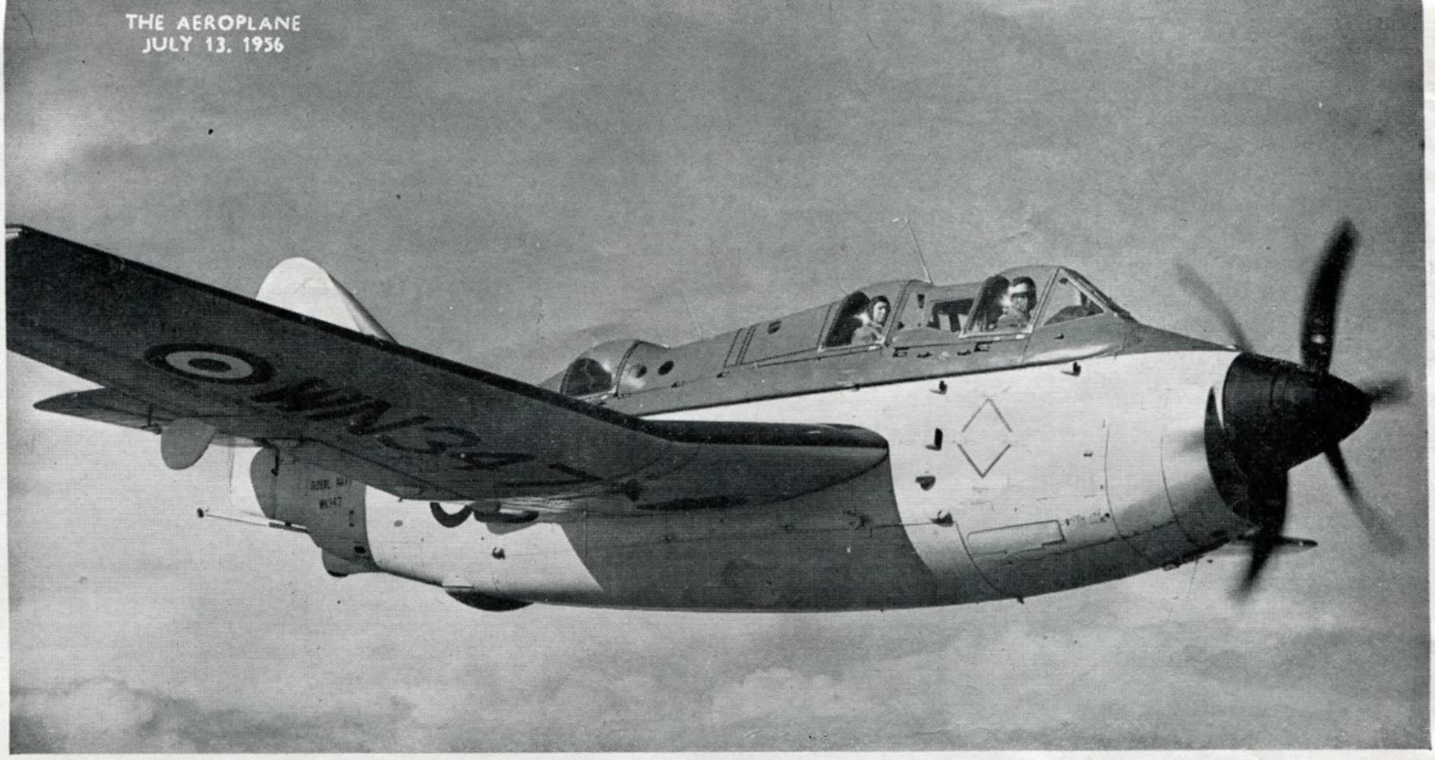
A FORMIDABLE SUBMARINE HUNTER

Reprinted from "The Aeroplane," July 13, 1956

THE FAIREY AVIATION CO. LTD.

HAYES, MIDDLESEX



"A Formidable Submarine Hunter"

The Fairey Gannet is an aeroplane of notable interest, both for its technical novelty and as the principal anti-submarine type in service with the Royal Navy. The evolution of the Gannet and its introduction into service is related here in greater detail than has previously been permitted.

IN the phrase which forms the title of this article, the Fairey Gannet was described in the White Paper on the Supply of Military Aircraft (Cmd. 9388) of February, 1955. Experience with the Gannet in squadron service with the R.N. and R.A.N. since then has given every reason to suppose that the description is an apt one.

As the only aeroplane adopted by the Royal Navy able to carry a full complement of electronics and weapons required today for the dual role of submarine search and strike, the Gannet would have a vital role to play in any hostilities in the next several years. But its claim to fame lies not only in its importance as a fighting machine, but also in its several technical novelties. The Gannet represents a completely new airframe design built by an entirely novel method of construction, coupled to a power plant which is radical in its conception.

Despite its novelty, however, the Gannet—developed under M.o.S. contract—has progressed quickly through the necessary stages prior to its introduction into service. Throughout the period of development, scheduled production dates have been met and the period taken for C.A. release trials to be completed established a record for post-war aeroplanes.

Any study of the development of the Gannet must necessarily be incomplete in certain respects, in order to comply with the existing security restrictions. Within these limits, however, the story which follows is the most complete survey of the Gannet's design, development and operational history which has been published. The story must begin with a reference to the power plant, for the use of a double turboprop engine gives the Gannet several of its unique features.

The idea of using two turboprops in this way, driving co-axial but independent airscrews, appears to have occurred to Mr. H. E. Chaplin, M.B.E., F.R.Ae.S., M.I.Mech.E., M.S.A.E. (then chief basic designer of the company and now chief designer, aircraft), towards the end of 1945, soon after the general requirements of the Navy for a new anti-submarine aeroplane to replace the Swordfish had become known. The use of turboprops was in accordance with Admiralty policy immediately after the War; but it was only by pairing two of these engines, in such a way that for cruising flight one could be shut down while the other continued to operate at near-maximum r.p.m., that Faireys could show an improvement on the fuel consumption of the piston engine.

For the design prepared to meet the anti-submarine requirement (GR.17/45), Fairey chose a double version of the Armstrong Siddeley Mamba (which had not then run). Armstrong Siddeley agreed enthusiastically to the idea of pairing this 1,000 h.p. turboprop, and Faireys based two proposals, submitted to the Admiralty at the end of 1945, upon this engine. A third scheme proposed at the same time was for an aeroplane using a single Rolls-Royce Tweed turboprop, but it had no clear advantages over the Double Mamba versions.

From these proposals, one, with a nose-wheel undercarriage and Double Mamba engine, was selected for development. The Fairey tender to specification GR.17/45 had, however, been a private venture, and placing of the prototype contract for two aeroplanes, on August 12, 1946, was conditional upon part of the expense being met by the company. This contribution was stated to be £539,500 by Sir Richard Fairey in his annual address to shareholders on November 24, 1955 (see THE AEROPLANE, December 2). Expenditure of so large a sum was a gamble—in the event a successful one—on the eventual placing of a production order.

The Double Mamba—or any comparable double turboprop engine—bestows a number of unique advantages upon the

The Gannet has been the subject of much modification since its first appearance, as explained in this article. On the left is the Gannet prototype in its earliest form; above is a standard Gannet A.S.1.

aircraft it powers. These advantages were for the most part incidental to the primary consideration of fuel consumption in the original conception of the engine, but the universal value of the safety factor afforded by the arrangement in the event of failure of one half was appreciated, especially for over-water operation.

From the early days of Double Mamba development, Armstrong Siddeley (and Fairey) engineers favoured the use of independent co-axial propellers, each driven by one "half" of the power unit. This meant that one "half" could be stopped, together with its propeller, without affecting the performance of the other "half"; in the case of coupled engines using inseparable contra-rotating propellers, failure of one half when both were at full power would probably cause the other half to stall because of the suddenly increased load it would be called upon to deal with.

The close side-by-side arrangement adopted provided installational advantages, as well as operational ones, and allowed the aircraft design to be tackled in most respects as if it were a single-engined machine, with consequent savings in weight and expense. All engine controls and the fuel system are duplicated, however, to make each half of the engine really independent.

Design Development

Although details of the specification requirements cannot be given, an examination of the Gannet as it is today gives an indication of what was required. It is clear that the specification emphasized ability to carry a wide variety of offensive stores in addition to A.S.V. radar, with good endurance of more importance than high top speed. The absence of defensive armament suggests that the aircraft was not to be required to operate in the face of enemy aircraft.

Controllability at the lower end of the speed range will have been an important factor, both for deck landing and for certain phases of submarine hunting. To meet the accommodation limits on aircraft carriers there were the usual strict dimensional requirements; in 1945, in fact, the overall height (folded) was limited to 13 ft. 9 in. as there were still some Merchant Aircraft Carriers (M.A.C.-ships) in service; this height limitation is now less severe.

The Fairey design to meet the specified requirements proposed a mid-wing monoplane with the pilot located far forward over the engine where his view was probably better than that provided on any other aeroplane at that time. The observer, completing the crew, was close behind, level with the wing leading edge, with an excellent view for visual submarine search.

Stores were to be accommodated in a bomb-bay beneath the wing centre section, with a retractable "dust-bin" radome behind the bomb-bay. The undercarriage main units turned through 90° to retract backwards into the wing, and the wings turned and folded backwards along the fuselage side, Firefly fashion. This latter feature produced C.G. difficulties, to overcome which it was proposed to use the arrester hook in the down position as a steadying strut.

With the design in this stage, it was passed, in August, 1946, to Mr. G. M. Spinks, project engineer, by Mr. D. L. Hollis-Williams, B.Sc., F.R.Ae.S., who was at that time chief engineer of the company. Since November, 1951, this latter position has been occupied by Mr. R. L. Lickley, B.Sc., D.I.C., M.I.Mech.E., F.R.Ae.S., who has, therefore, been responsible for production design and development of the Gannet. Dr. H. F. Winny, B.Sc., F.R.Ae.S., as head of the technical department, has been primarily responsible for aerodynamic aspects of the design.

Important design changes were made before prototype construction started; the undercarriage was changed to the inward-folding type, for simplicity, and an upward-folding wing was adopted when redisposition of the equipment aggravated the C.G. problem already mentioned. To meet the overall height limitations, vertical folding entailed the use of a double fold in each wing, the outer panel folding downwards simultaneously with the upward movement of the inner portions.

By March, 1947, the mock-up was ready for examination. A little later in the same year, Fairey's received official intimation that any production aircraft would probably require to carry a crew of three, and were asked to mock-up a fuselage making such provision. A good deal of uncertainty was apparent at this time over the best operational disposition of the crew, and various alternative arrangements were prepared with either one or two crew in the additional third cockpit behind the wing.

Some attention was also given at this period to an alternative version of the design with a Griffon piston engine. This was principally an insurance against the failure of the Double Mamba to come up to expectations and was not taken very seriously by the Fairey team, who always had the utmost confidence in the double turboprop engine.

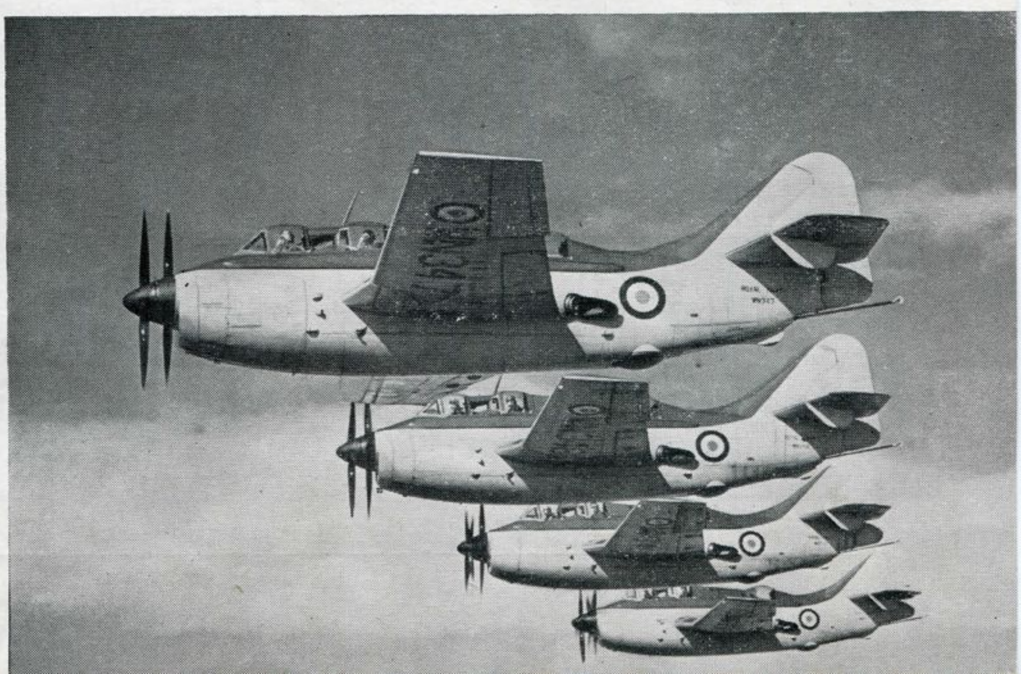
In June, 1949, a contract was placed for a third, three-seat prototype; when construction started, provision was made for the pilot forward and two crew in the rear cockpit; the forward observers' cockpit was re-introduced during construction as it was considered that the view from this station was of the utmost operational value.

After the various layouts had been considered at the School of Air/Sea Warfare, R.N.A.S. Eglinton, the arrangement adopted was with two cockpits forward as on the initial prototype, and the third crew member alone in a rear cockpit.

No decision on production was taken until January, 1951, when it was officially decided that the Fairey design should be adopted as the standard anti-submarine aeroplane for the Royal Navy. This followed competitive trials between the Fairey prototypes and those built by Blackburn and General Aircraft Ltd., to the same specification. The name Gannet was chosen in due course, and its production given the benefits of "super-priority."

Inevitably, between the prototype design and production stage, many changes have been necessary, some in the light of flight trials (discussed below) and others to meet changing operational requirements. In fact, 90% new drawings were required for the production aircraft. Apart from the introduction of the third cockpit already mentioned, the production aircraft differed noticeably from the prototype in having a lengthened bomb-bay—one presumes to accommodate bigger and better weapons—and this modification has caused the re-location of the radome further aft.

Parallel with development of the production aeroplane—officially the Gannet A.S.1—a dual-control trainer was initiated—the Gannet T.2—and trainers are now produced at regular intervals along the Mk. 1 production line. The Gannet 2 has a second set of flight controls in the forward observer's cockpit and a periscope is provided for the benefit of the



Four of the five Gannets of No. 703X Flight, which completed a valuable period of intensive flying trials with the type before the Gannet entered operational service.

instructor who occupies this cockpit, with the pupil in front. Provision is made for two occasional passengers in the rear fuselage, the radar and radome being deleted.

When the first prototype of the Gannet (VR546) flew for the first time at Aldermaston on September 19, 1949—it was customarily known as the Fairey GR.17 in those days—it was also the first time the Double Mamba engine had flown, although the single Mamba had been flying for two years by this time. Consequently Fairey were committed to the flight development of the first coupled turboprop unit in the World, in addition to development of the Gannet itself. In fact, the Double Mamba has flown only in the Gannets, and in one prototype of its Blackburn competitor.

On the first flight, the Gannet was flown by Gp. Capt. Gordon Slade, the company's chief test pilot, who has been responsible for all Gannet flight development, assisted by Peter Twiss, David Masters, and Roy Morris. From November 8, 1949, onwards, test flying of the prototype was transferred to the company's base at White Waltham. From the earliest days, the twin-engined reliability of the Double Mamba proved itself of value, and incidents occurred when the prototype might well have been lost but for it.

As at first installed in the Gannet, the Double Mamba (in its ASMD.1 version) was intended to drive Rotol 11-ft. diameter co-axial propellers; as these were not initially available, 10-ft. units were used at first with limitations on speed and *g*. The engine itself was operated by a single "throttle" lever in the cockpit, which controlled fuel flow and r.p.m. on a fixed ratio basis; engine r.p.m. were controlled by a constant-speed unit in orthodox piston-engine style.

This type of control, which suffered from a lag in terms of power response to throttle operation at low powers, had been developed originally by Armstrong Siddeley for the Python without reference to aircraft carrier operating techniques. Experience with the Wyvern, and during the first few months of Gannet flying, showed that this type of control was unsuitable for existing deck landing techniques (the introduction of the mirror deck-landing aid with its consequent effect on approach technique has made responsiveness and control on the approach much less critical than heretofore).

Constant Speed the Solution

The solution, in the case of both the Python and the Double Mamba, was to resort to a constant-speed engine. In conjunction with it, to overcome an inherent lag in the responsiveness of the system, a device known as the engine control unit (E.C.U.) or anticipator, was developed by Armstrong Siddeley. This is, in effect, a mechanical override of the C.S.U., connected to the "throttle" lever, which anticipates and causes the correct change of pitch at the same time as the r.p.m. go up or down, rather than following a second or two later. This problem was discussed more fully in an earlier article in the series, when the Python-engined Wyvern was featured (see THE AEROPLANE, June 15, 1956).

A further complication in the control system arises from the need to limit the fine pitch setting of the propeller in flight whilst also providing for a much finer pitch to be used for the deck landing approach when immediate response to the throttle is essential, especially in the event of a "wave-off." The flight setting would also impose too great a load on the slow-running engine, if used during starting and taxi-ing. In the case of the Gannet the flight fine-pitch stop is now withdrawn automatically when the undercarriage is selected "down," permitting the propeller pitch to be reduced to 6°, which satisfies all conditions.

A Notable First

The first flight with a constant-speed engine in VR546 was made on June 1, 1950, and the 11-ft. propellers for which the engine was designed were flown on July 28. In the intervening period, the first deck landings were made, on H.M.S. "Illustrious." Lieut. Cdr. G. R. Callingham, R.N., and Peter Twiss made a total of 26 landings on June 18, with generally satisfactory results. This was the first occasion on which a turboprop-powered aircraft had landed on a carrier deck.

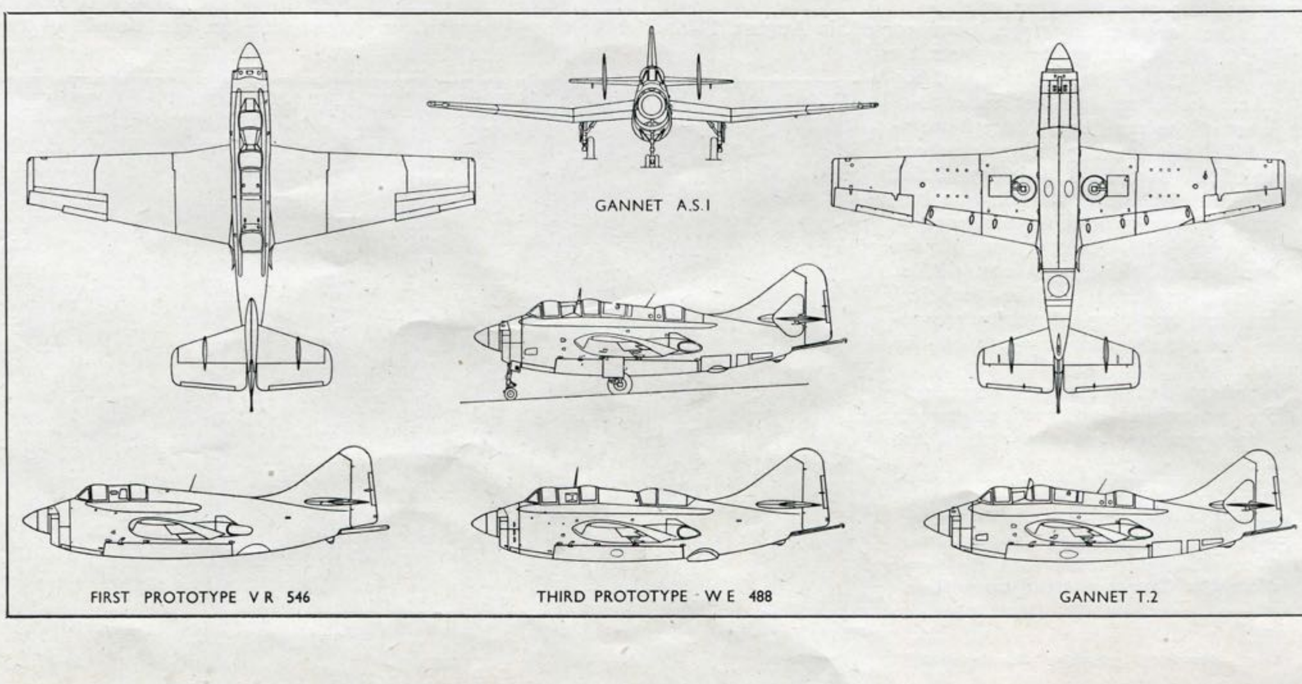
Both prior to and following these trials, flight tests were very largely concerned with aileron and elevator behaviour. During its initial flights, the Gannet flew with a fixed tailplane, set at a negative incidence of $-2°$ to give adequate elevator control, whilst the slipstream effect of the Double Mamba was being assessed. Subsequently, a fixed tailplane set at $+2°$ of incidence was found to be not altogether satisfactory, for the "standard" deck-landing technique, especially for a high cut at the extreme forward C.G. limit. This was because of inadequate pitching control of the aircraft through loss of air flow over the tail when the propeller pitch went to 6° on the closure of the throttles.

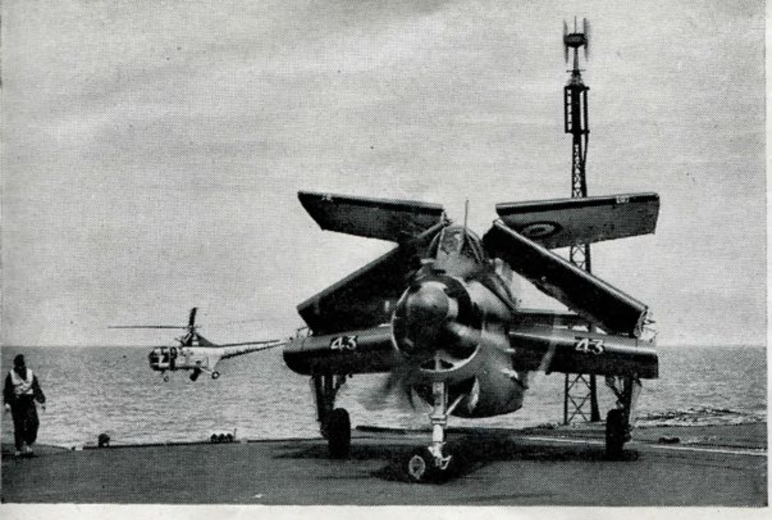
A great deal of development went into this problem, with various combinations of tailplane incidence, elevator size, spring tab size and tab gear ratio being tried. The span of the outer flaps was also reduced, but finally it was decided to adopt an all-moving tail, the incidence changing automatically from $+2°$ to $-4°$ as the flaps were lowered. This arrangement was first flown on VR546 on September 14, 1950, with electric actuation, but hydraulic operation was applied in all production aircraft.

To achieve the best possible lateral control, larger ailerons were used, with spring tabs to compensate for their consequent heaviness. Concurrently with the tailplane investigation, more than 20 combinations of aileron size, hinge position and tab size and power were test flown on VR546, before the optimum was chosen for production.

Originally the spring tab-operated ailerons had no connection other than the "elastic" one of the spring tab control runs. This was found to result in an unpleasant "float" in the ailerons under certain conditions of flight, and a rigid mechanical interconnection was introduced in June, 1951. Subsequently, the system was modified to introduce differential up and down movement of the ailerons.

One other aerodynamic problem encountered was a "buzz"





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The double wing-fold on the Gannet is characteristic; upward folding, rather than backward was adopted to avoid C.G. changes when the wing folded.

(slight flutter) of the elevator spring tab. There was no obvious aerodynamic reason for this "buzz," which has been cured by increasing the tab's mechanical rigidity and improving its mass distribution by moving its C.G. forward of the hinge line.

On July 6, 1950, the second prototype (VR557) made its first flight, from London Airport to White Waltham. To all external appearances, it was substantially identical with the first and it was this machine which made the Gannet's first appearance at an S.B.A.C. display, in September of that year. A further series of 84 deck landings was made by VR546 on H.M.S. "Illustrious" in October, 1950.

As already noted, the production order for Gannets was placed in January, 1951, and from that year onwards, flight development was concerned with changes to be made on the production aircraft, as well as continuing the aerodynamic investigations. Reference has already been made to the introduction of a third crew member; on March 13, 1951, VR546 flew for the first time with a mock-up rear hood for aerodynamic investigation. It was followed on May 10 by the third prototype (WE488) which was the first genuine three-seater, with the experimental double cockpit at the rear and the usual two crew positions forward.

The new cockpit and the re-location of the radome necessitated by the lengthening of the bomb bay, led to unsatisfactory airflow conditions over the tail and resulted in the introduction of the small auxiliary fins on the tailplane. Some earlier buffeting of the rudder which arose when the radome was extended had already been cured by fitting spoilers down each side of the radome.

In the normal course of development, the all-up weight of the aircraft had been increasing as it was called upon to carry more equipment. Moreover, the move of the radome aft, and of much equipment into the new rear cockpit, began to have a serious effect on the C.G. The decision was made to re-locate the main undercarriage 12 in. further aft, and this modification was first incorporated on VR546 in July, 1951, for flight trials in an unretractable form. A year later, the same prototype was flown with the production type undercarriage, also set back, and with its velocity absorption characteristics increased from 14 ft./sec. to 16.5 ft./sec., one of the highest figures for a British aeroplane to date. In this condition, 67 deck landings were made on H.M.S. "Eagle" in May, 1952.

Meanwhile, the second prototype had been to R.N.A.S. Eglinton for tactical trials together with the third machine, and to the A. and A.E.E. Boscombe Down, for armament trials. It subsequently went to Armstrong Siddeley for engine development flying. The third aircraft was flown at the S.B.A.C. Air Display in both 1951 and 1952, and in October, 1951, was demonstrated to the French Navy at Hyeres. This latter occasion was the first Gannet trip outside Britain.

Warm weather trials were undertaken in Malta by VR557, which sailed in H.M.S. "Theseus" in July, 1953. In the same month (on the ninth), the first production Gannet (WN339) was flown from London Airport and in four flights on that first day it completed 5.15 hours in the air. The next two production aircraft flew in August and September respectively and were used with WN339 for 90 hours of concentrated development flying before going to the A. and A.E.E. for final clearance.

A target of six months had been set for completion of the flying required for C.A. release. In fact, this target was slightly bettered: the first five production aeroplanes flew a total of 350 hours at these trials between September, 1953, and February, 1954, at the end of which the first release was obtained. It was the first occasion on which C.A. release trials had been made with the simultaneous use of several aeroplanes.

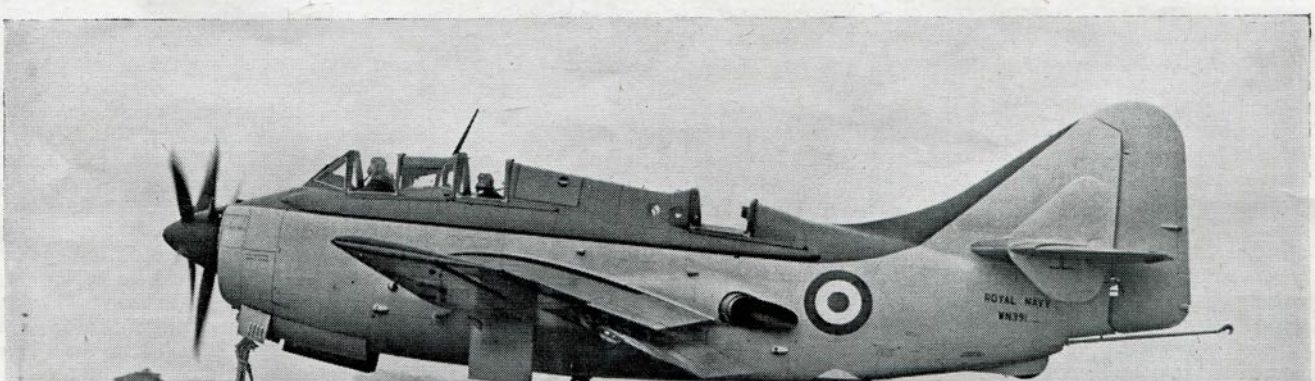
Serviceability and maintenance trials were undertaken at Ford, and day and night deck landing and catapult trials were made on H.M.S. "Eagle" and H.M.S. "Illustrious" in October and November.

Technical Features

A technical description of the Gannet A.S. Mk. 1 is not permissible, on security grounds, but a number of interesting features of the design have been discernible during its public appearances at S.B.A.C. displays and elsewhere, and can be deduced from published references to the Gannet.

The Double Mamba is mounted—by three point suspension —quite low in the front fuselage, with the thrust line of the propellers raised in order to keep undercarriage length, and therefore overall folded height, to a minimum. To simplify servicing a special feature of the installation is that the engine can be withdrawn forwards, using special auxiliary equipment which can be carried in the aircraft when necessary. This involved some ingenious designing to keep the engine tailpipes clear of the nose-wheel strut in the fuselage during engine withdrawal, and it was also necessary to attach the fireproofing to each engine instead of, more conventionally, to the airframe.

Raising the propeller thrust line was also beneficial in keeping it clear of the "line of sight" of the A.S.V. radar, but it was still necessary to extend this equipment below the fuselage for



A Gannet 1 about to touch down on the long Farnborough runway at the end of its demonstration at an S.B.A.C. Display.

The latest announced version of the Gannet is the A.S.4. As this illustration shows, it has no external changes from the A.S.1.

maximum efficiency. A variety of radio aerials is to be seen on the Gannet's fuselage and wings. Control runs and electrical circuits are carried in an external fairing down each side of the fuselage—for maximum accessibility; in the case of the trainer, the interconnections of some of the flying controls are also located in this fairing.

Catapult attachment points, one-piece steel investment castings produced by Faireys, are arranged on each side of the fuselage below the wing leading edge, and the arrester hook is of the sting type, extended, damped and retracted hydraulically. Although a free carrier take-off is no longer required officially, the excellent take-off performance of the Gannet at all weights does in fact permit free take-offs to be made under most conditions from angled decks.

Spread, the Gannet has a span of 54 ft. 4 in.; this is reduced to 19 ft. 6 in. folded. The length is 43 ft. and the height of 13 ft. 8½ in. increases by ½ in. when the wings are folded.

Among the loads which can be carried in the capacious bomb-bay are a 2,000-lb. "store," two 1,000-lb. mines, four 500-lb. mines, six 220-lb. depth charges, two Lindholme air-sea rescue packs or torpedoes. Under the wings the Gannet can carry, each side, eight 90-lb. rockets, or sono-buoys, flame floats, practice bombs, flares, a Saro Mk.1 rotary dispenser for six stores, or a Lindholme pack. The bomb-bay capacity is, in fact, comparable with that of early Lancasters, and 28 different combinations of stores can be carried.

Following the C.A. release for the production Gannet A.S.Mk.1 in February, 1954, the next phase of development began. It now became the responsibility of the Fleet Air Arm rather than the Fairey company to continue the process smoothly, and for this purpose No. 703X Intensive Flying Flight was formed on March 15, 1954, at R.N.A.S. Ford, with Lieut. Cdr. F. E. Cowtan, R.N., in command.

Overcoming Development Troubles

As an initial target, the flight was to fly four Gannets for 200 hrs. each at 25 hrs. a week—a rigorous enough programme for aircraft and crews alike. The trials went smoothly to begin with and the target was met. It was then decided to continue intensive flying beyond the original figure, and towards the middle of the year, following the first set of engine changes, engine stalling troubles were experienced which once again were attributed to the P.C.U./E.C.U. system and its associated controls being unable to respond to rapid throttle changes, particularly in hot weather.

While action was being taken to investigate and overcome this fault, the Double Mamba was grounded and Gannet flying stopped temporarily. To overcome this tendency of the compressor to stall, Armstrong Siddeley developed a new E.C.U. (anticipator) which automatically restricted the rate at which the engine end of the throttle linkage responded to opening movement of the throttle control lever.

At the same time the engine was modified to operate at a constant 15,000 r.p.m. whereas it had previously run at 14,500 r.p.m. with a special override to 15,000 r.p.m. for take-off. The angle of the inlet guide vanes was altered to improve compressor performance at high temperatures, and a fuel recuperator was introduced to prevent fuel starvation during catapult launchings.

A fully modified engine was fitted in a production Gannet (WN372) in October, 1954, and flown to Khartoum by Faireys for hot weather trials. The aircraft flew for 81 hr. during these trials, which included some launchings from H.M.S. "Albion" operating in the Mediterranean. No. 703X Flight began flying again with modified engines, and successful deck-landing trials with the new anticipator were made in H.M.S. "Illustrious" in November, 1954.

Other incidents of note in 1954 were the departure for Canada in May of WN344 for winterization trials (which have now been completed); the first flight, on August 16, of the prototype Gannet T.Mk.2 (WN365), and the first flight on September 7, 1954, of the first Gannet A.S. Mk.1 assembled on the second production line at Ringway.

No. 703X Flight completed its task, with 1,700 hr. to its credit, in December, 1954, and on January 17, 1955, the first squadron, No. 826, formed with Gannets at Lee-on-Solent. Commanded by Lieut. Cdr. G. F. Birch, R.N., it embarked with its aircraft in H.M.S. "Eagle" for her cruise to the Mediterranean in June 1955.

Other squadrons followed quickly—No. 824 at Eglinton and now aboard H.M.S. "Ark Royal"; No. 825 for H.M.S. "Albion" and No. 820 for H.M.S. "Centaur." Gannets also went into service during 1955 with Nos. 719 and 737 training units at Eglinton (respectively the anti-submarine and observers' schools), No. 700 (S.T.U.) at Ford and No. 744 development unit at St. Mawgan.

More recently, 40 Gannets from the original Royal Navy order have been made available to the Royal Australian Navy to equip Nos. 816 and 817 Squadrons aboard H.M.A.S. "Melbourne," and Nos. 812 and 815 Squadrons, R.N., have been formed at Eglinton.

Power Plant Development

Up to the end of 1955, Armstrong Siddeley production of the Double Mamba for the Gannets was based on the A.S.M.D.1 (Mk. 100) variant, comprising two Mamba A.S.M.3s. Development running of the Double Mamba had begun in September 1948, and the first production unit was delivered for fitting in the Gannet in January 1953. The Double Mamba 100 has a static take-off rating of 2,540 s.h.p. plus 825 lb. thrust at sea level at 15,000 r.p.m. The equivalent fuel/consumption is 298 g.p.h., and the net dry weight is 2,180 lb.

Production is now based on the A.S.M.D.3 (Mk. 101), comprising two Mamba A.S.M.5s. This engine differs from the Mk. 100 in having an annular combustion system and high-energy ignition, but it is interchangeable with the A.S.M.D.1 for installation. Its static take-off rating at sea level is 2,740 s.h.p. plus 820 lb. thrust at 15,000 r.p.m., when the specific fuel consumption is 287 g.p.h. Net dry weight is 2,170 lb.

Development flying of the Double Mamba was begun by Armstrong Siddeley in April 1951, in the Blackburn Y.B.I. and continued in the second prototype Gannet, VR557, which arrived at Bitteswell in November 1952. This Gannet was used solely for Double Mamba 100 development flying, completing 280 hours before its disposal in October 1955. Development of the control systems on the Mk. 100 engine was mostly on WN395, from October 1954 to the end of 1955. The first Gannet flown with the Double Mamba 101 was WN340, in August 1955, and WN395 was re-engined with this mark early this year. Mention is permitted of the Gannet A.S. Mk. 4, which is externally identical with the A.S. Mk. 1 and has been reported to have a different engine.

Reference has been made to further developments of the Double Mamba designated A.S.M.D.4 (comprising two Mamba A.S.M.6s) and the A.S.M.D.8. It is to be presumed that these versions of the engine are intended for later variants of the Gannet.

Starting turboprop engines continues to be something of a problem, because of the large powers required to spin the rotating assembly up to self-sustaining speed. The best solution

Approaching to land, a Gannet displays its large-area flaps in the down position, and the arrester hook extended.

Photograph copyright "The Aeroplane"

seems to lie in the use of an external source of compressed air, and the Double Mamba can, of course, be started in this way. Up to the present time, however, use has also been made of two Rotax twin-breach cartridge turbo-starters. With the engine cold, both cartridges are normally required for a start; a warm engine will start on one.

At the opening of this article, we noted that one of the Gannet's triple claims to fame lay in the method of construction used to build it. This is the system known as envelope jigging, developed by Mr. H. E. Chaplin and Mr. Alan Vines (production manager) and patented by Fairey's in 1944. Its subsequent application to the Gannet has been largely the responsibility of Mr. G. T. Maughan, A.I.Mech.E., production development engineer.

Producing the Gannet

The envelope jigging system has been fully described on other occasions. Briefly, it entails the use of an external profile jig which controls to close limits the external contours of the part in question. This jig is drilled for all fittings, bolts, rivets, etc., and ensures the production of a component with a degree of interchangeability not easily obtained by other production methods. Moreover, the inside of the component is more easily worked on and a large proportion of the internal equipment can be located while the skin is still in the jig.

The first experimental application of envelope jigging was to certain Firefly components and the system was subsequently used extensively in construction of the Gyrodyne. Results were so promising that the company had no hesitation in basing Gannet construction on the system right from the beginning, and every aeroplane from the first prototype onwards has been jig-built.

To quote one small example of the benefits bestowed by the system, it was found that the bomb-doors were fully interchangeable between the two prototypes. Later, when the first two production aircraft were damaged in a taxi-ing accident while on C.A. trials, new components were fitted, from the third and fourth aircraft, in record time and with no difficulty, so that the trials could be continued without delay.

Another indication of the interchangeability of envelope-jigged components is given by the fact that it has never been necessary to change elevators or ailerons in the course of flight trials in order to obtain the required control characteristics. Handling qualities have remained completely consistent between aircraft, as a result of the control surfaces having aerodynamic consistency and repeatability. This is a direct and immensely beneficial result of the control which envelope jigging exerts over the external shape of the components.

The sub-assemblies system used by Faireys for production of the Gannet makes use of two final assembly lines at Northolt and Ringway, both are fed by components built at Hayes, Hamble and Stockport. Aircraft assembled at Ringway complete all their test flying there, where David Masters is senior test pilot. Gannets assembled at Northolt are flown to White Waltham on their first flight for completion of the test flying programme.

Further assistance to Gannet production has been given by the degree to which the company is self-sufficient. It has, for instance, an extensive hydraulic section which produces a large proportion of the hydraulic equipment for the Gannet. An investment-casting foundry at Hayes produces the wide range of castings required, whilst other departments deal with glass-fibre forming, including the large radome, and Perspex moulding for the cockpit hoods. All the electrical looms required in the Gannet are assembled at Hayes. The Gannet's undercarriage is also a Fairey product.

The present year, then, sees the Gannet established in service as one of the most vital aeroplanes in the Naval armoury and in production as the only aeroplane still afforded super-priority. It is significant that it is almost alone among the aircraft ordered in Britain in the past five years in having suffered no cuts in production contracts, although it is true that production has been "stretched out" now that the initial requirements have been met and the wastage rate has proved so low.

The Gannet has overcome, without undue delay, the various aerodynamic and engine control problems which were, perhaps, inevitable in an aeroplane of its size and kind married to a novel powerplant. Its future development—which is assured—will be along lines designed to make the maximum use of the additional power which will become available from the Double Mamba.

At the same time, the Gannet's load-carrying ability, coupled with provision for deck operations, is likely to lead to its adoption in other roles. In this respect, a recent official reference has been made to the eventual introduction of an airborne early-warning version of the Gannet to replace the Skyraiders used in this role by the Fleet Air Arm.—F.G.S.