1956 in the new colour scheme, but sporting red spinners and an unusual anti-glare nose colouring. Note flare discharger openings by roundel.

Shackleton Mk.2 WL789 ASWDU/F-D with extended tail for Magnetic Anomaly Detector trials seen at St. Mawgan in October, 1956. (Photos: Arthur Pearcy)

Three of the four aircraft from No. 224 Squadron that made a tour of South America in March, 1957 seen at Gibraltar just prior to departure. Note numbers and squadron badge on nose, and Union Jack on fin. (Photo: Flight)

15. 1956. During another reorganization, later, MOTU moved down to St. Mawgan in July 1965 and the long-serving T.4 aircraft were eventually replaced during 1968 by training versions of the Mk.2 Phase 3 aircraft—called T.2—10 of which were converted by Langar during 1967.

Meanwhile the Mk.1/1A- and Mk.2-equipped squadrons had been busy with exercises at home and overseas with national and NATO forces, and the worsening political situation in Cyprus created a new role for the Shackleton—anti-smuggling patrols, to prevent arms reaching the island. No. 38 Squadron in Malta was given the task of patrolling the coast of Cyprus, and on July 21, 1955 flew the first patrol on what was to become a major undertaking involving 250 flying hours a month, and lasting four years. No. 42 Squadron assisted for a while in 1957 during the disturbances, and then during 1959 the situation in Cyprus eased and the last of 884 sorties was flown on December 14, 1959.

During October and November 1955, four aircraft (WR956, WR959, WR957 and WR953) of No. 228 Squadron emblazoned with Union Jacks and numbered '1' to '4' instead of letters carried out a goodwill tour of South America, visiting Brazil, Venezuela, Colombia and the then British Guiana (Guyana). At the end of the year No. 42 Squadron (with Mk.2

aircraft) and No. 206 Squadron (Mk.1/1A aircraft) carried out trials with the Shackleton as an emergency transport, and both agreed that it was feasible to transport 33 troops, with equipment in panniers, over reasonable ranges. A full-dress rehearsal was made in January 1956 when, under *Exercise Encompass*, five aircraft of No. 206 Squadron uplifted the 16th Parachute Brigade from Blackbushe to Cyprus.

These trials bore fruit sooner than expected, for President Nasser of Egypt seized the Suez Canal in the autumn of 1956, and the Shackleton squadrons were used to transport RAF Bomber Command personnel and British Army troops out to Cyprus and Malta for the Suez campaign. No. 38 Squadron was more actively involved, carrying out several reconnaissance patrols of Egypt in September, sending a fully-armed detachment to Idris at the end of October, and providing anti-submarine cover for the invasion fleet during the actual campaign. Subsequently, the Shackletons were used to bring the troops home again.

In the International Geophysical Year of 1956, No. 204 Squadron participated with ocean survey work during the early summer; and it was also the year which saw the start of British nuclear testing in the Pacific. In June, No. 269 Squadron sent a detachment to Darwin and Alice Springs in Australia to participate in early experiments; and, during June and July, two aircraft of No. 206 Squadron encircled the world eastwards during their task of setting up Christmas Island as the base for the forthcoming nuclear tests.

During the periods of the tests, Shackletons were used for meteorological reconnaissance and patrols of the vast danger area to keep it clear of shipping. One ship that had strayed into the area, and which Lloyds Register stated was capable of 8 knots, was seen to raise a second bow wave in its haste to depart the danger zone once one of the multi-lingual leaflets dropped by a Shackleton had been picked up and digested.

No. 206 Squadron and No. 240 Squadron covered

the 1957 tests, and aircraft from No. 224 Squadron and the three Ballykelly squadrons covered the 1958 tests, although a Mk.3 aircraft of No. 206 Squadron carried out a proving flight to the island during the autumn tests.

Further tests in Australia at the Maralinga Research Grounds in the autumn of 1957 were covered by No. 204 Squadron, under *Operation Antler*. The nuclear tests from Christmas Islands were codenamed "Operation Grapple", and the participating Shackletons wore the grapple crest on their fins—a red cormorant clawing a grapple.

A further goodwill tour to South America was made by No. 224 Squadron in March 1957, using four aircraft, emblazoned with Union Jacks and aircraft numbers again—WL758(1), WL753(2), WL751(3), WL752(4). But this event was overshadowed later in the year by the flare-up of rebel activity in the Southern Arabian Peninsula, and British forces were called in to assist under treaty agreements. The anticipated secondary role of the Shackleton Mk.2, colonial policing, was now applied. In July 1957, No. 37 Squadron was moved permanently to Khormaksar, Aden, to help the land forces, attacking the rebels with bombs and its nose cannon, and patrolling the Aden Protectorate borders. Detachments were sent to Sharjah in the Persian Gulf to assist the forces of the Sultan of Oman, but as rebel activity built up No. 37 Squadron became fully committed in Aden, and the Sharjah detachments were provided by other Mk.2 squadrons (42, 228, 224) and continued into the autumn of 1958. No. 37 Squadron did not remove their mid-upper turrets until the winter of 1957/8, although they had been gunless since 1955, and for a while used a much deeper white top on their aircraft than standard.

The final step was made in 1958 to standardize on the Shackleton aircraft when the last remaining Sunderland 5 squadron, No. 205 Squadron in Seletar, Singapore, started converting onto Mk.1A aircraft made surplus by the Mk.3 re-equipment in the UK. Squadron headquarters was moved to Changi and conversion started in May 1958 and was completed by May the following year. The last operational flight with a Sunderland occurred on May 15, 1959. The standardisation scheme had meant that some famous

squadrons had been disbanded, and late in 1958 a renumbering of squadrons was made to keep the well-known numbers alive; 220 became 201 on October 10, 240 became 203 on November 1, and 269 became 210 on December 1. At the time of the renumbering No. 269 Squadron had been converting onto Mk.2 aircraft, and this left only No. 205 Squadron equipped with Mk. 1A aircraft, although No. 204 Squadron re-equipped with Mk. 1A aircraft for the period May 1958 to May 1959. All the Mk.1A aircraft not scheduled for T.4 conversion were disposed of, some becoming ground instructional trainers, some used for fire training, but most were eventually sold as scrap from Aldergrove and Shawbury Maintenance Units. It was not until February 1962 that No. 205 Squadron re-equipped with Mk.2 aircraft, and the last Mk.1A aircraft were withdrawn from service.

No. 42 Squadron moved to St. Mawgan on October 8th, 1958, and on March 6th, 1959 a dual-purpose parade was held at St. Eval, the airfield was closed down and No. 228 Squadron was disbanded.

Maritime reconnaissance work is primarily centred on the task of combatting the submarine, and aircraft equipment has to be continuously upgraded and renewed to achieve this. Initially Shackleton crews had to rely on radar and eyesight for detection, non-directional sonobuoys for investigation, and depth charges for attack. But over the years equipment had been added for detecting and homing onto engine exhausts (scoop on port nose side), directional sonobuoys for better underwater tracking, and homing torpedoes for attacking submarines at greater depths. The Mk.3 aircraft had introduced a sonics plotting table, and at that time much new equipment was becoming available, so a modification programme was started in 1959 to completely upgrade the aircraft, being carried out in three distinct phases that took until 1968 to complete. The squadrons were kept at full strength during the modification programme by swapping aircraft as modified ones became available from the maintenance units, and aircraft changed squadrons several times during this period. To assist the programme No. 203 Squadron converted onto Mk.2 aircraft in May 1962.

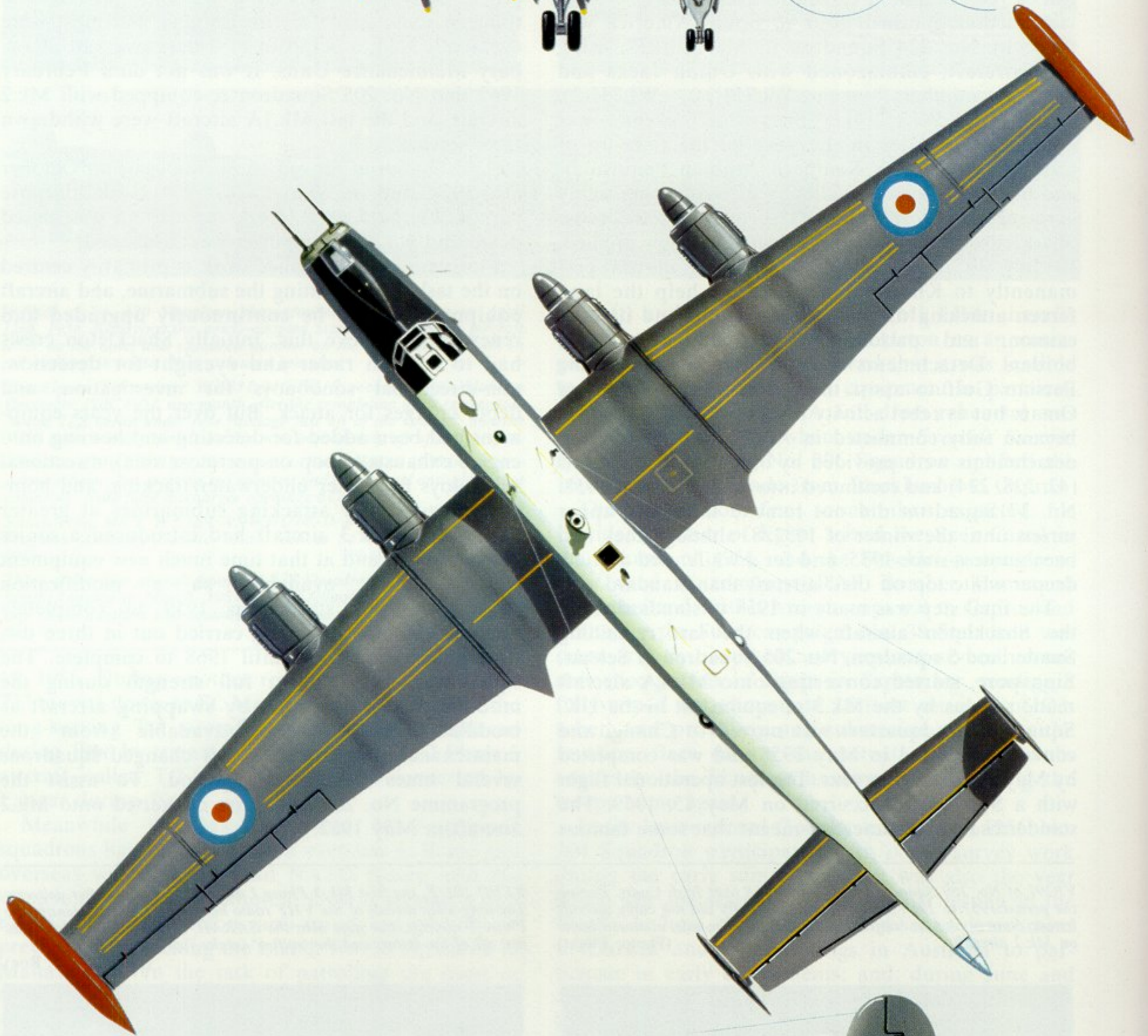
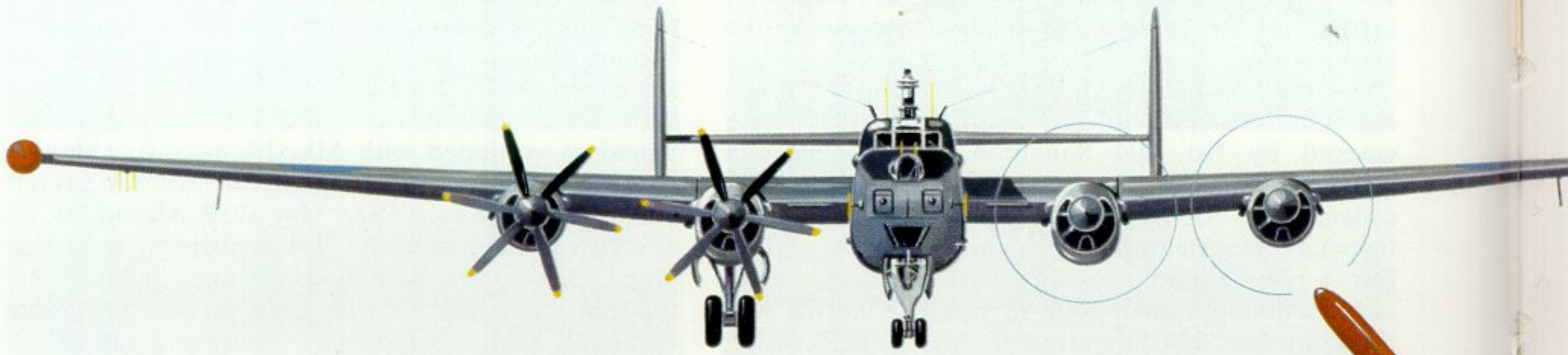
VP291 of No. 269 Squadron in March, 1958 over Irish Coast. During the period 1957 to 1960 aircraft from Ballykelly did not carry aircraft letters. Note intake for 'snifter' equipment on nose side, mounted lower on Mk.2 aircraft. (Photo: Flight)



XF707 201/P, the first Mk.3 Phase 1 aircraft, seen soon after delivery. The long whip aerials of the VHF radio homer on the nose identify the Phase 1 aircraft, but note also the SARAH aerials on the nose sides just aft of the letter, and the 'snifter' intake just below them.

(Photo: A. V. Roe)







Avro Shackleton Mk. 3 Phase 2. From July 1963 to February 1965, XF707 served with No. 206 Squadron, R.A.F. Coastal Command. The fins display the squadron's "octopus" motif in red although the officially-approved badge incorporates a brown- and yellow-coloured cephalopod mollusc. Previously, XF707 had been delivered to No. 201 Squadron in Mk. 3 Phase 1 condition in February 1959 and became squadron aircraft "P". Prior to a useful if ignominious end on the fire dump at R.A.F. Benson, Oxfordshire, in April 1971, XF707 had been transferred from No. 206—after Phase 3 improvements—to No. 42; exchanging its individual letter "C" for "D".

Phase 1 introduced the long-awaited ASV21 radar, Instrument Landing System (aerial under nose), Zero Reader, V.H.F. radio homer (twin whip aerials on the nose), Mk.5 Radio Altimeter, Doppler Navigator, Search And Rescue And Homing equipment (aerials each side of nose), Mk.10 Autopilot (Mk.3 had been hand-flown previously), a new improved intercom system, a flame-float dispenser in the beam position, and wiring for the lifeboat was removed. The first Phase 1 aircraft were received in early summer 1959, and could be recognised by the twin whip aerials on the nose. The Mk.2 aircraft also received the sonics plotting table from the Mk.3 aircraft, and for a while these aircraft were known as Mk.2C on the squadrons.

Phase 2 changed the outline of the aircraft by introducing Electronic Counter Measures (ECM) equipment, the aerial being a large triangular-shaped affair on the fuselage top to which was fitted a detachable head, forming a lighthouse-like tower. Other equipment included U.H.F. radio, U.H.F. radio homer (smaller more rigid nose aerials), TACAN (radio bearing and distance equipment), active sonobuoys, improved Radio Compass (recessed aerial just behind cockpit, and sense aerial fitted to starboard bombdoor), and the H.F. radio aerial support posts were moved back to just forward of the ECM post. The first Phase 2 aircraft were received on the squadrons during late 1961, and the Mk.2 aircraft also received the Mk.3 engine exhaust system.

The Phase 3 modification involved considerable structural rebuilding, and changed the outline of the Mk.3 aircraft. The great amount of added equipment had eroded the performance of the Mk.3 aircraft so much that additional power was badly needed at take-off, so Bristol-Siddeley Viper jet engines were fitted into the outer nacelles, below and behind the Griffons. This required a strengthening of the wing spars, and at the same time the wing fuel tanks were slightly enlarged, the wings reskinned, and the rocket wiring removed in the process. Internally, the tactical table was extended aft to include another position, taking up part of the crew rest room, which was remodelled to have a rear-facing dinette and one tier of three bunks. All aircraft received the improved Radio Compass, the SARAH aerials were removed from the nose sides as the equipment was replaced by the SARBE (an improved Search & Rescue aid), an improved V.H.F. radio was fitted that required a roof post aerial that was mounted just forward of the H.F. posts. Red anti-collision lights were fitted for the first time, one just ahead of the ECM post, and the other under the rear fuselage. The navigation equipment was vastly improved, and a new compass system, the GM.7, was fitted for greater accuracy. All this new equipment needed extra electrical power and a crate of seven inverters was fitted in the nose. The empty weight of the Mk.3 Phase 3 had gone up by 6,500 lbs., and the maximum take-off weight by 8,000 lbs., from the original Mk.3 aircraft. The Mk.3 Phase 3 aircraft could be recognised by the deletion of a window just aft of the port overwing escape hatch, and by the VHF radio post ahead of the HF posts.

The first Mk.3 Phase 3 aircraft was WR973 and it flew for the first time on January 29, 1965, but the

aircraft was found to be tail heavy, and all the soundproofing aft of the crew rest room was removed, the inside being sprayed with green flock instead. Phase 3 aircraft started arriving on the squadrons in Spring 1965 without the Vipers fitted, and these were retrofitted during 1966/67.

The Mk.2 aircraft were completely rebuilt inside up to full Mk.3 standards during the Phase 3 modifications, but as they did not have the extra weight of the tricycle undercarriage they did not require the Viper installation, and therefore were able to retain the rear fuselage soundproofing. Extra rear fuselage cabin heaters were fitted externally just above the aft end of the radome, giving a good recognition feature, together with the four-in-line flare dischargers at the starboard beam. The Mk.2 Phase 3 aircraft arrived on the squadrons during the autumn of 1966. All the Phase 3 aircraft had the ability to drop nuclear depth charges, and the Griffon engines had become Mk.58 by a slight change in the oil feed.

The Viper engines of the Mk.3 Phase 3 aircraft ran off the normal gasoline fuel system, and consequently had a very short lifespan, being used only to give extra power for take-off and overshoots. Counters were fitted by the engineers seat to record their running time in hours and minutes, and eventually a Time Between Overhauls of 250 hours was reached, with an operational necessity maximum of 275 hours. All controls for the Vipers were fitted in the engineers desk under a hinged transparent perspex lid.

The T.4 training aircraft received most of the modifications from the programme, but the interior layout was not changed, and they never received the ECM equipment. One interesting facet of the modifications was that the Mk.7 Radio Altimeter worked normally in the Mk.2 Phase 3, but not in the Mk.3 Phase 3, and had to be replaced in the latter by the Honeywell Radar Altimeter which required a box-like aerial under the rear fuselage.

The modification programme caused major upheavels in the squadrons, ground training being required on all the new equipment, and much airborne training was needed before operational standards were reached again. Nevertheless, an ever increasing number of exercises, detachments and commitments was achieved throughout the period, No. 42 Squadron making a goodwill tour of the Carribean in 1959 and No. 224 Squadron one of the West Indies during 1961. During May and June of 1959 a Mk.3 Phase 1 aircraft of No. 201 Squadron, XF707/P, made a round-the-world flight called Operation Globetrotter to demonstrate the aircraft to the Indian and New Zealand authorities.

One of the highlights of the 1960 SBAC Show was the daily 22-hour flights by Mk.3 aircraft of No.201 Squadron, taking off at the end of each days display and landing back at the start of the next. The Shackleton showed its versatility by being used as a freighter on relief flights to Agadir after the earthquake in March 1960, to Belize, British Honduras, after Hurricane Hatti damage in October 1961, and to Cuba after Hurricane Flora damage in October 1963.

At the end of 1961 a slight change was made in the colour scheme; the squadron number was moved forward and lowered to just above the radome, the



Shackleton Mk.2 WL791 38/Q in white top livery on a visit to Blackbushe in September, 1958 from Malta.

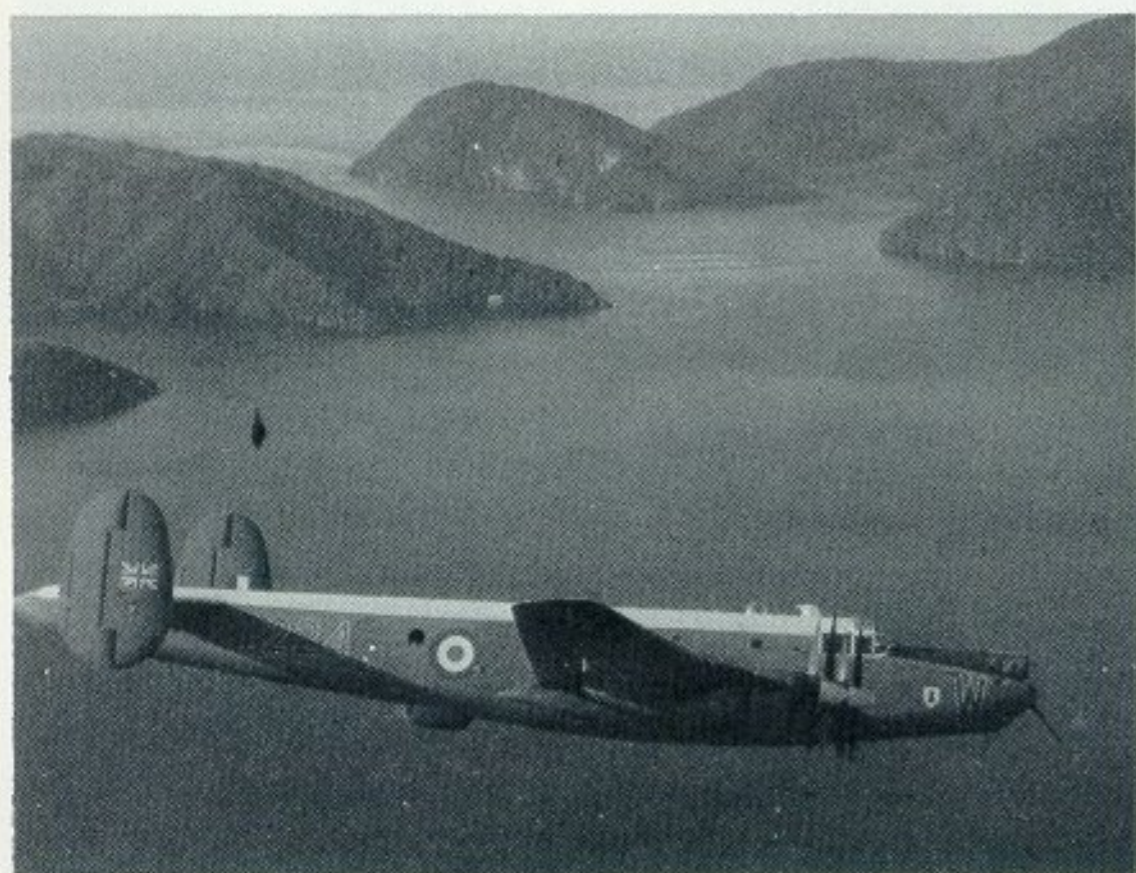
(Photo: Arthur Pearcy)

A Mk.3 Phase 2 aircraft of No. 206 Squadron, XF707/C, flying along the Cornish coast from its base at St. Mawgan. Most of the Phase 2 mods can be seen; the ECM aerial on the roof (minus its head), HF radio aerial posts moved back and coloured black, UHF radio and Homer aeriels (lower aerial mounted under rear fuselage on Mk.3 aircraft). Shows revised colour scheme introduced in 1962, with squadron number over radome, roundel moved forward and up, 'ROYAL AIR FORCE' on rear fuselage in plain white.

(Photo: M.O.D.)

Shackleton Mk.2 Phase 1, WL750 224/W, flying amongst the islands of the West Indies during the squadron goodwill tour in 1961. Notice white spinners and squadron crest on nose. ILS aerial under nose.

(Photo: R.A.F. Gibraltar)



Lunchtime for some of the crew of Mk.3 Phase 1 XF730 206/C in the rest room during a flight to Gibraltar on November 14th, 1960. There are two tiers of three bunks, but the centre ones have been dropped down to form backrests, and trays clipped on for mealtime use. Note rexine lining over soundproofing, and access door to rest room over signallers left shoulder.

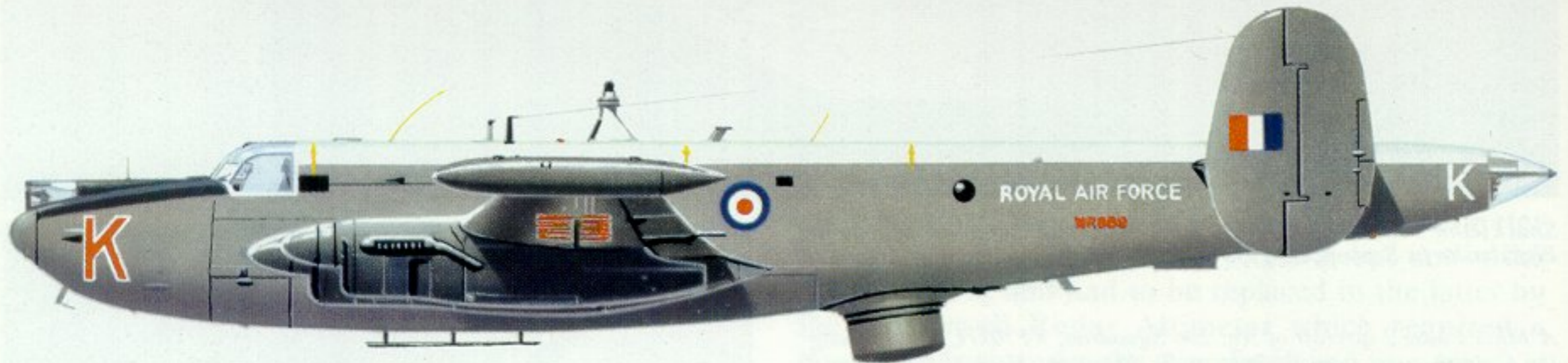
(Photo: Times Newspaper)



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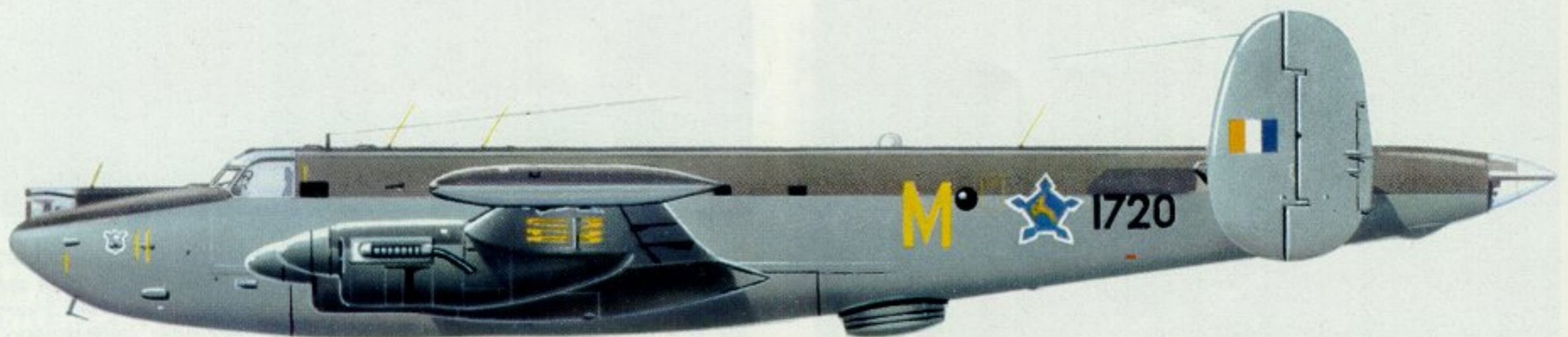
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Colour illustrations

- 6 WR967, a Mk.2 Phase 3 aircraft as modified to T.2 standard for training duties with MOTU at St. Mawgan. Shown in post-1966 colour scheme with unit markings removed, and is 'Q' of the St. Mawgan Wing.
- 7 WR976, a Mk.3 Phase 1 aircraft with No. 206 Squadron, shown in the 1962 colour scheme, but with non-standard red tiptanks adopted by the Squadron. Aircraft is fitted with UHF Radio and Homer from the Phase 2 mods., omissions and additions under the various Phases being quite common.
- 8 A fully-modified Mk.3 Phase 3 aircraft of the Malta Wing, being WR989 'K' of No. 203 Squadron. Note yellow 'rescue' arrows pointing to escape hatches, adopted late 1969, and the Radar Altimeter aerial under the fuselage just forward of the fin.
- 9 WR972, a much-modified Mk.3 Phase 2 aircraft of the R.A.E. at Farnborough, used for experimental work including drag-chute development, hence modified rear end. This aircraft never entered R.A.F. service, being purchased for the R.A.E. after two years of trials with the M.O.A.
- 10 A South African Air Force Mk.3 aircraft. The first four aircraft, 1716-19, carried roundels when delivered in 1957, but the last four had the 'Castle' insignia as illustrated.

roundel was reduced in size and moved above and just forward of the wing trailing edge, and the words 'ROYAL AIR FORCE' in unlined white were painted on the rear fuselage with the small red registration placed centrally under them. No further change was made until 1966 when the squadron numbers were deleted. Then in 1968, after the bases had taken over control of the aircraft and 'Wings' had been formed, another change appeared. Kinloss Wing (120, 201, 206) painted a repeat of the aircraft letter in dayglo orange on the aft end of the fuselage just ahead of the tailcone, and the St. Mawgan Wing (42, MOTU) did likewise in white paint. The Ballykelly Wing (203, 204, 210) did not take up the idea, but they were a law unto themselves, for during the period 1957-60 their squadron aircraft had carried no aircraft letters. In the autumn of 1969 the Shackletons started having their propellor tips painted in the new R.A.F.-standard Red-White-Red, and some had the yellow rescue arrows painted on their fuselages, pointing to the various hatches, and the 'Foam Lance'

marking of white disc with yellow edge on their bombdoors.

One of the penalties of modern technology is the need for constant renewal of equipment to stay 'one jump ahead', and even as the latest Phase 3 aircraft were entering squadron service their eventual replacement was going through the design stage—the Hawker Siddeley Nimrod aircraft. It was anticipated that the Nimrod would enter squadron service during 1970 and the Shackleton would then be phased out. In the meantime the Shackleton had to continue coping with the seemingly ever-increasing commitments.

Shackletons of No. 204 Squadron assisted the security forces during the civil disturbances in British Guiana during early 1962, and later in the year the Brunei Rebellion and the ensuing Indonesian Confrontation from 1963 to 1966 involved No. 205 Squadron and the Ballykelly squadrons in army support, anti-infiltration and anti-piracy patrols.

During 1965 a move of units occurred between Kinloss and St. Mawgan; in the Spring No. 201 Squadron moved up to Kinloss, and in July No. 206 Squadron followed and MOTU moved down to St. Mawgan.

After the declaration of independence by Southern Rhodesia in 1965, Shackletons were called upon to assist ships of the Royal Navy in the blockade of the port of Beira as part of the United Nations sanctions. A detachment base was established at Majunga in the Malagasy Republic in March 1966 by No. 37 and No. 38 Squadrons, and operations were started, the Shackletons flying 400 hours a month on the patrols. Apart from a short period at the start of 1968 when No. 42 Squadron went to Majunga, the whole burden for the operation fell on the Ballykelly squadrons, and the operation continued until February 1972 covered by the Majunga Detachment Support Unit of No. 204 Squadron at Honington.

In 1966 a study was made of the British armed forces, their areas of influence, and their future commitments, and the Defence Review of that year heralded many changes. It was anticipated that Bri-

A Mk.2 Phase 2 aircraft, WG532/E, of No. 205 Squadron flying along the Malayan coast in 1967. ECM head fitted, but HF radio posts still old position. No. 205 Squadron never adopted the new colour schemes, and retained their squadron number on the rear fuselage until disbanded at the end of October, 1971. Note engine exhausts from Mk.3 aircraft. Dark blue spinners. (Photo: Roger Brooks)





The remarkably clean lines of the later Shackletons displayed by WL754/F of No. 42 Squadron whilst on detachment overseas. This is a Mk.2 Phase 2 with full mods, note the recessed Radio Compass aerial on roof and the forward end of the sense aerial on the bomb-bay door. Red spinners.

(Photo: R. H. W. Wakelin)

Two Mk.3 Phase 3 aircraft of the Kinloss Wing seen at Kinloss early in 1970, WR971/Q and WR990/N, the latter aircraft showing another recognition feature of the Phase 3 aircraft, the deleted window just aft of the overwing escape hatch.

(Photo: Paul Tomlin)



Shackleton Mk.3 Phase 3 without Viper engines, WR981/B of No. 120 Squadron, on typical Coastal Command work, flying at low level over the sea and experiencing the choppy ride this brings. Picture shows the white spinners adopted by the squadron.

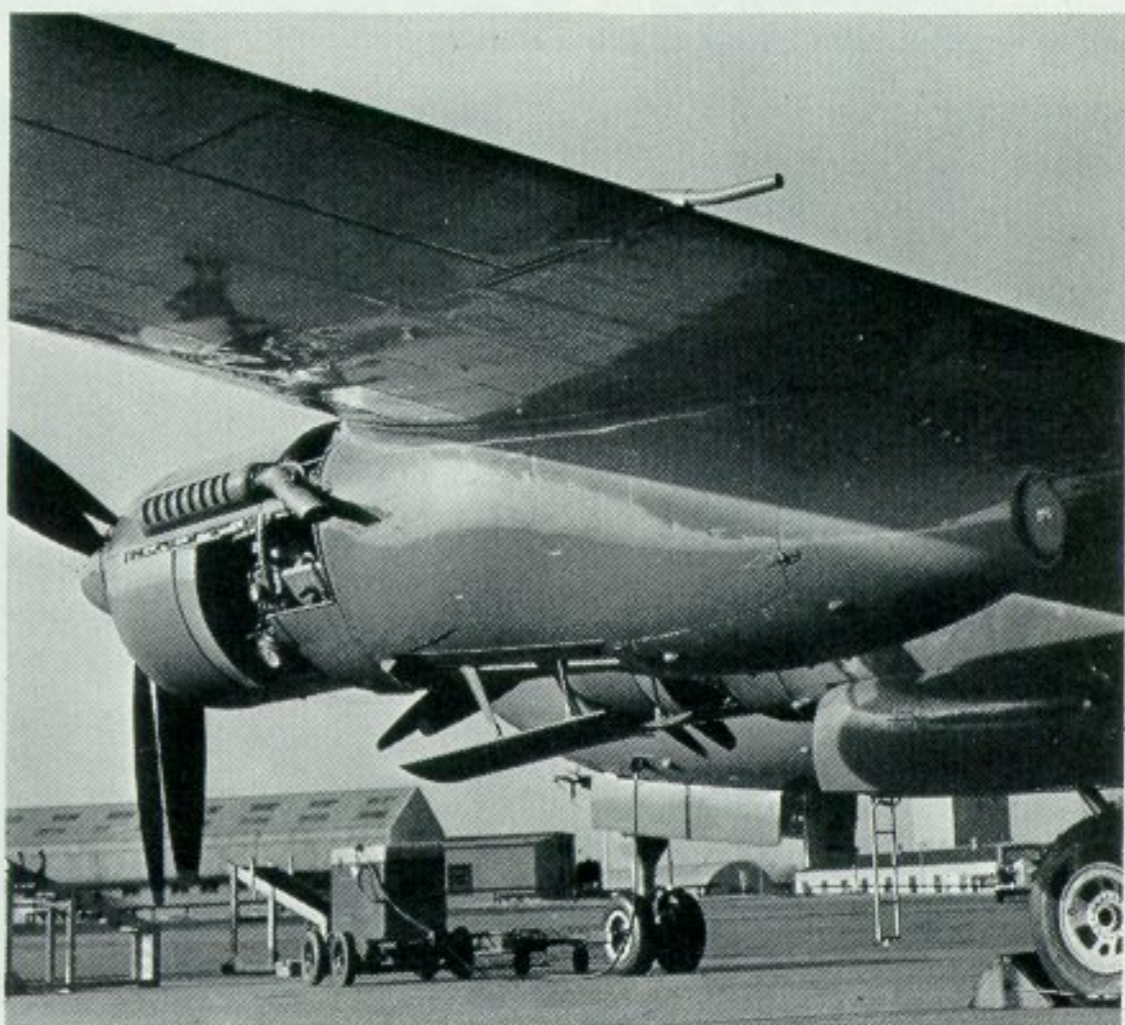
(Photo: Bruce Rigelsford)

A Mk.3 Phase 3 aircraft of No. 206 Squadron, XF703/R, in the modification state that they were received on the squadrons during 1965, with Viper engines not fitted. Seen at Llanbeair on June 15th, 1965 this aircraft is fully modified except for the Vipers, and the main recognition feature of the Phase 3 aircraft is the white aerial just forward of the black HF radio posts for the improved VHF radio.

(Photo: Arthur Percy)

The B.S.Viper engine installation in the outboard nacelle of the Mk.3 Phase 3 aircraft, with the intake open under the nacelle, and a ground protective plug in the exhaust. Some of the cowling is removed from round the Griffon engine in this photograph of WR973 just after its completion in January, 1965 as the trial installation aircraft. Note the standard Mk.3 aircraft crew entrance hatch just aft of the nosewheel, and the fuel jettison pipe on the wing trailing edge.

(Photo: Hawker Siddeley)



tain would withdraw from Aden in 1967, and would gradually run down her forces east of Cyprus. The immediate requirement was to reduce overseas spending and the axe fell on No. 224 Squadron at Gibraltar. It disbanded on October 31, 1966 and the last Shackleton to leave the Rock was WG533, 224/B, a Mk.2 Phase 2 aircraft, the squadron never having received the Phase 3 aircraft. In December 1966 a redistribution of maritime air forces was worked out as a result of the Defence Review, and it was decided to disband No. 38 Squadron in Malta. Aircraft of the squadron were recalled from the Majunga detachment in February 1967 and the squadron disbanded on March 31. The elimination of British maritime air forces from the whole Mediterranean area and the Near East was completed in September 1967 when No. 37 Squadron was disbanded in Aden as Britain withdrew from the former colony.

At this stage there was no maritime air cover between St. Mawgan in Cornwall and Changi in Singapore, apart from a detachment of No. 205 Squadron kept on Gan for Search & Rescue cover, so when trouble flared up again in the Persian Gulf detachments had to be sent out from England to Sharjah in December 1967. A Sharjah Maritime Detachment was formed and controlled by the Kinloss Wing, although aircraft from St. Mawgan and Ballykelly still participated, and surveillance, anti-smuggling and anti-gun running patrols were flown over the Persian Gulf area. During July 1969, two aircraft from the Ballykelly Wing (WL785/P and WL800/J) flew west-about to Singapore on an exercise for simulated F.E.A.F. reinforcement, and then continued on round the world through Sharjah to Ballykelly, taking 17 days and 125 flying hours. The need for a permanently-based squadron in Sharjah was met when No. 210 Squadron reformed there on November 1, 1970, being equipped with five ex-MOTU T.2 aircraft that had been refurbished as Mk.2 Phase 3 aircraft by Kemble during the summer (WG554/V, WL787/W, WL739/X, WG558/Y, and WR967/Z).

To counter the Russian naval build-up in the Mediterranean a detachment of four aircraft from No. 42 Squadron was sent out to Malta in October 1968, and was relieved on January 30th, 1969 when

No. 203 Squadron moved there permanently. Both these squadrons had re-equipped with Mk.3 Phase 3 aircraft during 1966.

The reorganisation of the Royal Air Force during the late 1960's meant the end of Coastal Command as such, and on November 27, 1969 the Coastal Command Disbandment Parade was held at St. Mawgan. The flypast was led by two Whirlwind SAR helicopters towing an R.A.F. Ensign and a banner bearing the Coastal Command motto "Constant Endeavour", followed by a formation of nine Shackletons, three from each of the home bases, St. Mawgan, Ballykelly and Kinloss. A Nimrod brought up the rear. The next day the force was reformed as No. 18 (Maritime) Group, Strike Command.

Strike Command inherited a rapidly changing maritime air force, the first Nimrod had just been delivered to St. Mawgan, and the 1966 Defence Review plans were being implemented. The three squadrons at Kinloss (120, 201, 206) converted onto the Nimrod aircraft during 1970, and the last Shackleton course completed training at MOTU on July 28, 1970. On August 1 MOTU was renamed No. 236 O.C.U. for Nimrod conversion, and the following April No. 42 Squadron started re-equipping with Nimrod aircraft. Their last Mk.3 Phase 3 aircraft, XF703 42/J, was held back to fly at the Battle of Britain celebrations at St. Mawgan in September 1971, and then on September 23 it was flown to Henlow for the R.A.F. Museum.

It had been decided that the Nimrod would be too expensive to use on Search & Rescue standby, so No. 204 Squadron with Mk.2 Phase 3 aircraft was assigned the responsibility of SAR cover for the whole of the United Kingdom. It disbanded at Ballykelly on April 1, 1971 and reformed at Honington the same day with two flights, the Search & Rescue Unit with six aircraft, and the Majunga Detachment Support Unit with two aircraft. Ballykelly airfield was handed over to the British Army on June 2, 1971 and was renamed Shackleton Barracks by them—a very nice gesture.

On October 31, 1971, as part of the withdrawal of British forces from the Far East, No. 205 Squadron disbanded at Changi, and their aircraft were flown back to Maintenance Units in this country, except for

A Mk.2 Phase 3 aircraft of No. 205 Squadron, WR963/H, passing Mt. Egmont in New Zealand whilst on detachment for a naval exercise in October, 1969. Note the externally-mounted rear cabin heaters alongside the radome, a recognition feature of these aircraft. Pale blue spinners adopted for their Phase 3 aircraft. Radome partially lowered. (Photo: Roger Brooks)



four which remained for Search & Rescue cover and became a detachment of No. 204 Squadron. On November 15, 1971 No. 210 Squadron in Sharjah became another victim of the withdrawal and disbanded, the three remaining aircraft being ferried back to England, WG554 and WG558 had returned to St. Athan in the June. The disagreement over the Malta bases at the end of 1971 saw No. 203 Squadron on the move again; it had started re-equipping with the Nimrod aircraft in the October, and during December it moved to Sigonella in Sicily, and its two remaining Shackleton Mk.3 Phase 3 aircraft were flown back to Maintenance Units in the UK—these being the last Mk.3 aircraft in R.A.F. service. So at the end of 1971 the only Shackleton aircraft in R.A.F. service were twelve Mk.2 Phase 3 aircraft with No. 204 Squadron, six at Honington, two in Majunga, and four out in Changi, but several were held in Maintenance Units.

In February 1972 the blockade of Beira was lifted due to improved relations with Rhodesia, and with the transfer of S.A.R. coverage on April 4 to the Nimrod squadrons No. 204 Squadron became jobless, and disbanded at Honington on April 28. Settlement of the dispute with Malta enabled No. 203 Squadron to move back to Luqa on April 23, 1972.

Three other Shackletons remain flying in this country, but they are owned by the M.O.D. for use by the Royal Aircraft Establishment at Farnborough. They are a completely unmodified Mk.2, WG557, purchased on January 31, 1958, for the Empire Test Pilots School; a partially modified Mk.3 (without ECM and Vipers), WR972, purchased on March 13, 1959 and used for drag parachute development work, amongst other things; and a partially modified T.4, VP293, purchased on January 6, 1964.

NON-ROUTINE FLIGHTS

Any breaks from the normal routine of endless training exercises are welcomed by aircrews—not least those assigned to Shackletons. Three such non-routine flights serve to make the point.

Endurance checks. During February 17-18, 1959, a Shackleton Mk.3 of No. 206 Squadron engaged in an

endurance check during which it was flown around the Canary Islands. The "Shack" remained airborne for 24 hr. 21 min. during which time it clocked-up 3,440 naut. miles and landed with 270 Imp. gallons (see "Specification") remaining in the tanks.

Four years were to pass before another Shackleton,—a Mk. 2 Phase 2 of No. 204 Squadron—surpassed this figure with 24 hr. 36 min. in March 1963.

North Pole drop. A few weeks earlier, a Shackleton Mk.2 Phase 2 of No. 210 Squadron trekked to the North Pole. This gyro-steering, grid-navigation exercise, from Thule (n.w. Greenland) to Bodo (Norway), took place on the night of February 7-8, 1963 after four days of being snowed-in at Thule. At 03:24 (GMT) and over the North Pole, a "Genuine Irish Survival Pack" was dropped. In the interests of historical accuracy, the pack contained: One copy of *Desert Survival*; one item of turf; two hairclips; two chocolate biscuits; and four cigarette gift vouchers.

EXPORT SHACKLETONS

The only export order for Shackletons arose out of a requirement by the South African Air Force.

From the initial production batch of Shackleton Mk.3, eight (contractor's nos. 1526-1533; SAAF serials 1716-1723) were eventually assigned to No. 35 Squadron, SAAF., and based at D.F. Malan airfield, Cape Town, to replace the squadron's Sunderland MR.Mk.5s which had operated previously from Durban.

On May 16, 1957, the first two SAAF MR.Mk.3s were officially handed over at the Woodford airfield and were subsequently temporarily-based at RAF Station St. Mawgan for SAAF aircrew work-up exercises with Coastal Command Shackletons over the North Sea.

Internally, the SAAF Shackletons differed in detail from the RAF Mk.3s but the main external change affected the astrodome—this being positioned well aft. Although during service with No. 35 Squadron, SAAF, these export aircraft were to be continuously updated with modifications—including ECM—the Viper installation was never adopted.

PROJECTED MARKS 4 AND 5

Back in the early 1950s, aero-motor thinking was not exclusively concentrated on gas turbine development. One of the most active advocates of the piston engine was the once-famous but now defunct company of D. Napier & Son Ltd., Acton, in West London. Between the wars, Napier had been sufficiently impressed by the potential of the compression-ignition Diesel to engage in a licence agreement with the equally-famous Dessau (now in East Germany) company of *Junkers Motorenbau GmbH*.

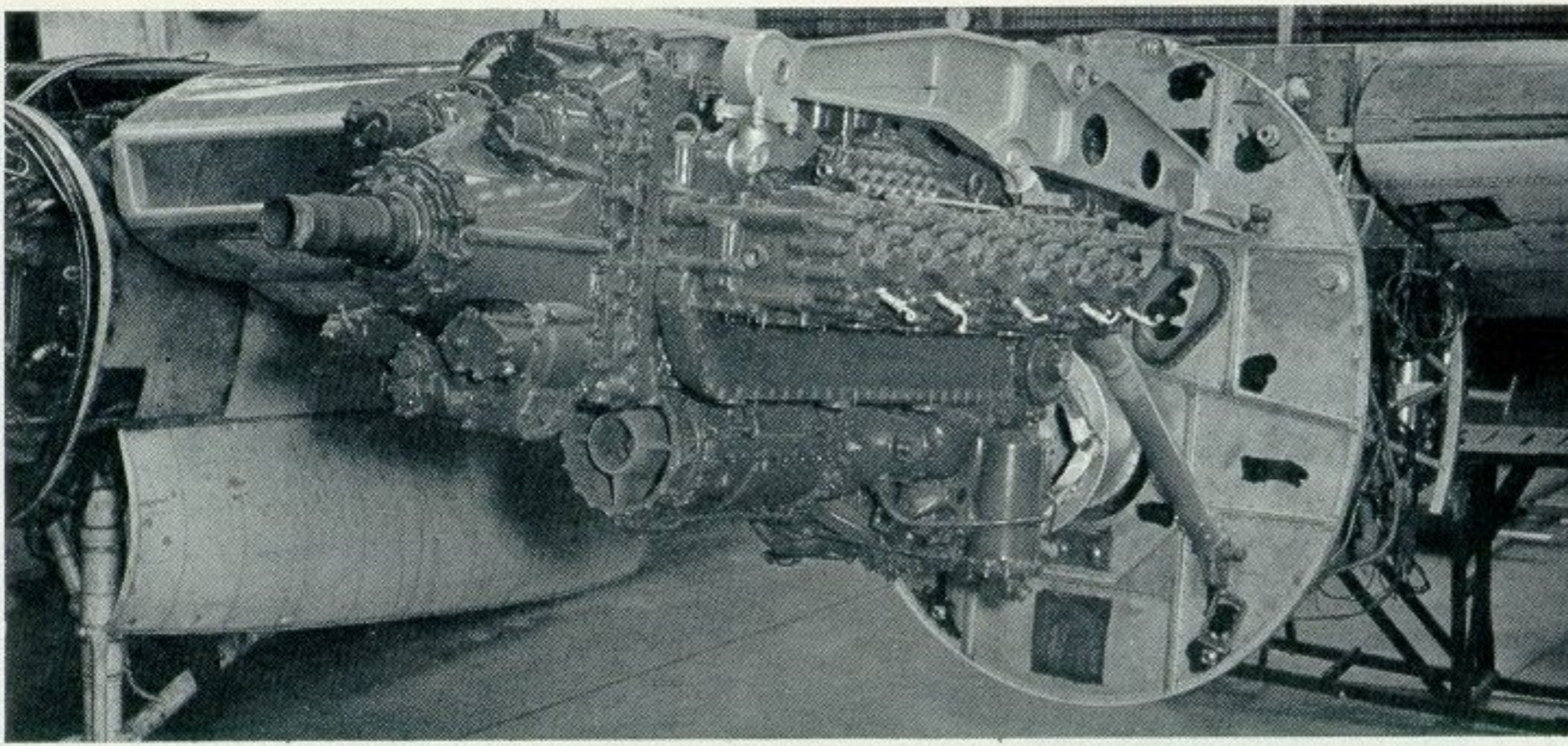
In particular, Napier spent much time on the Junkers Jumo 204 A, a 600-750 h.p. 6-cylinder inverted inline engine which they renamed as the Culverin. In 1933, a German-built Jumo 204 was installed for test in a Hawker Horsley II, a RAF day torpedo-bomber biplane (serial J8620). But, evidently, the authorities were not sufficiently impressed to give Napier further encouragement.

After World War Two ended, Napier renewed its Diesel interest and developed the E.125 Nomad 1;

A real Napier Nomad E.145 engine fitted in the starboard outer nacelle of Shackleton VW131 at Napier's Luton hangar ready for trials to start. See text.

(Photo: Charles Cain)





Dummy Napier Nomad engine mounted in the port outer nacelle of Shackleton VW131 for vibration tests in April, 1954. Note intake in wing leading edge for cooling radiator. The cowling fitted tightly with blisters over the cylinder heads, and the intake was below the spinner. Seen in Napier's hangar at Luton.

(Photo: Cliff Minney)

and, for rail traction, the Deltic engine which was an entirely different design philosophy. By the time of the SBAC Show at Farnborough in 1951, the novel compound aero-engine was being heralded as the "answer" to every modern need for a powerful but economic long-distance power plant. In turn, the Nomad inspired Avro to project the Shackleton MR.Mk.4.

Shackleton MR.Mk.4. Based on a Mk.1 airframe, the Nomad-Shackleton would have been developed in two stages: Avro Type 717 with two Nomads replacing the outer Griffons, and the Type 719 (the true MR.Mk.4) with four Nomad 2s.

Perhaps the Nomad was too ambitious and its supporters too optimistic for such an unusual engine which was most complex. In its E.125 form, the Nomad was a 12-cylinder, horizontally-opposed, pressure liquid-cooled, two-cycle compression-ignition Diesel inline coupled to an exhaust-driven, 11-stage axial-flow compressor and turbine assembly. The 6-blade Rotol contra-rotating propeller unit (feathering and reversing capability) was driven separately by both compound units.

One of the development E.125s was installed in the nose of an Avro Lincoln (SX973) and flown in public at the 1951 SBAC Display. The Lincoln could be kept in the air on the Nomad alone. Fuel consumption was quoted as 0.36 lb./e.s.h.p./hr. for a take-off power of 3,000 shaft horsepower plus 320 pounds thrust.

Recognizing the complexity of the Nomad 1, Napier offered a simplified version, the E.145 Nomad 2, in which the Diesel and compressor outputs were coupled through a variable gear unit to drive a single 4-blade Rotol or D.H. propeller of 13-ft. diameter.

The Nomad 2 was first run in December 1952 and the Ministry of Supply authorized trial installation in a Shackleton and agreed to an initial order of six engines. The E.145 offered 3,135 equivalent shaft horsepower for a weight of 3,580 pounds and a specific fuel consumption (s.f.c.) of 0.345 lb./e.s.h.p./hr. at sea-level. With developing turbine and compressor efficiency, the performance of the engine increased with height, giving a standard output of power from sea-level to 25,000 ft. and complementary improvements in s.f.c.

Trial installation was undertaken at the Luton Airport establishment of Napier in 1953 when the second prototype Shackleton (VW131) was flown in.

The outer Griffons were removed and, in the first instance, dummy Nomads were applied to iron-out installation problems associated with the new engine. Vibration tests were conducted in April of the following year.

Ironically, just when the Nomad 2 design was virtually complete and the conversion of the Nomad-Shackleton well advanced—with two E.145s installed for flight tests—the entire project was cancelled because of Treasury demands (government-dictated) for severe cutbacks in the British aircraft industry. Shackleton VW131 remained in the Luton flight sheds for several years until, by the close of the 1950s, it suffered the ultimate indignity of being reduced-to-produce.

Shackleton MR.Mk.5. While the Nomad 2 was still highly regarded, there was talk of a Nomad version of the Mk.2 Shackleton which might have become an MR.Mk.5 with four E.145 Nomad 2s.

AEW SHACKLETON

As the 1960s drew to a close, several projects were advanced in an attempt to solve the radar early warning problem facing Britain. One which was eventually adopted automatically extended the life of existing Shackletons—not the Mk.3s but the earlier Mk.2s.

The Mk.3 Shackleton became a victim of progress in that its Viper jet engines—so necessary to lift the increasing weight of maritime equipment—brought about early fatigue because of greater airframe stresses. By the end of 1971, all Mk.3s were out of service.

The Mk.2 Shackleton, however, had been less prone to fatigue.

Now, after a period of 20 years in which the Mark 2 Shackleton has served in a variety of roles—from reconnaissance (both maritime and meteorological), ground-support for the army, policing, transport and freighter duties (and "mailman" to ocean weather ships) through to search & rescue—now, this veteran has been selected to fill the vital AEW or Airborne Early Warning role.

Twelve Mark 2 Phase 3 Shackletons (serials at close of this *Profile*) have been undergoing conversion by Hawker Siddeley at Woodford, Manchester and Bitteswell, Rugby. The transformed AEW.Mk.2's most distinctive external difference is the adoption of a big ventral radome (Fairey Gannet AEW.Mk.3-

type) at the forward end of the bomb-bay. At Woodford on September 30, 1971, the first Shackleton AEW.Mk.2 (WL745) underwent its first test flight; the fuselage still bearing the aircraft letter "O" assigned during its previous allocation to No. 204 Squadron.

Then on January 1, 1972, No. 8 Squadron (motto: "Everywhere Unbounded") was reformed in Scotland at RAF Station Kinloss to become the first AEW squadron in the Royal Air Force. Lossiemouth, not far from Kinloss and also in Moray, is the squadron's permanent base. Many of the radar operators are former Royal Navy AEW aircrew; a sign of changed fortunes.

Another sign of the time is the fact that, in the interests of national defence over Britain, these former Coastal (later Maritime) Command Shackletons also "wear a new hat"—that of belonging to No. 11 (Fighter) Group, RAF Strike Command. Some, including those like the author who have flown "Shacks", may regret that the Shackleton will not finish its long Service career in a well-known maritime squadron—or even in No. 18 (Maritime) Group, Strike Command—but many will be pleased that the familiar Rolls-Royce Griffon "growl" will heard for a number of years yet to come.

Series Editor : CHARLES W. CAIN

SQUADRON SERIALS (with markings, where known)

No. 37 SQUADRON

Mk.2: WG556/K, WL754/H/E, WL755/H, WL756/H, WL757/D, WL759, WL785/E, WL786/F, WL787, WL788/C, WL791/A, WL795/A, WL796/J, WL797, WL800/Z, WL801, WR954, WR964/F, WR965/B
WL752/D, WL753, WR959, WR960, WR962
Mk.2 Phase 1: WL738/D, WL744/B, WL747, WL752/D,
Mk.2 Phase 2: WL788/B, WL797/C, WR962/A

No. 38 SQUADRON

Mk.2: WL740/Y, WL754/Z, WL755/U, WL756/T, WL785/W, WL788/R, WL791/Q, WL793, WL794/Y, WL796, WL797/W, WL798, WL799/V/U, WL800/Z, WL801/T/W, WR964/V
Mk.2 Phase 1: WG533/W, WL744, WL755/U, WL758, WL759/V, WL786/S, WL787/S, WL788/R, WL790/X, WL798, WL801/Z, WR954/Z
Mk.2 Phase 2: WG533/W, WL740/U, WL756/V, WL758/Y/V, WL789, WL795/T, WL798/X, WR956/W, WR961/S, WR963/X, WR967/Z, WR969/S

No. 42 SQUADRON (Code 'A')

Mk.1: VP263, VP293/A-F/F, WG510/A-F, WG525/A-B, WG526/A-C, WG527, WG528/A-G, WG529
Mk.2: WG531/A-H, WG532, WG533/A-H/H, WG554/A-A/A, WG555/A-G, WG556/A-J/J/D, WL737/B, WL742/B, WL743/A-F, WL744, WL745/E, WL757/B, WR951/A-J/E, WR958/D, WR959/G
Mk.2 Phase 1: WG530, WG558/B/D, WL741/D, WL747/B, WL785/O, WR952/E, WR953/A, WR955/C, WR958/D, WL800/C/A
Mk.2 Phase 2: WL754/F, WL785/C/A, WL788/F, WL797, WL801/B, WR951/E, WR953/B, WR955/C, WR958/E/C/D, WR959
Mk.3 Phase 3: WR973/B, WR974, WR977/B, WR978/A, WR984/C, WR987/B, WR988/A/E, XF701/B/H, XF703/D/J, XF705/G/A, XF706/E, XF707/D, XF709/A, XF711/G/C/G, XF730/F

No. 120 SQUADRON (Code 'A')

Mk.1: VP258/A-C, VP259/A-B, VP260/A-A, VP261/A-J, VP262/A-D/D, VP265, VP266/A-G, VP267/A-H, WB828/C, WB835/A, WB844, WB846, WB849, WB853, WB854
Mk.2: WG530, WG532/F, WG533, WG554/E, WG556, WL744/G, WL745/B, WL749, WL750, WL752/H, WL758, WL796, WR955/H, WR956, WR968/D
Mk.3: WR987, WR988, WR989/C, WR990/D, XF700, XF701
Mk.3 Phase 1: WR971/C, WR979/C, WR981, WR987/G, WR989/B, WR990/F, XF700, XF702/D, XF703/F, XF704, XF705, XF706
Mk.3 Phase 2: WR971/E, WR980, WR982/A, WR986/E, WR987/C, WR988, WR989/B, WR990, XF700/A, XF701/F, XF703/F, XF704/D, XF708/A, XF709/D, XF710/F, XF730/B
Mk.3 Phase 3: WR973, WR975/A, WR979/D, WR981/B/G, WR983/E, WR984/C, WR985/H, WR989/K, XF702/B, XF703/C

No. 201 SQUADRON

Mk.3: WR975/P, WR976/K, WR977/L, WR978/M, WR979/N, WR980/O, WR987/R
Mk.3 Phase 1: WR979/N, WR986/M, XF707/P, XF708/O, XF709/N, XF710/N, XF711/L, XF730/L
Mk.3 Phase 2: WR977/O, WR980, WR981/P, WR984, WR988/K, XF701/N, XF705/M, XF706/N, XF708/O
Mk.3 Phase 3: WR971/O/Q, WR976/M/K, WR981/N, WR982/J, WR985/H, WR989/K, WR990/N, XF700/M, XF703/O, XF704/L, XF709/M

No. 203 SQUADRON

Mk.1: WB856, WB859, WB860, WG507, WG509
Mk.3: XF702/H, XF703, XF704/G, XF705, XF706, WR974/F
Mk.3 Phase 1: WR973, WR975/F, WR982/G, WR984/H, WR985, WR986/K, XF703/L
Mk.3 Phase 2: WR975, WR981/K, WR984/J, WR988, XF705, XF706/G
Mk.2 Phase 2: WG558/G, WL742/H, WL750/F, WL753/G, WL800/E, WR957/J, WR959/E, WR965/J/K
Mk.3 Phase 3: WR974/H, WR977/B, WR979, WR986/G, WR987/D, WR988/E/S, WR989/K, XF700/F, XF708/C, XF709/F

No. 204 SQUADRON (Code 'T')

Mk.2: WL738/T-R, WL739, WL740/T-X, WL744, WL747, WL748/T-S, WL750, WL759, WL790/T-T/T, WL792, WL793/O, WR955, WR956/Q
Mk.1: VP263, VP266, WB826, WB828, WB850, WB851, WB857
Mk.2 Phase 1: WG558/P, WL739/P, WL745/M, WL751/N, WL793/O, WL796/M, WL797/P, WR951/Q, WR957/R, WR962/R, WR966/O, WR969/R
Mk.2 Phase 2: WG555/N, WL739/P, WL750, WL753/G, WL787, WL788, WL791, WL795/M, WL796/M, WR952/L, WR957, WR960/O, WR964/Q, WR966/O, WR969/R
Mk.2 Phase 3: WB833/T, WG555/K, WL738/Y, WL745/M/O, WL748/R, WL751/M, WL754/H, WL755/L, WL758/W, WL785/P, WL798/J/Z, WL800/J, WR955/N, WR956/Q, WR961/U, WR965/Q, WR966/O, [WG533/K, WL737/J, WR954/C, WR969/A (Left at Changi by 205)]

No. 205 SQUADRON

Mk.1: VP254/B, VP255, VP267/L, VP288/K, VP291/F, VP294/N, WB818/A, WB825/H, WB827/O, WB834/G, WB835, WB836/D, WB854/C, WG525/E
Mk.2 Phase 2: WG530/G, WG532/E, WG553/D, WG554/H/G, WL745/A, WL759/B/N, WL786/B, WL789/H, WL790/E, WL796/C/E, WR953/F, WR959/A, WR967/Z
Mk.2 Phase 3: WG533/K, WL737/J, WL741/H/F, WL748/C, WL750/H, WL754/J, WL756/C, WL757/K, WL786/E, WL790/D, WL795/G, WL798/J, WR952/B, WR954/M/C, WR960/A, WR963/H, WR965/L, WR966/G, WR969/A



WL745, the prototype Shackleton A.E.W. Mk.2, on its maiden flight of September 30th, 1971. Radome from Fairey Gannet 3 aircraft faired into forward bomb-bay, normal radome removed, and extra aerials of transmitters along roof. All the twelve aircraft to be converted will be ex-Phase 3 aircraft. (Photo: Hawker Siddeley)



WL756, a Shackleton AEW Mk.2 of No. 8 Squadron, seen at R.A.F. Wattisham in June, 1972. Note squadron badge on nose (Arabian dagger on white circle) and last two numbers of serial repeated on fin. Turret deleted from nose, and most of "maritime" equipment removed. (Photo: M. Brewer)

No. 206 SQUADRON (Code 'B')

Mk.1:	VP263, VP265, VP289, VP293/A, VP294, WB821, WB823, WB824, WB826, WB828, WB832/B-W/B-C/G, WB836/B-T/H, WB851, WG508/B-X/H, WG510/B-B/B, WG526/B-C/C, WG527, WG528, WG529/B-F/F
Mk.2:	WG557/B-Z, WG558/B-Y, WL742/B-Z, WR952
Mk.3:	WR981/A, WR982/B, WR983/C, WR984/D, WR985/E, WR986/F
Mk.3 Phase 1:	WR976/F, WR977/B, WR978/A, WR980, XF730/C
Mk.3 Phase 2:	WR973/C, WR978/A, WR975/S, WR979/B, WR980/D, WR983/F, WR985/A, XF701/E, XF702/B, XF703/D, XF707/C
Mk.3 Phase 3:	WR973/U, WR975, WR977, WR978, WR980/S, WR985/T, XF700, XF701/T, XF703/R, XF705/R, XF706, XF702/Q

No. 210 SQUADRON

Mk.1:	WB835
Mk.2:	WL738, WL745, WL747, WL748/X, WL750, WL790/X, WL795, WR954/T, WR955
Mk.2 Phase 1:	WG555/U, WL737, WL738, WL748/X, WL757/W, WL797/Y, WR960/U, WR963/Z
Mk.2 Phase 2:	WL739, WL748, WL751, WL787/T, WL788/Z, WL791/V, WR964, WR968/Z
Mk.2 Phase 3:	WB833/T, WG556/Y, WG558/Y, WL737/Z, WL738/Y, WL747/X, WL756/V, WL785, WL793/S, WR958/U, WR961/U, WR964 (Sharjah) WG554/V, WL787/W, WL739/X, WG558/Y, WR967/Z

No. 220 SQUADRON (Code 'T')

Mk.1:	VP257/T-P/K, VP263/T-D, VP265, VP288/R, VP294, WB821/T-L/L, WB823/T-N/N, WB824/T-O, WB825/T-M, WB828/T-K, WB831/T-Q, WB836, WB837/T-S, WB851, WG508, WG525, WG526
Mk.2:	WG557/T-L, WL737/T-K, WL743/T-P, WL745/T-O, WR961, WR962, WR969
Mk.3:	WR975/P, WR976/K, WR977/L, WR978/M, WR979/N, WR980/O, WR987/R,

No. 224 SQUADRON (Code 'B')

Mk.1:	VP256/A, VP283, VP287, VP289, VP290/B-D, VP291/B-C, VP293, VP294, WB819, WB820, WB832, WB836, WB844/B-M, WB845, WB846/B-P, WB852, WB853, WB854/B-S, WB856
Mk.2:	WG558/B-R/R, WL741/B-O, WL751/B-L/L/3, WL752/B-T/T/4, WL753/B-Q/Q/2, WL758/S/1, WL792, WL797, WR953/P, WR955/B-P/P, WR961/L, WR963/B-M/M, WR965/T, WR968/B-R/R
Mk.2 Phase 1:	WG530, WG532/S, WG556/A, WL741, WL742, WL750/W, WL789, WL800/B, WR957/R, WR968
Mk.2 Phase 2:	WG532/S, WG533/B, WG554/M, WL755/T, WL757/C, WL789/A, WR951/W, WR953/P

No. 228 SQUADRON (Code 'L')

Mk.2:	WG557/L-L, WL744, WR951/L-K, WR953/4, WR956/1, WR957/U/3, WR958/O, WR959/L-O/O/W/2, WR960/X, WR961/Y, WR962/Z, WR966/U/S, WR969/T
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No. 240 SQUADRON (Code 'L')

Mk.1:	VP287/B, WB823, WB824, WB826, WB828, WB835, WB848, WB850, WB856, WB857, WB858/L-A, WB859/L-B, WB860/L-C, WB861/L-D, WG507/L-E/E, WG508/L-F, WG509/L-G, WG529
Mk.2:	WL739, WL748

No. 269 SQUADRON (Code 'B')

Mk.1:	VP255/B-D, VP256/B-A, VP265, VP266/B-A, VP284/B-F, VP287/B-B/B, VP289/J, VP290/D, VP291/B-F/C, VP294, WB818/B-G/G, WB819/M, WB820/B-S/F, WB826, WB835, WB851, WB852, WB855, WG529
Mk.2:	WL738/B-K, WL739, WL745, WL746, WL747, WL748, WL750, WL795

A.S.W.D.U. (Code 'F')

Mk.1:	VP261, VP281/F-B, VP282/F-K, VP285, VP288, WB851/V, WB856/F-D, WG526
Mk.2:	WB833, WG532/F-F/F, WG553/F-A, WL789/F-D
Mk.2 Phase 1:	WG553
Mk.2 Phase 2:	WG554/A, WL759/B
Mk.2 Phase 3:	WL801/A, WG556/B
Mk.3 Phase 3:	WR974

No. 236 O.C.U./M.O.T.U. (Code 'C')

Mk.1:	VP262/P, VP263/W, VP264/C-Z, VP265/F, VP266, VP268/C-Y/Y, VP281/Z, VP284/C-X, VP285, VP286, VP289, VP290/T/V, VP292/C-S/S, VP293, VP294/C-T, WB819, WB821, WB822, WB824, WB826/C-P, WB827, WB829, WB830, WB831, WB834/L, WB835, WB845, WB846/G/B, WB847/C-J/N, WB848/O, WB849/W, WB853, WB854/Q, WB855/C-H, WB858/M, WG526
T.4:	VP258/D/N, VP259, VP293, WB819/V, WB820/S, WB822/T, WB826/Y, WB831/S/U, WB832/U, WB837/W/H, WB844/X/R, WB845/X, WB847/Z/B, WB849/Z/O, WB858/M, WG511/O, WG527/K/P
T.2:	WG533/R, WG554/V, WG558/Y, WL739/S, WL750/T, WL787/U, WR964/Z, WR966/W, WR967/Q, WR969/X

J.A.S.S. FLIGHT (Code 'G')

Mk.1:	WB849/G-W, WB850, WB851/G-V, WB856
Mk.2:	WG555/G-A, WR967/G-B, WR969/G-A, WR966/G-C

No. 8 SQUADRON

AEW.Mk.2:	WL745, WL756, WL747, WR960, WR963, WL757, WL790, WL795, WL741, WL793, WR965, WL754
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No. 35 SQUADRON, SOUTH AFRICAN AIR FORCE:

Mk.3:	1716/J, 1717/O, 1718/K, 1719/xx, 1720/M, 1721/N, 1722/P, 1723/xx Contractors numbers 1526-1533
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An aerial photograph of St. Mawgan showing Shackleton Mk.3 Phase 3, XF705 42/A, alongside its replacement, a Hawker Siddeley Nimrod of No. 236 O.C.U. (Photo: R.A.F. St. Mawgan)

SHACKLETON PRODUCTION

Prototypes	Total	3	VW126; VW131; VW135
Mk.1:	Total	29	VP254-268; VP281-294
Mk.1A:	Total	47	WB818-832; WB834-837; WB844-861 WG507-511; WG525-529
Mk.2:	Total	70	WB833; WG530-533; WG553-558; WL737-759; WL785-801; WR951-969
Mk.3:	Total	34	WR970-990; XF700-711; XF730

Production total: 180

Conversions:-

T.4:	Total	17	VP258, 259, 293; WB819, 820, 822, 826, 831, 832, 837, 844, 845, 847, 849, 858; WG511, 527
T.2:	Total	10	WG533, 554, 558; WL739, 750, 787; WR964, 966, 967, 969
AEW.Mk.2:	Total	12	(Order of rebuilding) WL745, 756, 747; WR960, 963; WL757, 790, 795, 741, 793; WR965; WL754



WR972, a Mk.3 Phase 2 aircraft without ECM, purchased by the Ministry of Technology in March, 1959 for the Royal Aircraft Establishment. Note rear fuselage observation position. Colour scheme dark blue and white, grey fuselage.

(Photo: T. H. Shepperd)

CONSTRUCTION & SPECIFICATION

Airframe

Light-alloy, stressed-skin construction. Fuselage assembled in five sections: nose, front centre-section, intermediate centre-section, rear centre-section, and rear section.

Powerplant

Four Rolls-Royce Griffons. Shackleton Mk.1 (Griffon 57/57A); Mk.1A, 2 & 3 (Griffon 57A); Phase 3 (Griffon 58). Take-off power, 1,960 brake horsepower (2,435 b.h.p. with water-methanol) m.s.l. in ISA conditions. Bristol Siddeley Viper 203 of 2,500 pounds static thrust (two per aircraft) applicable to Mk.3 Phase 3.

	Mk.1		Mk.2*		Mk.3		Mk.3 Phase 3	
Span (ft. in.)	120	0	120	0	119	10	119	10
Length (ft. in.)	77	6	87	4	87	4	87	4
Height (ft. in.)	17	6	16	9	23	4	23	4
Basic weight (lb.)	54,500		n.a.		57,800		64,300	
Maximum weight (lb.)	86,000		89,000		100,000		108,000	
Landing weight (lb.)	72,000		72,000		86,000		88,000	
Wing area (sq.ft.)	1,421		1,421		1,458		1,458	
Aileron area (sq.ft.)	113.4		113.4		133.4		133.4	
Fuel (+400 overload:Imp.gal.)	3,292		3,292		4,248		4,316	
Hydraulic pressure (lb./sq.in.)	1,750		1,750		2,450		2,450	

Common features: Wheel track, 23 ft. 9 in.; tailplane span, 33 ft. 0 in.; wing dihedral, 4 deg.; aerofoil section (at root), NACA 23018; propeller diameter, 13 ft. 0 in.; flap area, 187.3 sq.ft.; rudder area, 100.2 sq.ft.; elevator area, 87.3 sq.ft.

ACKNOWLEDGEMENTS

The author wishes to extend his grateful appreciation to the many who have assisted him in researching this Profile; not least those who have helped with photographs and other material. In particular, thanks to those at the Ministry of Defence including Messrs Revell and Bennett and Anne McGuiggan; A&AEE's T. Heffernan; Hawker Siddeley's P.

Birtles, H. Holmes, G. Jenks and G. Allen; members of Air-Britain and others: R. C. B. Ashworth; J. Bartholomew; P. M. Blee; R. Brooks; C. Cove; T. Coyne; J. Crail; P. M. Dallison; J. Harding; W. Harrison; E. Heyes; D. Hill; B. Kirk; J. James; D. E. Leppard; W. Lewis; A. Lovett; P. McBurney; P. W. Mills; D. H. Morris; A. Percy Jnr.; E. Peck; J. Pote; D. C. Ransome; B. Rigelsford; D. M. Stroud; R. H. W. Wakelin and G. R. Williams.