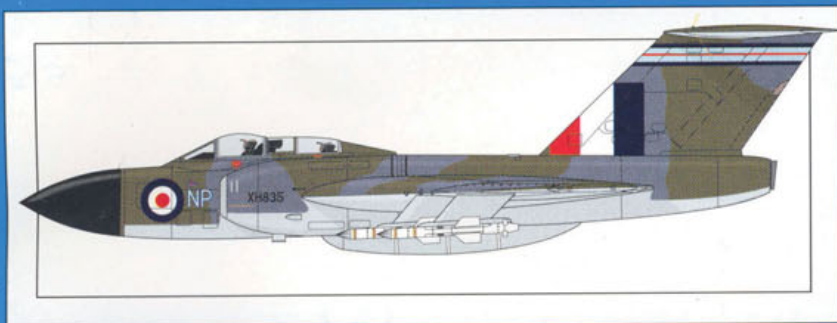




WARPAINT SERIES No.17

Gloster JAVELIN

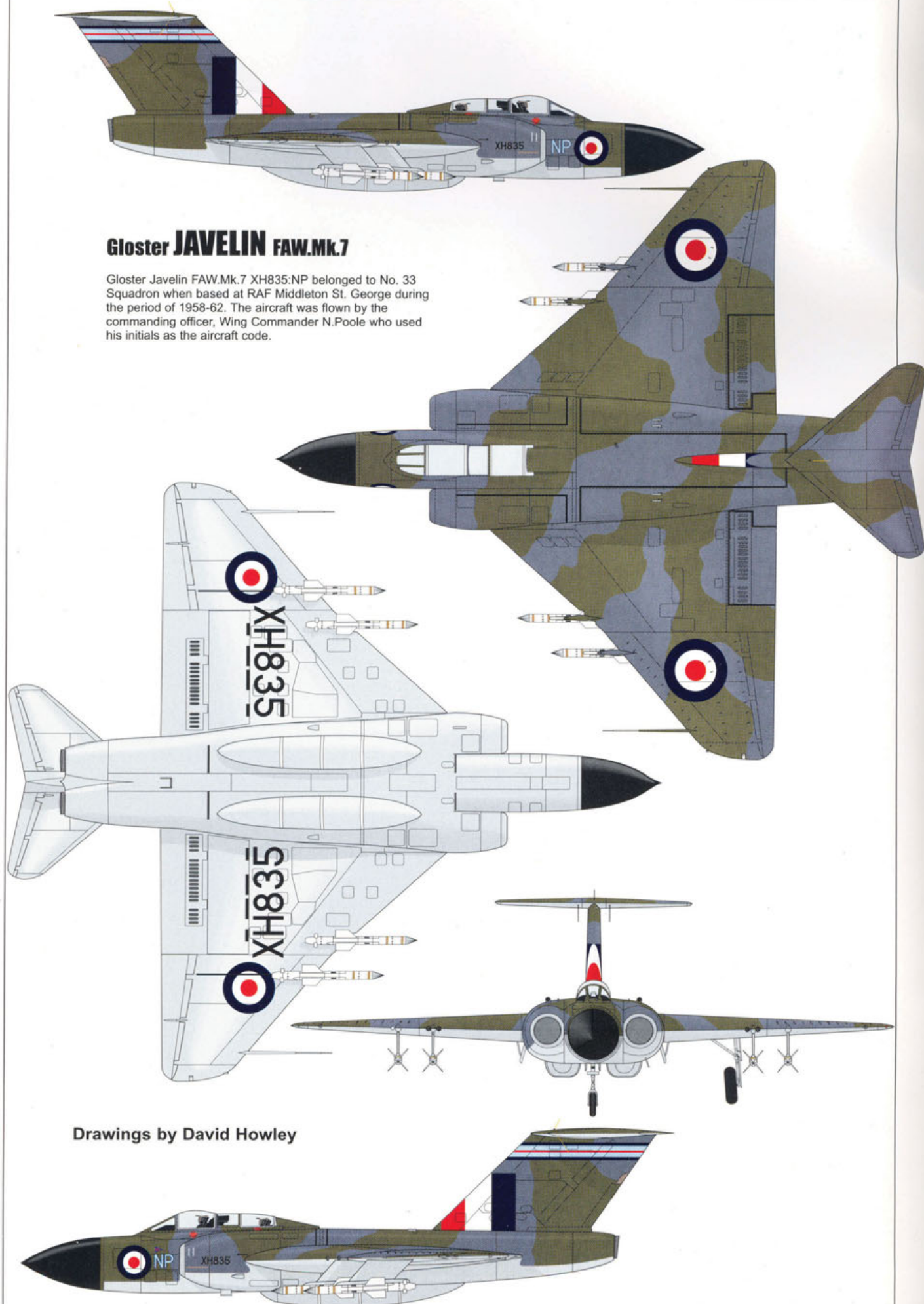
BY TONY BUTTLER AMRAeS

Gloster Javelin FAW.Mk.9 XH881:M of No. 25 Squadron armed with four Firestreak air-to-air missiles, the inner two of which are dummy rounds. The squadron was based at RAF Waterbeach when this photograph was taken, probably in 1960. (MoD)



Gloster JAVELIN FAW.Mk.7

Gloster Javelin FAW.Mk.7 XH835:NP belonged to No. 33 Squadron when based at RAF Middleton St. George during the period of 1958-62. The aircraft was flown by the commanding officer, Wing Commander N.Poole who used his initials as the aircraft code.





Gloster JAVELIN

By Tony Buttler AMRAeS

THE Gloster Javelin holds the distinction of being the first and, to date, only all-British delta wing fighter to enter squadron service, and it was also the world's first twin-jet delta. In an era marked by many distinctive and unusual shapes, the 'Ace of Spades', 'Flying Flat Iron' or 'Flying Triangle' was unique but, as a fighter and as an aeroplane, the Javelin possessed some weaknesses and flaws which have resulted in frequent criticism, much of it unjustified since the Javelin filled an important role well for twelve years.

EARLY BEGINNINGS

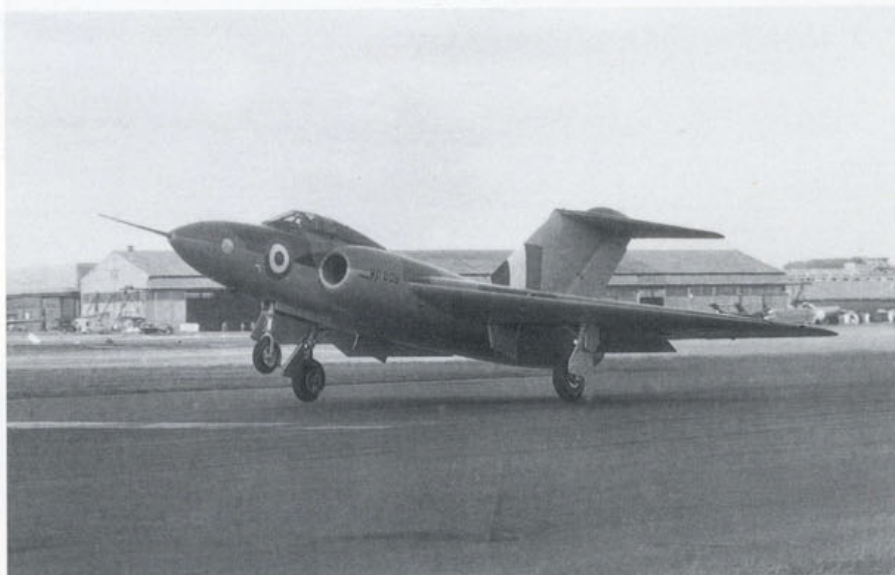
The story begins in early 1947 when specifications were issued for new combat aircraft for the RAF:- F.43/46 for a day interceptor and F.44/46 for a night fighter. Gloster Aircraft tendered to both documents; its P.228 was a clear descendant of the Meteor

but the P.234 day fighter had a whopper of a delta wing (and a V-tail). Gloster drew numerous fighter projects around this period showing evidence of Meteor ancestry, no surprise as the firm's first jet fighter had been a great success. Just when the point was reached where the designs stopped being Meteor developments to become

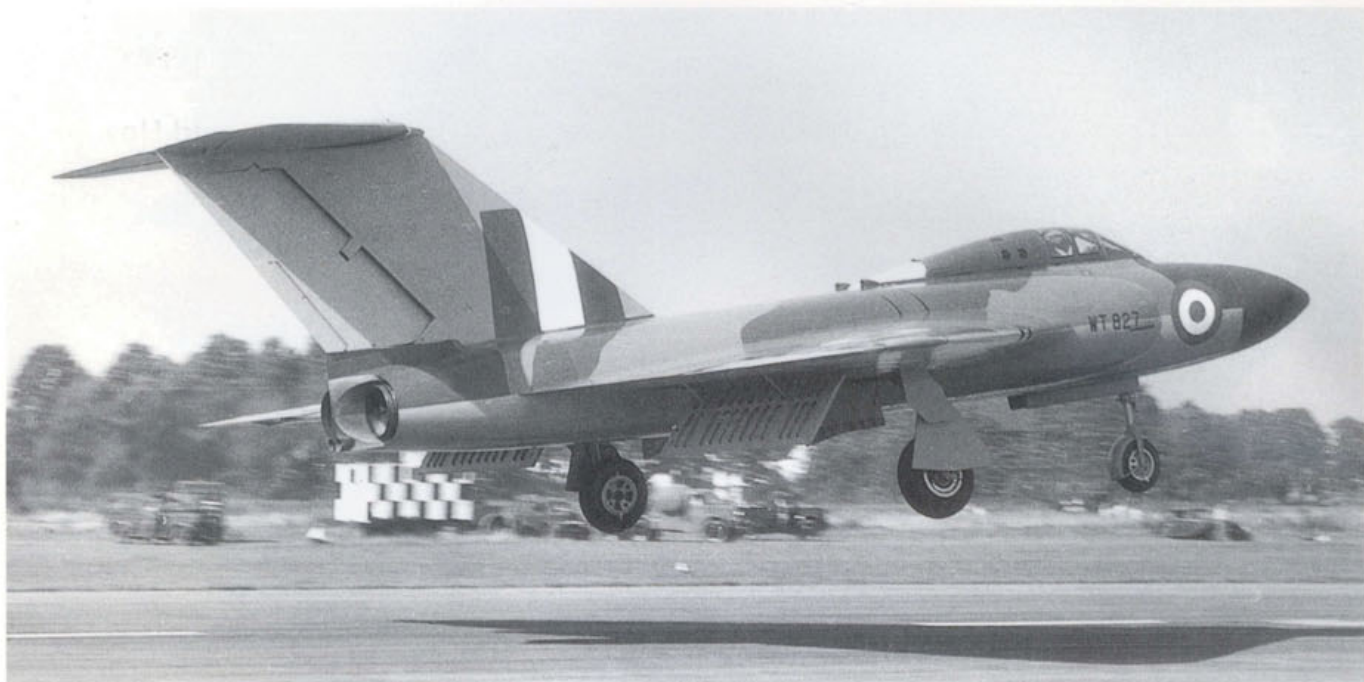
A fully armed Javelin FAW.Mk.7 XH756 showing its four Firestreak missiles and ventral tanks. The aircraft was part of the All Weather Development Squadron of the Central Flying School at the time, hence the apparent lack of squadron markings. It was later converted to an FAW.Mk.9 and was part of Nos. 5 and 11 Squadrons later in its career (MoD).

ancestors of the Javelin is near impossible to identify but, by August 1947, the follow-on P.248 and P.250 projects had some distinct Javelin features.

At this time, Gloster's fighter conception was concentrated towards the F.43/46 day fighter specification which called for the destruction of high speed, high altitude bombers by a fighter far superior to the



Second prototype of the Gloster GA.5 Javelin, WD808, seen at the SBAC show, Farnborough, in 1952. Unfortunately it crashed near Bristol on 11 June 1953 killing the pilot Peter Lawrence. The cause was said to be a deep stall condition that could not be controlled. (Gloster Aircraft)



Meteor. At the Tender Conference on 9 April 1947, Gloster's P.234 was seen as the superior project and agreement was reached to place an order. Gloster received confir-

mation of go-ahead in June but no order was received as the Air Staff altered its requirements. The firm drew the P.248 and P.250 to incorporate the new thinking, but then the

The third prototype WT827 being shown at the 1953 Farnborough air show. It was the first to carry guns and radar and experimented with both blunt and pointed noses. Note the faired-in rear cockpit. (APN)



Ministry of Supply requested the replacement of guns with the Red Hawk air-to-air missile (AAM). A large air-interception radar was needed and further changes brought forth the P.259 which, for the first time, was a two seater.

Parallel progress had also been made on the F.44/46 night fighter, favoured projects being the de Havilland DH.110 and the Hawker P.1057, both two seaters. Hawker, however, had started a major study of single seat fighter concepts and the results were so good, particularly when the firm was struggling to produce a decent two seater, that the Air Ministry began to think in terms of Hawker doing the day fighter. With Gloster's P.259 lending itself better to F.44/46, it was decided in January 1948 to switch everything around and order three Hawker F.43/46s (the P.1067 which became the Hunter), three DH.110s and three (later four) Gloster F.44/46s (plus a further structural test airframe). From now on Gloster's aeroplane was looked on solely as a night fighter.

Dropping the P.1057 brought de Havilland and Gloster into direct competition on F.44/46. A total of 13 DH.110s was eventually ordered to satisfy long range and naval fighter requirements as well as F.44/46 but, due to economic pressures, this figure was eventually cut to just two. There was a comparative evaluation in mid-1952 between the DH.110 and G.A.5 which influenced RAF preference for the latter, and when the first DH.110 crashed at the 1952 Farnborough Show, the Gloster fighter's growing favouritism became more secure.

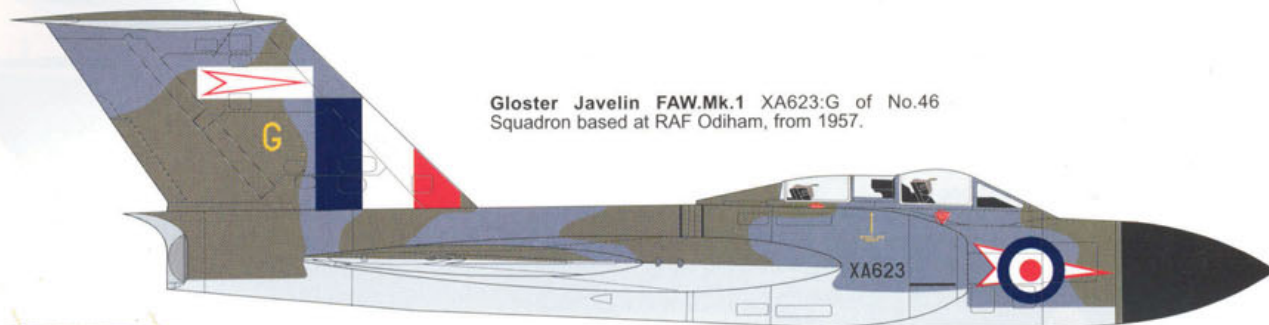
Gloster's first project fully prepared to Above left and left: First prototype Javelin WD804 showing off its paces over the Gloucestershire countryside. The power of the Sapphire engines allowed plenty of scope for this sort of manoeuvre even though the Javelin was heavier than most World War 2 bombers (via D. James)

Gloster Javelin camouflage and markings

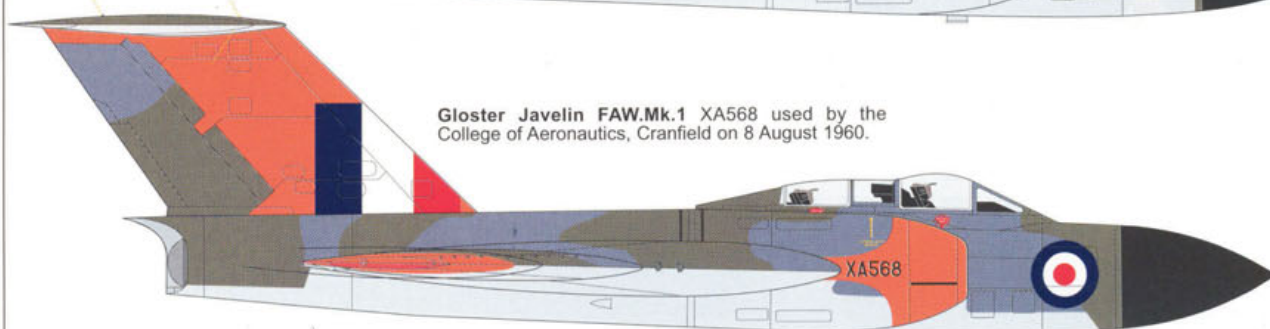
Drawings by David Howley

GLOSTER JAVELIN COLOUR KEY

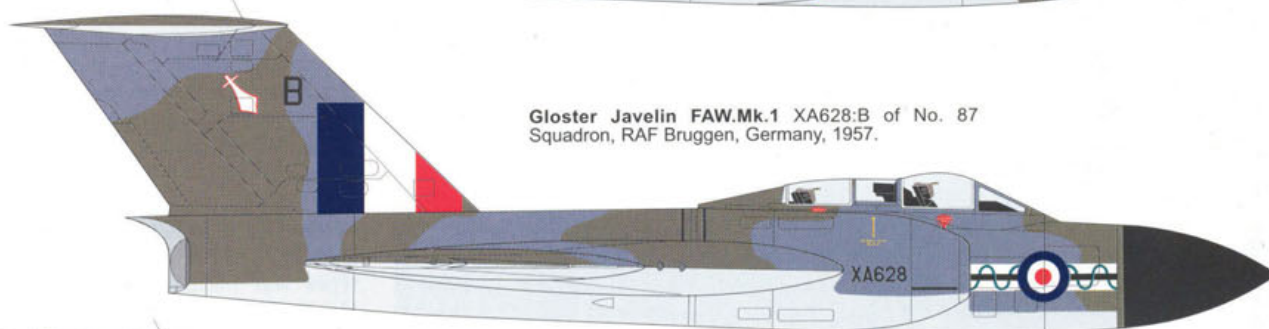
										
Black	White	Yellow	Roundel Red	R. Blue	P.O. Red	Dark Green	Dark Sea Grey	Med. Sea Grey	Aluminium	Dayglo Red



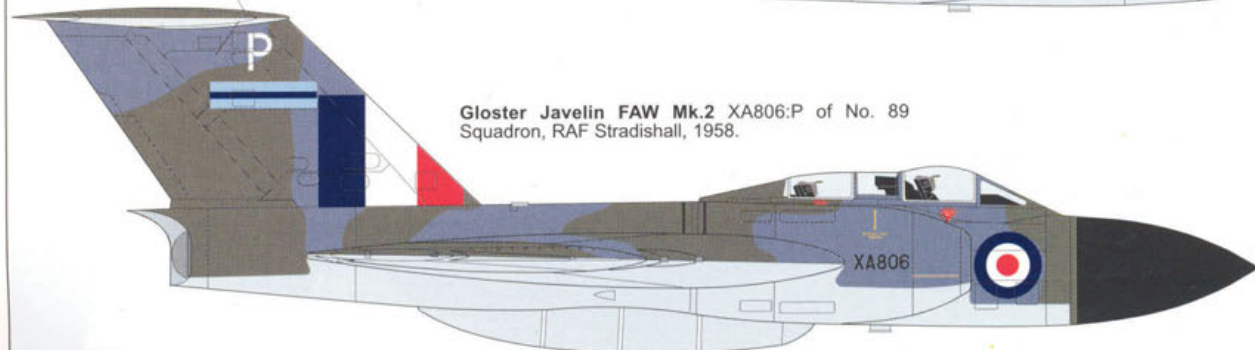
Gloster Javelin FAW.Mk.1 XA623:G of No. 46 Squadron based at RAF Odiham, from 1957.



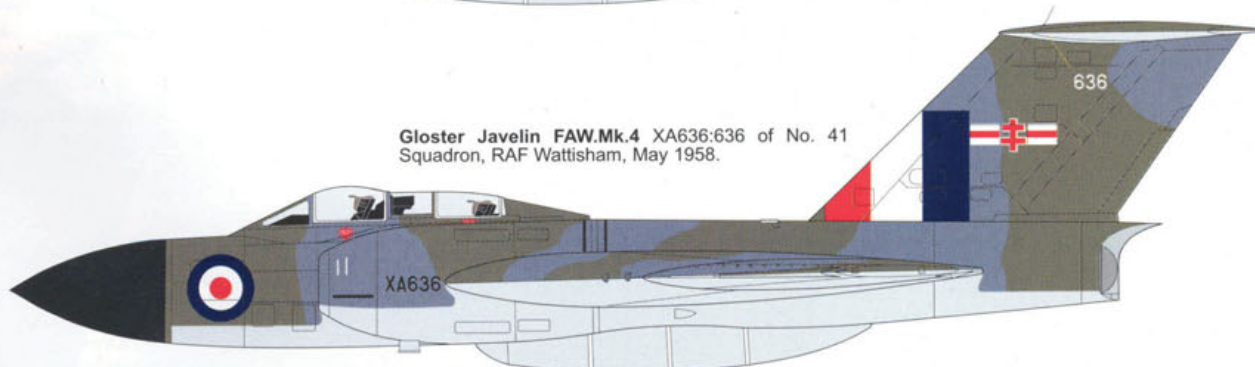
Gloster Javelin FAW.Mk.1 XA568 used by the College of Aeronautics, Cranfield on 8 August 1960.



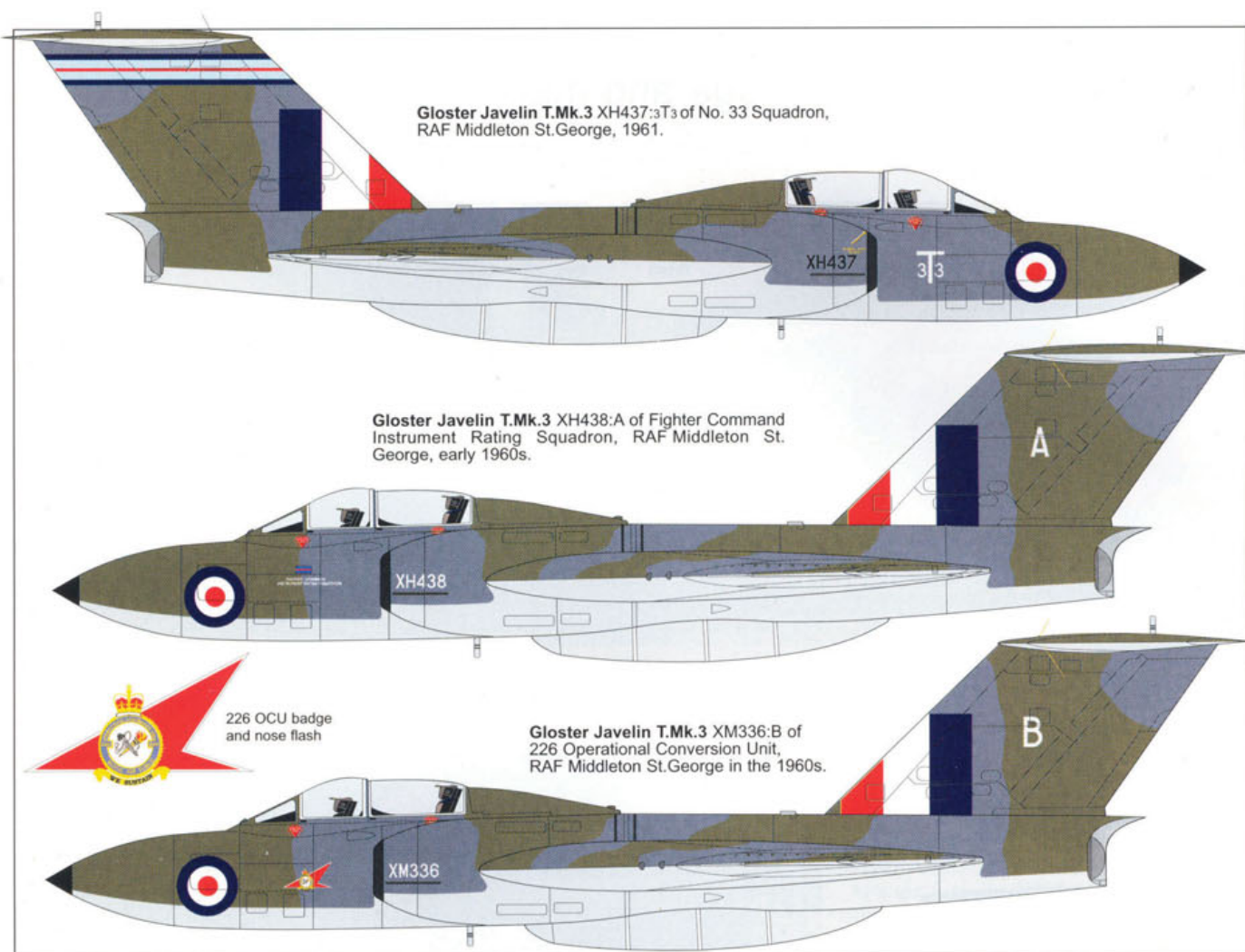
Gloster Javelin FAW.Mk.1 XA628:B of No. 87 Squadron, RAF Bruggen, Germany, 1957.



Gloster Javelin FAW Mk.2 XA806:P of No. 89 Squadron, RAF Stradishall, 1958.



Gloster Javelin FAW.Mk.4 XA636:636 of No. 41 Squadron, RAF Wattisham, May 1958.



F.44/46 was the P.272, dated 15 April 1948, and developed out of the P.259. It had a 39in (99.1cm) diameter radar scanner and an all-moving tailplane. F.43/46 and F.44/46 were now both renumbered, as F.3/48 and F.4/48, to accommodate the extensive changes in requirements. F.4/48 was to be the development specification and was issued to both de Havilland and Gloster in June 1948. Covered by Operational Requirement OR.227, it requested a night fighter capable of at least 525 knots (605mph/973km/h) top speed at 40,000ft (12,192m) and carrying four 30mm Aden cannon and an AIMk.9 intercept radar. It was to replace the Mosquito.

Estimated all-up-weight for P.272 was 25,500lb (11,567kg), a rise of 5,000lb (2,268kg) over earlier designs which worried the designers since such an alarming increase in all up weight would bring a big loss of performance. With the realisation that the aircraft was underpowered for its size, certain concessions were made to cut weight (such as reduced fuel and ammunition load) and the decision taken to adopt Armstrong Siddeley Sapphire engines instead of Rolls-Royce Avons through the prospect of greater thrust. This change also suited a broader plan for sharing the load between engine firms. The first Gloster drawing that one might call a Javelin proto-

type, also labelled G.A.5 under the SBAC numbering system, was P.276 with the original AJ.65 Avons. P.280 introduced two Sapphire Sa.2s. This was dated July 1948 and had a span of 52ft (15.8m), length 57ft (17.4m), and all-up-weight 27,000lb (12,247kg). It was expected to achieve Mach 0.89 at sea level and Mach 0.91 at 40,000ft (12,192m).

Contracts were awarded in March 1948 to proceed with mock-up and design work and the general layout was stabilised and finally agreed in August with the P.280. For example, proposed wing tip ailerons were changed to a trailing type. Armament would consist of four 30mm Aden cannon or Blue

Jay (later Firestreak) guided weapons and two Adens. Progress was slow to begin with thanks to a lack of precise information on new and vital equipment, but the Mock-Up Conference was held at Bentham on 26 October. The contract to supply four prototypes was placed in April 1949 but in November the total was cut to two since the aircraft was regarded, at this time, more in the nature of an insurance against any setbacks in the DH.110 programme. De Havilland's fighter was the preferable production choice because it was more conventional and easier to build.

Chief Designer on the Javelin for almost the entire programme was Richard



The fourth prototype WT830 shows the modified kinked wing leading edges. As with some of the other prototypes the rear of the cockpit is faired over. This aircraft ended its days as an instructional airframe at RAF Halton, serialised 7485M.



W.Walker. He succeeded George Carter, Chief Designer of the pioneer Gloster E.28/39 and the Meteor range, in 1948 after building up a strong background of experience at Blackburn, Hawker and AB Svenska Järnvägsverkstaderna in Sweden, before his appointment as Gloster's Assistant Chief Designer in 1937. Walker was to play an important or leading role in the design of the E.28/39, Meteor, Javelin and the follow-up G.A.6 Thin Wing Javelin. Assistant Chief Designer on the Javelin was R.W.Ward.

By July 1950 the planned flight programme for the two prototypes (the first a flying shell without military equipment) comprised handling, performance and aerodynamic development work on number one (due to fly in April 1951) and equipment trials including gunnery and radar with number two (from November 1951). In addition, there were proposals to use one machine on Sapphire engine development since the new aircraft could cover speeds and heights beyond the reach of test bed aeroplanes currently flying. With possible work on air-to-air missiles to be added, J.E.Serby, the Director of Military Aircraft Research and Development (DMARD), expressed concern that, with only two prototypes on order, clearance of the type for Service use would take well into 1954. At the time, five DH.110s were still on order for a very similar programme so, unless the Gloster F.4/48 was looked on as no more than just an experimental aircraft, further prototypes must be built. Walker supported the view in a letter in November confirming that two prototypes were completely inadequate for CA Release purposes.

Consequently, three further fighter prototypes were ordered in March 1951 to accelerate the programme since the Air Staff now felt the fighter had greater development potential than the DH.110. The latter's size was likely to limit it severely and this step placed the two types on an equal footing. Such action, however, was too late to pre-

Three Javelin FAW.Mk.1s of No. 46 Squadron which was the first UK based squadron to be equipped, at RAF Odiham, in February 1956. Their first duties were a series of extensive trials to clear up any prototype problems and managed to exceed 1,000 hours flying in eight weeks. (MoD)

vent a break in design and construction continuity and prototype manufacture was still unfinished before the first production machine appeared. The White Paper on the Supply of Military Aircraft, published in February 1955, outlined a new policy of ordering a development batch of 20 or so aeroplanes to help clear the much greater quantity of testing necessary with the increased complexities of these new combat

Javelin FAW.Mk. 1 XA563 was amongst the first production batch of aircraft. It is uncertain if this aircraft reached squadron service as many of the early machines were used to continue the test programme started by the prototypes and continued after service introduction because of the need for Javelins to become operational as quickly as possible. (MoD)

aircraft, but it was too late to benefit the Javelin. (Incidentally, the name Javelin would not be selected until the award of a production order in June 1952, normal procedure with RAF aircraft).

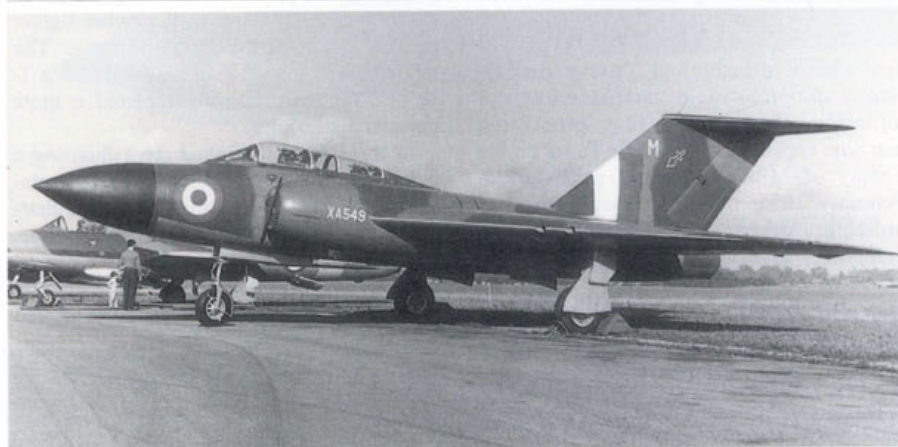
During 1950 it was decided to add ILS automatic approach equipment to the aircraft and armour protection for the crew and, in early 1951, fuel capacity was increased and additional equipment included, namely the American Hughes E4 Collision Course Fire Control and the APQ.43 search and gun-laying radar (first fitted on the FAW.Mk.2). This period of gestation ultimately produced a twin engine, two seat, all weather fighter of mid-wing delta configuration. The tailplane was placed high on the fin for a T-shaped tail unit which completed a quite unusual appearance.

In these early jet fighter days choosing a delta wing was seen as a big step when relatively little was known about the flight characteristics of such a planform. But in time, and with experience generated by research vehicles such as the Boulton Paul P.111 and Avro 707, it was learnt that the delta offered





Left: Javelin FAW Mk.1 XA618:N of No. 41 Squadron taxis past the air traffic control building at Odiham during the intensive trials period in February 1956. Lower left: The next, and only other squadron to be equipped with the Mk. 1 was No. 87 at Bruggen, Germany. (MAP)



great benefits in high speed flight while the large wing volume was useful for carrying more fuel and equipment. Other advantages were a reduction in peak supersonic drag, the rigid structure reduced flutter and helped control by eliminating aileron reversal from wing twisting, and the large wing area cut wing loading which helped manoeuvrability and handling - vital for a fighter. Disadvantages included a poor lift-to-drag ratio in low-speed flight caused by a low aspect ratio, high taper and the large sweep-back, and the low loading made the wing very sensitive to gusts when flown at high speed and low level.

CONSTRUCTION

Conventional metal construction dominated on what was a big and impressive aeroplane. The Javelin's delta wing used an RAE.101 section and an all-metal stressed-skin structure, a torsion box resulting from the main spar, leading edge ribs and the skin. Five fuel tanks were fitted inside each inboard wing and air brakes were fitted in the top and bottom surfaces, a little forward of the trailing edge. Slotted landing flaps were unusually located in the wing underside forward of the airbrakes. Two 30mm Aden

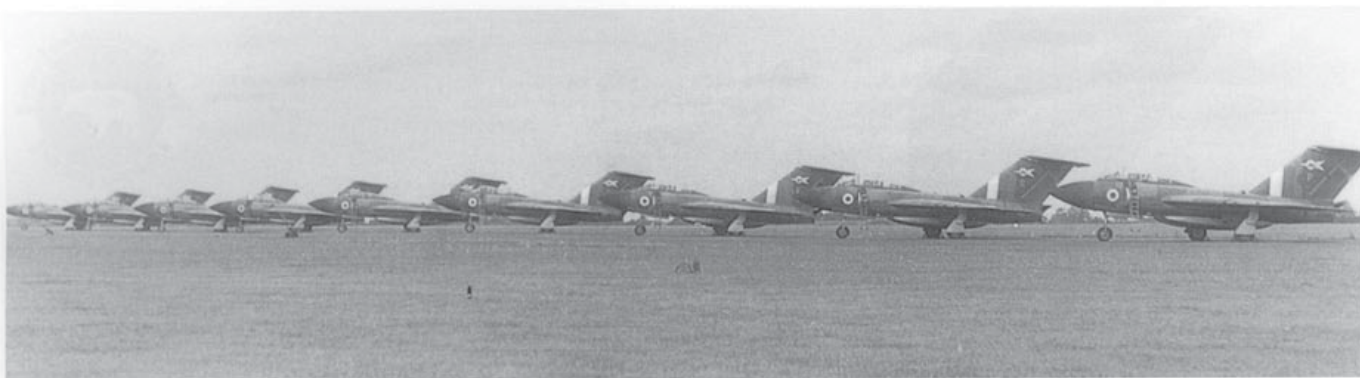
Upper right: Javelin XA552 became the test airframe for the new 10,000 lb thrust Gyron Junior engine. It was painted Royal blue with the nose logo in gold. The Gyron Junior engine was being prepared for installation in the Bristol 188. (APN) Right: XA563 was another Javelin that did not see squadron service. It spent its time between Boscombe Down, Martlesham Heath and the RAE at Bedford. (MoD)



cannon were mounted in each wing outboard of the undercarriage, a position generally abandoned by most fighter design teams, and the late Marks fitted with Firestreak missiles carried their weapons on underwing pylons. Eventually, Javelin FAW.Mk.7, 8 and 9 aircraft that operated in the European theatre usually carried just a single Aden in each wing; those deployed in the Far East retained all four guns.

The Air Ministry decided in September 1954 to strengthen the wing structure of airframe 41 onwards to take the carriage of four Blue Jay (Firestreak), but the full installation would not be introduced until considerably later in the programme. In fact, it was not until 16 May, 1956, that Gp. Capt. H.N.C.Wheeler, Deputy Director of Operational Requirements (DDOR), reported the decision to retrofit Blue Jay to Mk.7, 8, 6, 2 and 5 aircraft. In the event, only the FAW.Mks.7, 8, and the later FAW.Mk.9, received the weapon, one reason being delays in the missile's development. Design work on the Blue Jay fittings was finally completed around the end of December 1955; finding the correct aerodynamic shape for the launch pylons having proved a complex job.

The landing gear retracted hydraulically, the nose wheel folding beneath the cockpit, the main gear inwards into the inner wing.



Above: Thirty Javelin FAW.Mk.2s were built fitted with the American AI.Mk.22 radar and most went to No.46 Squadron seen here neatly lined up at Waterbeach. Right: FAW.Mk.2 XA777:R from No. 46 Squadron displays the squadron's insignia on the tail. (MAP)

Dowty liquid spring shock-absorbers, Dunlop wheels and Lockheed hydraulic disc brakes were employed. Power boost was



Thin Wing Javelin but the evidence suggests this too never took place.

The large angular T-tail unit overshadowed the thick delta wing and shared the same configuration. The tail was, on the prototypes, Mk.1s and many Mk.2s, of the variable incidence type with power assisted hydraulic elevators but, following a decision made in July 1954, this was substituted by an electrically operated 'all-moving' slab flying tail on remaining aircraft, one of the first fitted on a British aeroplane. A one-piece slab tail had originally been proposed before first flight. Once in service, it was found that high stick forces were needed at high speeds and the fully powered all-moving version replaced the variable incidence type from the FAW.Mk.4 onwards to improve handling characteristics at transonic speeds. On the new tail the elevators acted as anti-balance tabs.

The value of a delta tail on top of the fin was that it reduced the high angle of attack on approach and touch-down seen on previous delta wing aeroplanes, a big help when flying in darkness. Like the Panavia

Tornado of today, the Javelin could be recognised from a distance by its massive fin which was built around two fin posts attached to the centre fuselage beam. At 25 per cent chord, fin sweepback was 47.6 degrees, tail sweep 42.8 degrees. Light aluminium alloy was utilised throughout the whole aeroplane with the exception of a few critical steel parts.

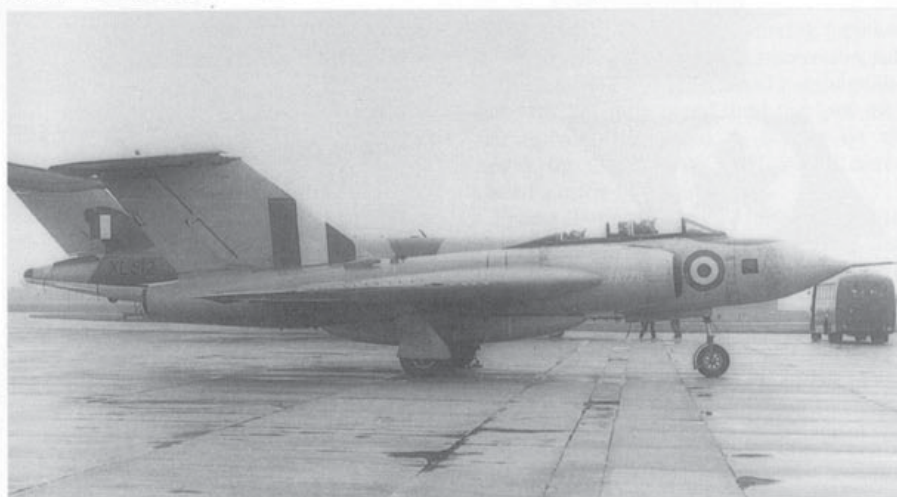
FIRST FLIGHT AND PROTOTYPE TESTING

With the outbreak of the Korean War, the British Government was faced with an urgent need to get new military equipment quickly but took until 1952 to find a way of getting things moving in regard to combat aircraft. The solution was called Super-priority and the most important aeroplanes were given priority over all others, with maximum urgency, to stop any delays. Fighters like the Hawker Hunter were included in what was really a cosmetic exercise since the system could not create more skilled staff, materials or tools when there

All-metal stressed-skin was also used in the fuselage and tail unit structure. The fuselage was constructed from four main assemblies, the centre part comprising a longitudinal box-beam structure with large frames forming the engine bays. Two Sapphire turbojets fitted snugly into these side fuselage nacelles and were fed by circular air intakes. The two-man crew, pilot and radar operator, were seated in tandem on Martin-Baker ejection seats inside a fully air-conditioned cockpit. The canopies were modified from the fifth prototype onwards with twin sliding hoods after criticism of the original arrangement where a one-piece hood offered only two small holes per side for the radar operator.

Two more fuel tanks were housed in the forward fuselage for a total of 12 tanks. The P.280 project had the AI.Mk.17 intercept radar in the nose but, to cover developments, a March 1951 proposal made provision for the projected and more powerful AI.18 which had a larger search scanner. Gloster estimated that an AI.18 version would be some 550lb (250kg) heavier but the fitment was never adopted. It was agreed on 23 October, 1954, to fit two standard Mk.1s with a redesigned nose to take AI.18 equipment as part of the trials for the follow-on

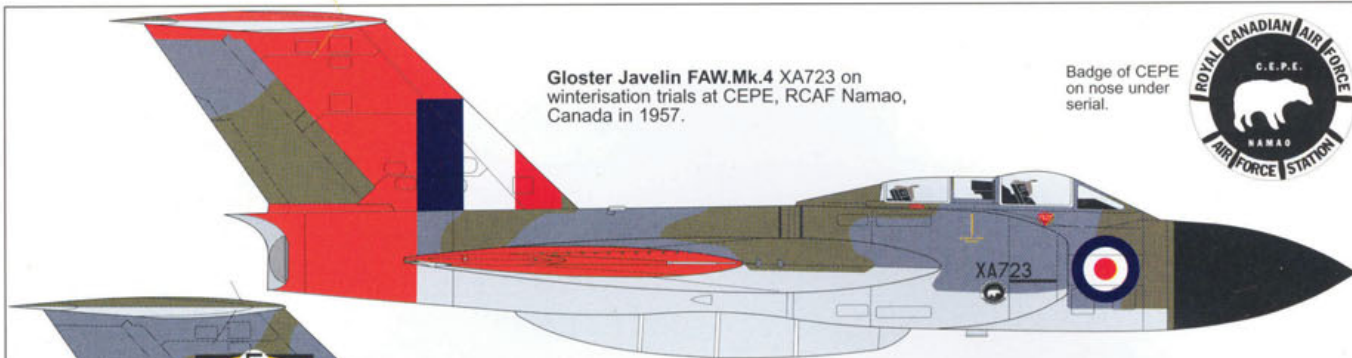
FAW.Mk.2 XA778 was used for test purposes. It first went to A&AEE as a calibrated 'pacer' aircraft and in 1968 was fitted with Sa.7 Sapphire engines and FAW.Mk.8 control system. It was painted a bright fluorescent orange overall and created quite a stir when visiting other stations such as Coltishall where it was seen at the 1968 Battle of Britain display. (Flightlines)



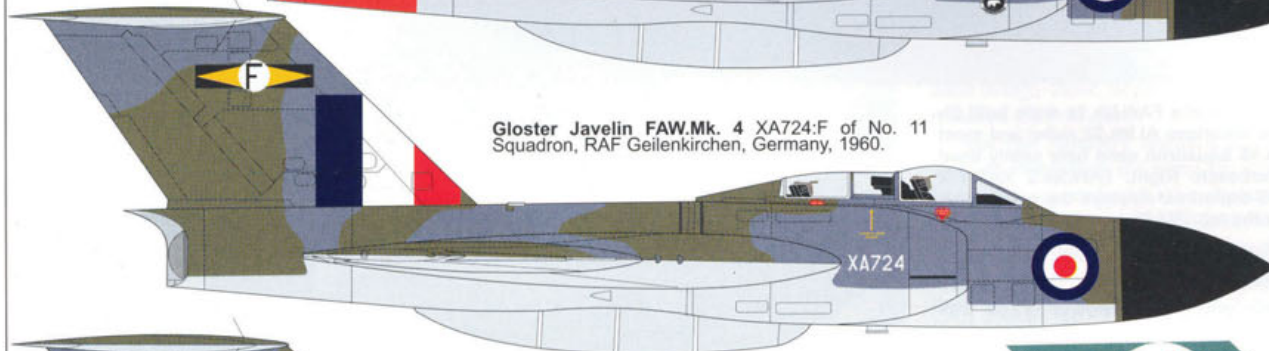


Gloster Javelin FAW.Mk.4 XA723 on winterisation trials at CEPE, RCAF Namao, Canada in 1957.

Badge of CEPE on nose under serial.



Gloster Javelin FAW.Mk. 4 XA724:F of No. 11 Squadron, RAF Geilenkirchen, Germany, 1960.



Gloster Javelin FAW.Mk.4 XA750:A of No. 3 Squadron, RAF Geilenkirchen, Germany, 1959.

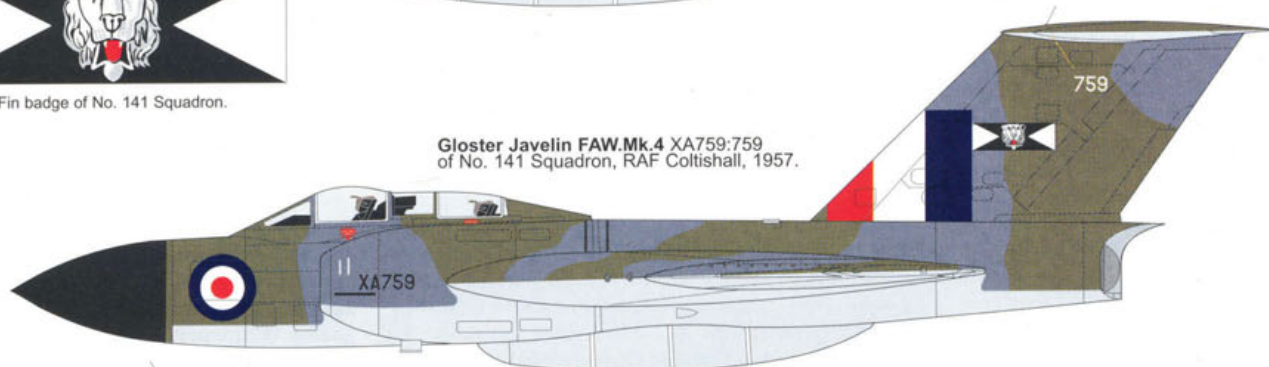


Badge of No. 3 Squadron on fin.

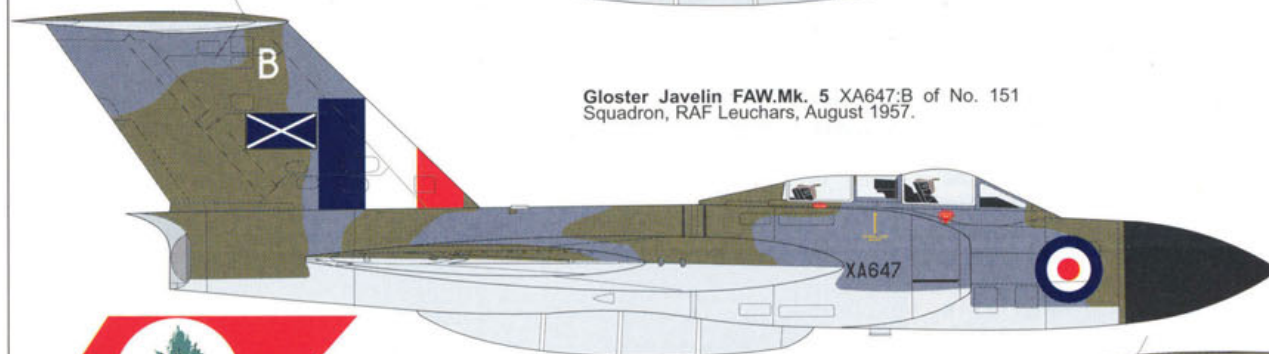


Fin badge of No. 141 Squadron.

Gloster Javelin FAW.Mk.4 XA759:759 of No. 141 Squadron, RAF Coltishall, 1957.

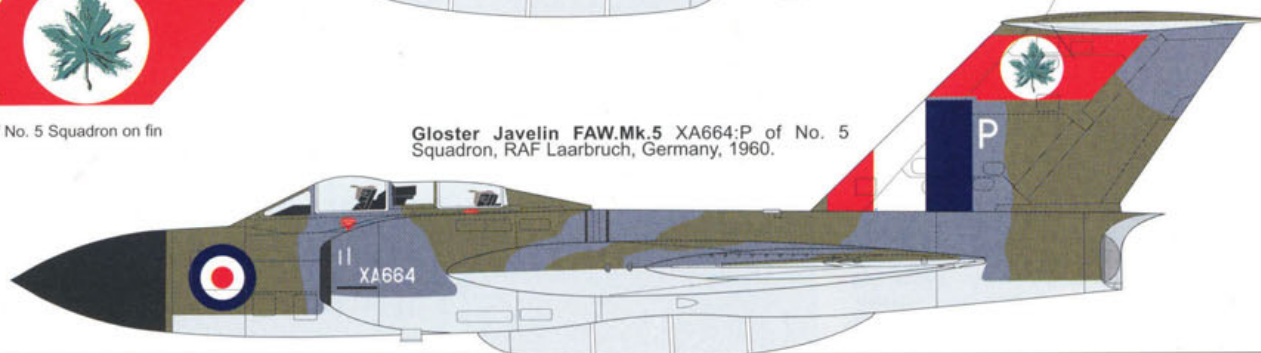


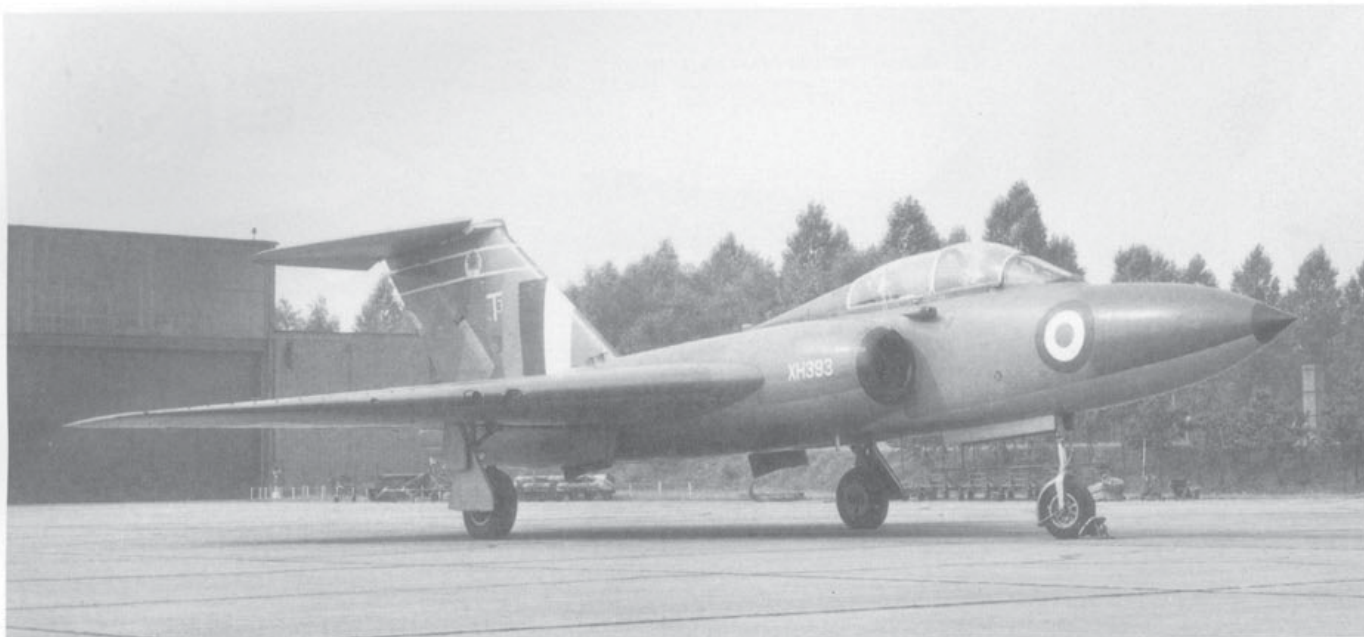
Gloster Javelin FAW.Mk. 5 XA647:B of No. 151 Squadron, RAF Leuchars, August 1957.



Badge of No. 5 Squadron on fin

Gloster Javelin FAW.Mk.5 XA664:P of No. 5 Squadron, RAF Laarbruch, Germany, 1960.

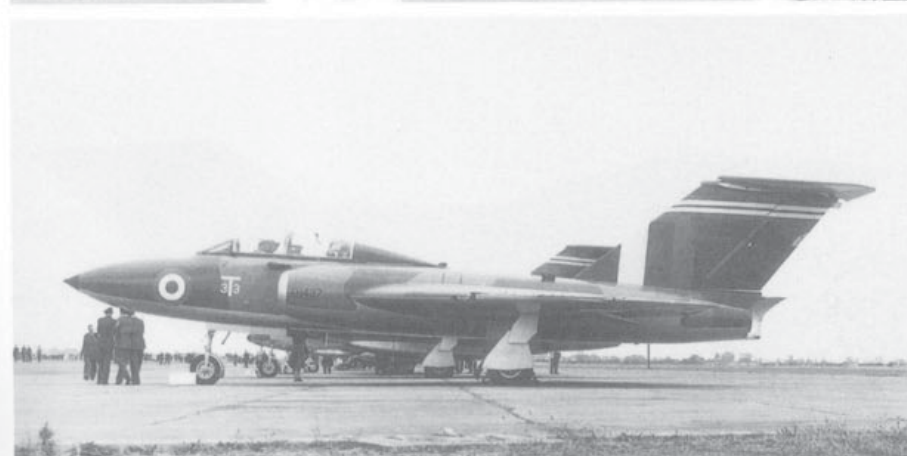
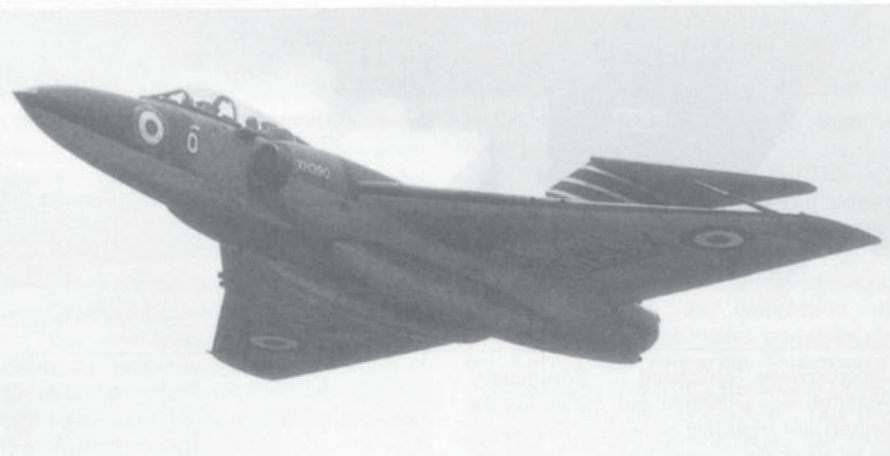




Above: XH393:T3 was an early production T.3, belonging to No. 5 Squadron. This view shows the different nose to the fighter variants and the change in canopy shape. (Eric Morgan). Right: In flight view of T.3 XH390:O of No. 60 Squadron (MAP)

was a shortage everywhere. The Javelin was classed as a super-priority type, but delays were caused by problems with the aircraft and some accidents.

Construction of the first G.A.5 Javelin prototype began in April 1949 but it did not get into the air until 26 November 1951. This machine, WD804, and the second prototype, WD808, were both assembled in sections at the firm's experimental department at Bentham. By July 1951, WD804 was approaching completion and was moved by

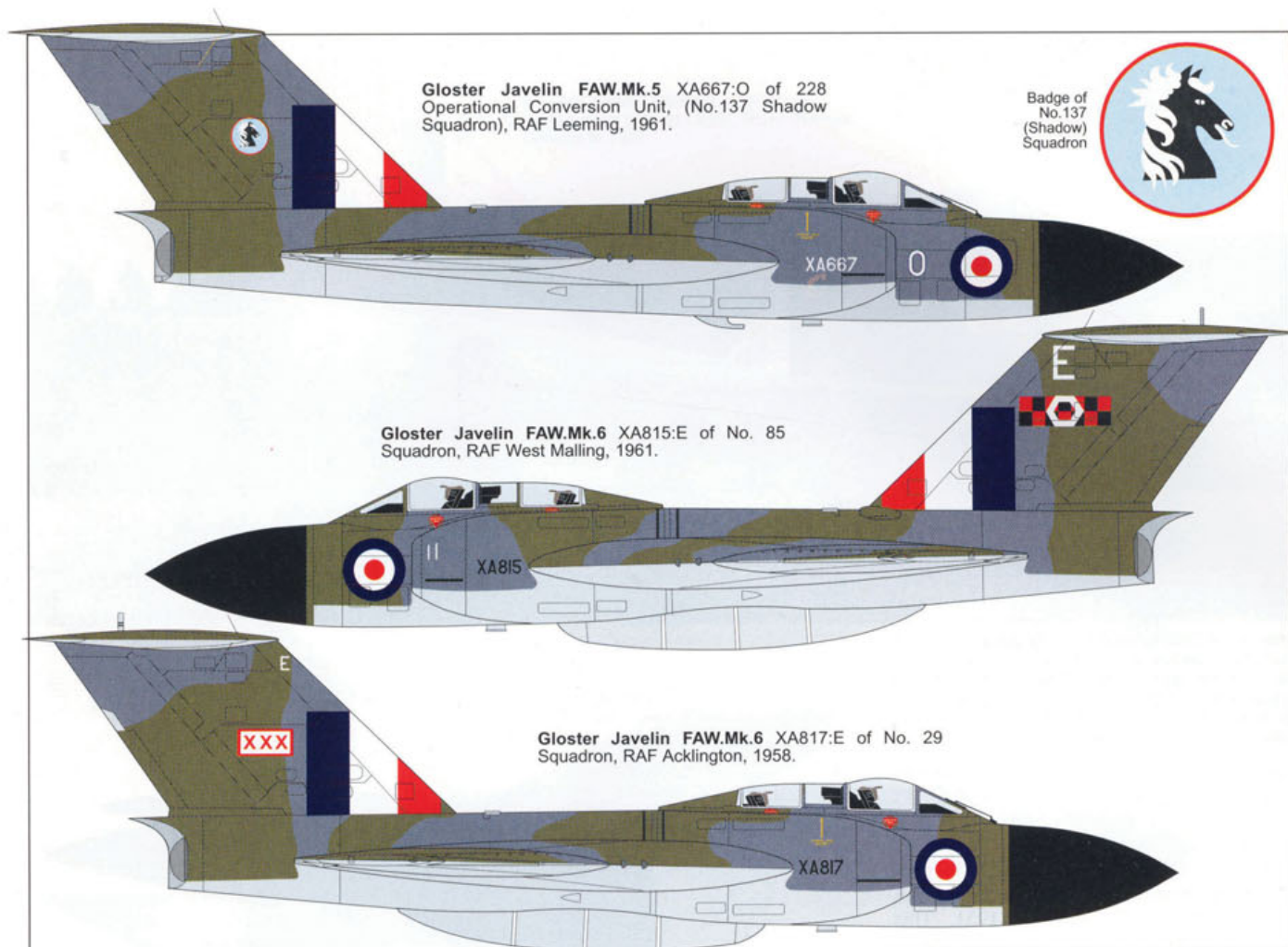


road to Moreton Valence where it was brought to flying condition. No weapons or radar were fitted to either aircraft, both had an all-metal nose cone with the pitot boom in the centre. Preliminary ground tests and taxiing began on WD804 a month before first flight.

Pilot for this important occasion was Sqn. Ldr. W.A. 'Bill' Waterton who had been involved with the Meteor High Speed Flight in 1946 before becoming Gloster's Chief Test Pilot. The flight was substantially a success but serious rudder buffet was experienced to such a degree that at 200mph (322km/h) violent shaking was felt through the whole airframe. The problem was that jet efflux and airflow were mixing together over the rear fuselage. As a prevention, the jet pipe fairing was lengthened but the problem was not fully cured until the 'pen-nib' fairing was introduced, a feature on all marks up to the FAW.Mk.7 which introduced a different engine.

Flying continued until 29 June 1952, when flutter resulted in both elevators being lost during a high speed run at 3,000ft (914m). With great skill, Waterton managed to land WD804 at Boscombe Down, but the aircraft was wrecked (and written off) when the

Top left: Javelin T.3 XH444:D belonged to the Fighter Command Instrument Rating Squadron. (MAP). Left: Most operational Javelin squadrons had at least one T.3 on strength. This is one of two belonging to No. 33 Squadron serialised XH437 with the interesting 3T3 code. (MAP)



undercarriage collapsed. Fortunately, Waterton was uninjured and, for saving the aircraft and recording equipment so bravely, he received the George Medal. A replacement was ordered immediately, serialised XD158 and known as the sixth prototype, and this became the FAW.Mk.2 trials aircraft.

WD808 made its first flight on 20 August but spent the rest of the year being prepared for flight resonance tests to investigate the flutter which caused WD804's accident; the Javelin was the first British aeroplane fitted with a resonance system. Resonance flight testing began in January 1953 and was held at speeds up to 520 knots (599mph/964km/h). By May WD808 had received the extended chord wing tips (cranked wing) described earlier, to help cure a tendency for tip stalling which made the fighter tighten into a turn, plus increased elevator boost and a stiffened fin, tailplane and elevators, all designed to improve the aircraft's handling. The centre section spar was modified to clear the aircraft to 530 knots (610mph/982km/h) maximum speed. Flight testing restarted on 23 May and preliminary trials did indicate that handling had improved.

Tragically, on 11 June, WD808 crashed near Bristol killing its pilot, Peter Lawrence. The centre of gravity (c.g) had been moved



Top right: Reflected in the puddles at Hucclecote shortly after roll out, Javelin T.3 XH391 went to No. 228 OCU. Right: The first Javelins used by No. 151 Squadron were FAW.Mk.4s. This is XA634:T showing off its paces and its Scottish associations through the unit insignia on the fin, at its home base Leuchars. (MAP)



Javelin FAW.Mk.4 XA638:J had a varied career. It was first used by No. 141 Squadron, then by No. 41 Squadron before being posted to Germany and No. 3 Squadron in whose colours it is seen here. (MoD)

further aft and WD808 entered a super or deep stall condition with the nose at a high incidence of 50 degrees. The aircraft dropped near vertically from 11,000ft (3,353m), no forward airspeed being recorded on the auto-observer apparatus. The principle problem, which sadly was to occur on several aircraft types with high tails, was that the large wing blocked off the airflow to the tail at high angles of attack. Despite the aircraft being essentially stable, no workable airflow could be obtained over the tail to allow recovery; the pilot could do nothing because of the lack of control. Service experience showed a Javelin fully stalled and/or in a flat spin would sink at a rate of 20,000ft (6,096m) per minute.

Instructions issued after the accident detailed the use of flap within certain combinations of speed and flight condition to prevent another occurrence. The second crash pushed Controller Aircraft (CA) Release date for the Javelin back to February

1955. This time there was no replacement prototype since it would not have been available before early production aeroplanes, but handling trials with dummy Blue Jay missiles planned for WD808 were delayed. In July 1954, urgent action was taken to provide power assisted hood jettison as soon as possible since the Air Ministry was pressing for this mandatory requirement to be enforced. Tunnel testing after the crash of the second prototype had revealed the prototype hood was difficult to release at greater than 40 degrees of incidence.

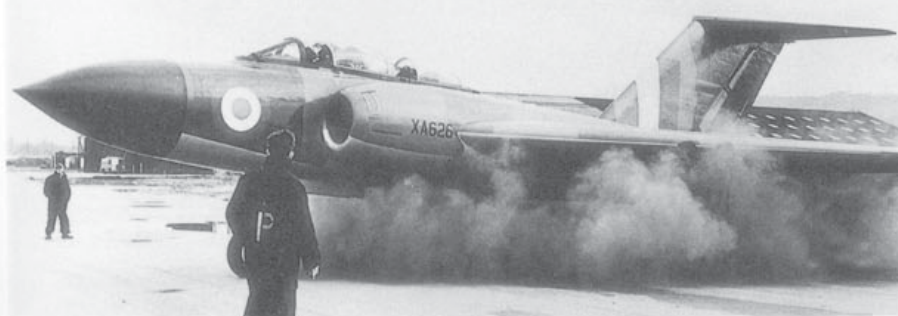
On 7 March 1953, the third prototype, WT827, joined the flying programme being the first to carry guns, radar and the nose radome, though it did experiment with both blunt bull-nose and pointed radomes after rain erosion had damaged the original. The pointed format became standard. Trial flying revealed that vortices entering the Aden's barrels were heating the cannon shells with the result that the leading edge blast tubes had to be extended very slightly. One prototype was test flown in the same month by two USAF pilots who criticised the small quantity of internal fuel and WT827 was quickly fitted with two 250gal

(1,137 litre) ventral tanks which were to become standard.

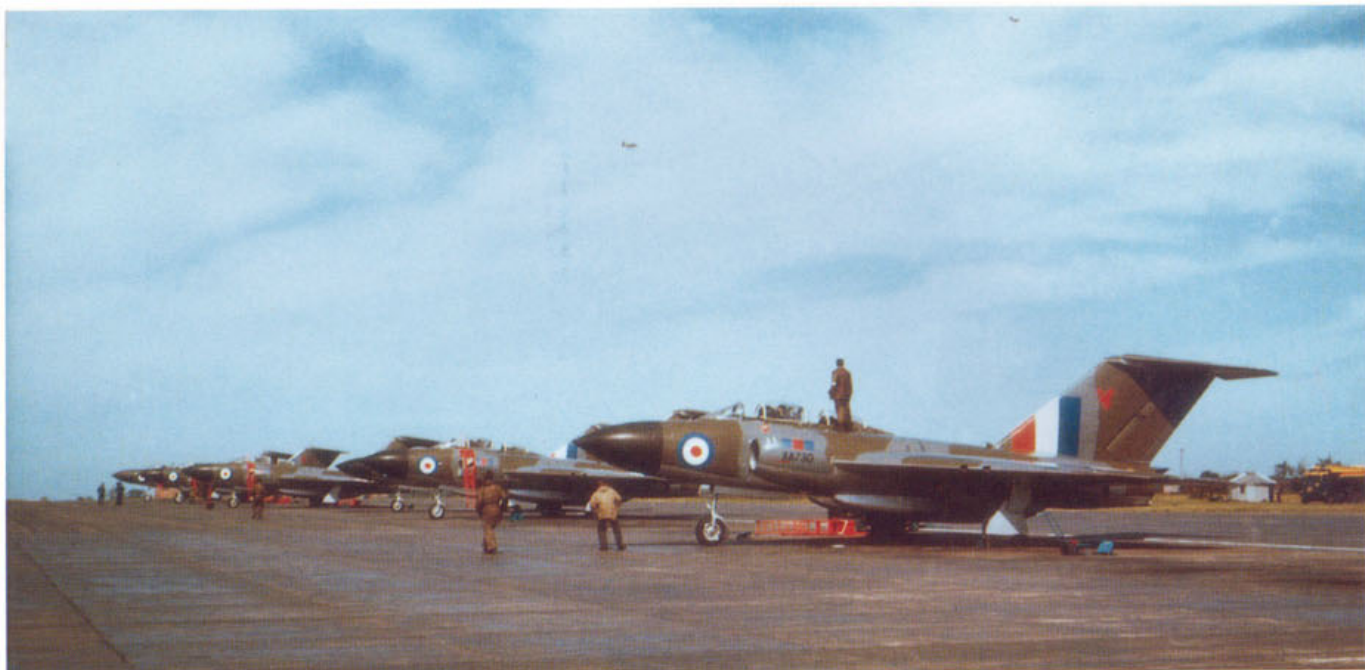
The fourth machine, WT830, an unequipped aircraft but with full power ailerons and the other improvements previously incorporated into WD808, flew on 14 January 1954. It became the aerodynamic test aircraft and on completion of Contractor's handling trials, proceeded to the Aircraft and Armament Experimental Establishment (A&AEE), Boscombe Down, for official handling assessment. This was the first time any Service flying had been done; up to now the firm's pilots had undertaken almost the entire flight programme, a fact considered most unsatisfactory at the Air Ministry.

The last fighter prototype, WT836, became airborne on 20 July in the hands of 'Dicky' Martin and was used to prove various engineering items. Wg. Cdr. R.F. Martin succeeded Waterton as Chief Test Pilot in March 1954 and spent a great deal of time developing the technique employed for Javelin spin recovery. However, in June 1955 Gloster and the Royal Aircraft Establishment (RAE) Farnborough could still not agree as to the correct recovery action for the aircraft. Spin direction in a Javelin was unpredictable and could often be reversed during the spin. In October, Gloster and A&AEE agreed the recovery technique needed full in-spin aileron to be applied when the nose dropped, followed by moving the stick fully forward and holding until the Javelin finished a nose-down pitch.

Gloster's Javelin became one of several new fighter aircraft capable of making supersonic bangs in dives over Britain, the others being the de Havilland DH.110, Hawker Hunter and Supermarine Swift, but



This picture could hardly be avoided in any book on the Javelin as many will remember the clouds of black smoke that at times happened when the engine starter cartridges were fired. XA626 is an FAW.Mk.4 and the hangar in the background reveals that the location is more than likely at Hucclecote.



there were comments within the industry that the Javelin could not go supersonic. In addition, Bill Waterton became the air correspondent for the *Daily Express* and in one article strongly criticised the aircraft. So, to prove a point, Martin flew a prototype right across South London during the night of 4-5 July 1954, ensuring as he went that a supersonic bang was heard on the ground.

The cause of the bang was not revealed until the 7th when the national press reported that it did come from a Javelin, but was accidental, Gloster stating that the oxygen tube got caught in the pilot's parachute harness. In fact it is quite possible the bang was aimed at Fleet Street. The main outcome was that thousands of people in Surrey, Kent and South London were woken up, reports revealing that police cars raced around London in the hunt for clues. Sir Winston Churchill, at home in Westerham, Kent, thought that a meteorite had fallen, and questions were asked in Parliament.

NINE DIFFERENT VERSIONS

A production order was placed for 200 Javelins for the Royal Air Force on 7 June 1952, but, despite growing interest from some European air forces and in particular Belgium, it appears the aeroplane was never close to securing an export order. As predicted, the two original prototypes proved far from sufficient to deal with all the development flying of this large and complex aeroplane and, as a result, by 1 March 1956, no less than 21 FAW.Mk.1s were allocated to trials work. The figure did include aircraft sent to Armstrong Siddeley, Rolls-Royce and Bristol Engines for Sapphire, Avon and Olympus engine development. Even by late November 1955, the then dozen plus Mk.1s allocated had ensured that more Javelin hours were flown between May and November 1955 than in the previous three years.

FAW.Mk.1 - The initial production version had the Sapphire Sa.6 of 8,300lb (36.9kN) thrust and the AI.Mk.17 S-band search,

lock-on and blind firing radar. XA544 was the first of 40 Mk.1s, all built at Gloster's Hucclecote factory, and was flown by Dicky Martin on 22 July 1954, just two days after the fifth prototype. CA Release was given on the FAW.Mk.1 on 30 November 1955, but with restrictions - stalling and looping were prohibited until the spin recovery technique was confirmed while the upper and lower speed limits were set at 540 knots (622mph/ 1,001km/h) and 125 knots (144mph/ 232km/h).

Deliveries to RAF Fighter Command thus began in February 1956 of the Service's first fighter to be prohibited from stalling. The squadrons eventually equipped with the FAW.Mk.1 were Nos. 46 and 87 at Odiham and Bruggen (Germany) respectively. No. 46 Squadron received its machines direct from 23 Maintenance Unit (MU), Aldergrove, and, under orders, clocked up 1,000 flight hours in eight weeks to clear any problems as quickly as possible. No. 87 Squadron received its machines from August 1957, the great majority of which had previously seen service with No. 46 Squadron.

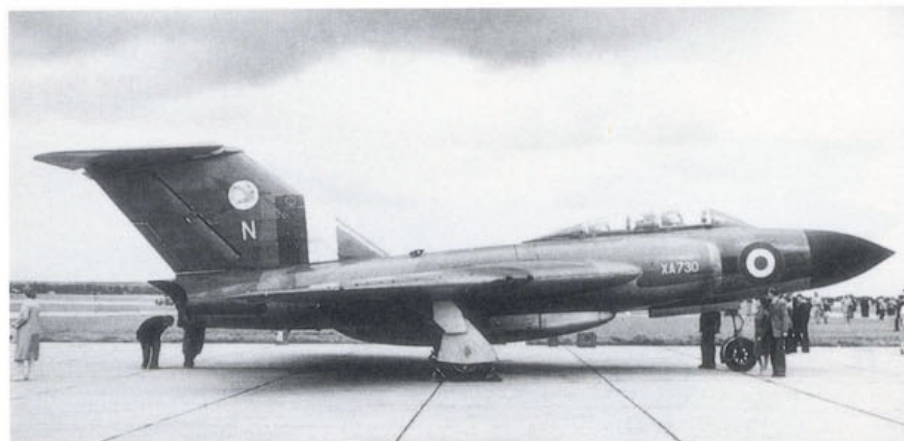
Of the aircraft retained for tests, XA545 became the first to examine the all-moving tail ready for the FAW.Mk.4, XA546 had the Gee navigation system fitted and XA547 became the first Javelin to try out the Firestreak missile pylons, albeit with dummy missiles. XA552 found employ-

No.23 Squadron's markings did vary from time to time. Later a more elaborate scheme was developed including the fin badge. In this line-up of FAW.Mk.4s the leading aircraft XA730, went on to serve with No. 72 Squadron (see below). (MoD)

ment as an engine test bed for the 10,000lb (44.4kN) thrust de Havilland Gyron Junior as part of preparations for the Bristol 188 supersonic research aircraft which was to use the same engines. Having been converted by Napier, it was painted Royal Blue with a white trim plus a gold 'Gyron Junior' logo on the nose, the most marked difference from the standard was the large jet pipe for the reheat. XA560 was the first to get reheated Sapphires, flying with 11,000lb (48.9kN) Sa.7s on 30 September 1955, while XA562 was the Avon RA.24R test bed. An announcement made in October 1954 confirmed that some Javelins would be paid for by the USAF under the US offshore procurement policy, all of them to serve with the RAF.

FAW.Mk.2 - This was the basic FAW.Mk.1 except for equipment changes, the most important being an alternative radar. Back in March 1952 it was agreed that the American APQ.43 radar would be introduced into production as soon as possible

Javelin FAW. Mk. 4 XA730, now coded 'N', the same as that seen in the picture above, after it had been transferred to No. 72 Squadron. (MAP)



without delaying the delivery of AI.17 equipped aircraft. The sixth prototype, XD158, was selected for the trial installation - in effect the basis of a new Mark - and its completion was thus delayed because of the necessary alterations. In British service the APQ.43 was designated AI.Mk.22 and required a larger radome which actually pulled out and hinged sideways for access instead of having to be removed. XD158 flew for the first time on 31 October 1955, but with a metal nose. Plans to also fit it with a trial Sa.7 installation were abandoned as the special engine instrumentation would clash with the new AI equipment; XA560 was substituted for the engine work.

The first production model, XA768, flew on 25 April 1956 and a total of 30 Mk.2s were built at Hucclecote on a near parallel production line to the Mk.1. Most went to No. 46 Squadron, arriving from May 1957, but a few found their way to No. 89 (later 85) Squadron. Some were used in experimental work (in fact the Javelin was to achieve an impressive test bed aircraft record); XA769 together with the prototype on radar trials, XA771 on full scale missile trials while XA778 found work as a calibrated 'pacer' aircraft at A&AEE until 1968 where it was painted bright fluorescent orange and fitted with an FAW.Mk.7 type non-reheat Sa.7 Sapphire and FAW.Mk.8 control system. In July 1954 orders for Mk.1 and 2 Javelins were increased to 296 and 123 respectively, but developments outlined below were to make a big difference to such plans.

T.Mk.3 - Gloster first considered a dedicated dual control trainer F.4/48 in June 1950 as the P.319 under OR.278, rejecting the side-by-side configuration of the Hawker Hunter

No. 41 Squadron's first Javelins were the FAW.Mk.4. They used an unusual method of aircraft identification as seen on XA636, by repeating the last three of the serial on the fin. The squadron was based at Coltishall at the time.

Gloster Javelin production list

INCLUDING PLANNED PRODUCTION

All built by Gloster Aircraft Limited at Hucclecote unless stated

Gloster G.A.5 Javelin

Prototypes:- (7 built) WD804, WD808, WT827. WT830, WT836, WT841 (trainer built by Air Service Training, Hamble) XD158.

Gloster Javelin FAW.Mk.1 (40) XA544 to XA572, XA618 to XA628

Gloster Javelin FAW.Mk.2 (30) XA768 to XA781, XA799 to XA814.

Gloster Javelin T.Mk.3 (22) XH390 to XH397, XH432 to XH438, XH443 to XH447, XK577, XM336 (XM337 to XM341 cancelled)

Gloster Javelin FAW.Mk.4 (50) XA629 to XA640, XA644, XA720 to XA737, XA749 to XA767 (XA720 to XA737 and XA749 to XA762 built by Armstrong Whitworth, Baginton)

Gloster Javelin FAW.Mk.5 (64) XA641 to XA643, XA645 to XA667, XA688 to XA719, XH687 to XH692 (XA654 to XA660, XA662 to XA667, XA688 to XA719 and XH687 to XH692 built by Armstrong Whitworth at Baginton)

Gloster Javelin FAW.Mk.6 (33) XA815 to XA836, XH693 to XH703.

Gloster Javelin FAW.Mk.7 (142) XH704 to XH725, XH746 to XH795, XH833 to XH849, XH871 to XH912, XH955 to XH965 (XH785 to XH795, XH833 to XH849 and XH871 to XH899 built by Armstrong Whitworth, Baginton)

Gloster Javelin FAW.Mk.8 (47) XH966 to XH993, XJ113 to XJ130, XJ165. (XJ112 built as static test airframe; XJ166 to XJ178 cancelled during manufacture)

Gloster Javelin FAW.Mk.9 (116 all converted from FAW.Mk.7s) XH707 to XH709, XH711 to XH713, XH715 to XH717, XH721 to XH725, XH747, XH749, XH751 to XH753, XH755 to XH774, XH776 to XH780, XH785, XH787 to XH788, XH791 to XH794, XH833 to XH836, XH839 to XH848, XH871 to XH899, XH903 to XH912, XH955 to XH965.

Gloster G.A.6 Thin Wing Javelin

Prototype XG336 (cancelled during manufacture at Hucclecote)

Pre-production XJ836 to XJ842, XJ877 to XJ887 (cancelled before start of construction)

trainer to ensure a minimum in structural alteration. It was initially rejected, but the need for such an aircraft was soon recognised and a prototype, WT841, was ordered in 1951. Specification T.118D was later written around the aircraft which had Sapphire Sa.6s and was based on the FAW.Mk.6. WT841 was designed and built by a subsidiary firm, Air Service Training Ltd of Hamble, using Gloster components and flew on 20 August 1956. Some delay was experienced in getting WT841 ready - by July 1952 the rear fuselage, largely common to the fighter prototypes was well advanced but the front fuselage had progressed little and was about 12 months behind.

The T.Mk.3 lacked the nose radar but had the all-moving tail while the guns were retained for instructional purposes.

Compared to the standard fighter variants, the T.Mk.3 fuselage was 3.67ft (1.12m) longer and had a bigger rear canopy. Removing the radar moved the c.g. rearwards and the fuselage extension was a counter which also proved useful in allowing two additional 50gal (227 litre) fuel tanks to be added. The first of 22 production machines flew on 6 January 1958, initial deliveries going to the Javelin's Operational Conversion Unit (228 OCU) at Leeming, but most squadrons to operate the Javelin received one or two Mk.3s. After disbandment in September 1961, 228 OCU reformed in June 1965 at Leuchars in order to supply the extra pilots found necessary for the confrontation between Indonesia and Malaya which represented a change of policy since it was planned to phase the Javelin out quite soon afterwards. 228 OCU also



Gloster Javelin Squadrons and Units

Reproduced with permission from *The Service History of the Gloster Javelin Mk.1 to 6 and Mk.7 to 9* by Roger Lindsay

N.B. A serial appearing twice means that aircraft was reallocated or moved elsewhere and then returned.

Unit	Serials	Unit	Serials
FAW.Mk.1			
All Weather Wing, Central Fighter Establishment (CFE)	XA565, XA566, XA568.		XH691, XA690, XA666, XA643, XA716, XA703, XA719, XH692, XA691, XA656, XA667, XA688, XA662, XA652, XA663, XA665, XH688, XA694, XA718, XA653, XA693, XH689, XA702, XA700, XA701, XA698.
All Weather Development Squadron, CFE	XA547, XA555, XA556, XA568, XA623.	23 Squadron	XA654.
Air Fighting Development Squadron	XA547, XA555, XA556, XA623.	41 Squadron	XA707, XA667, XA658, XA703, XA666.
46 Squadron	XA569, XA570, XA627, XA571, XA572, XA620, XA621, XA623, XA568, XA618, XA619, XA625, XA566, XA626, XA628, XA622, XA624, XA565.	72 Squadron	XA654, XA703, XA667, XA646
87 Squadron	XA623, XA558, XA565, XA628, XA618, XA572, XA559, XA627, XA626, XA566, XA619, XA624, XA625, XA569, XA549, XA620, XA571, XA554, XA621.	87 Squadron	XA645.
College of Aeronautics, Cranfield	XA547, XA555, XA556, XA568, XA623.	5 Squadron	XH690, XA707, XA699, XA689, XA649, XH688, XA658, XA659, XA641, XA709, XA704, XA666, XA663, XA657, XA654, XA705, XA697, XA664, XA718.
Gloster Aircraft	XA553 (aircraft flown exclusively by Glosters, never served with the RAF).	11 Squadron	XA660, XA647, XA650, XH689, XA665, XA661, XH688, XA716, XA695, XA694, XA667, XA690, XA717, XA714, XA691, XA643, XA696, XA663, XA689.
FAW.Mk.2		FAW.Mk.6	
All Weather Development Squadron, CFE	XA808, XA809, XA806.	29 Squadron	XH700, XA818, XH698, XA817, XA822, XA824, XA821, XA825, XH699, XH697, XA823, XA836, XA827, XA826, XH701, XA828, XA819, XA835, XH703.
46 Squadron	XA811, XA812, XA780, XA802, XA768, XA772, XA801, XA810, XA803, XA805, XA776, XA807, XA814, XA777, XA773, XA809, XA813, XA808.	89 Squadron	XH694, XH693, XH695, XH696, XH702, XA836, XA820, XA815, XA816, XA832, XA830.
89 Squadron (later 85)	XA774, XA781, XA800, XA779, XA775, XA806, XA799, XA804.	46 Squadron	XA830, XH702.
T.Mk.3		Air Fighting Development Squadron, CFE	XA832, XH702.
3 Squadron	XH444, XH446.	FAW.Mk.7	
5 Squadron	XH393, XH447.	All Weather Development Squadron, CFE	XH710, XH792, XH748, XH756.
11 Squadron	XH444, XH394.	33 Squadron	XH715, XH838, XH750, XH721, XH786, XH720, XH790, XH718, XH716, XH748, XH751, XH795, XH836, XH719, XH839, XH833.
23 Squadron	XH432, XH437, XH392.	64 Squadron	XH752, XH834, XH842, XH723, XH747, XH725, XH841, XH749, XH785, XH789, XH794, XH791, XH788, XH792, XH846, XH787, XH717, XH840, XH724.
25 Squadron	XH443, XH395.	25 Squadron	XH905, XH909, XH957, XH898, XH906, XH910, XH955, XH959, XH907, XH911, XH956, XH961, XH908, XH912, XH897.
29 Squadron	XH433, XH396, XH395, XH393.	No.1 Guided Weapons Trials Squadron	XH782, XH783, XH784, XH900, XH901, XH902.
33 Squadron	XH437.	23 Squadron	XH755, XH757, XH904, XH963, XH956, XH778, XH958, XH964, XH758, XH779, XH960, XH774, XH903, XH962, XH775, XH781, XH955.
41 Squadron	XH397.	FAW.Mk.8	
46 Squadron	XH395.	Central Fighter Establishment	XH792, XH795, XH796, XH799.
60 Squadron	XH390, XH445, XH446.	41 Squadron	XH791, XH981, XJ130, XJ129, XJ113, XJ165, XJ127, XH988, XH982, XH983, XH973, XH969, XH984, XH966, XH974, XH985, XH989, XH977, XH967, XH986, XH990, XH978, XH987, XH980, XH968, XH993.
64 Squadron	XH434, XH435, XH445, XH446.	85 Squadron	XJ119, XJ121, XJ115, XJ123, XJ120, XJ114, XJ117, XJ124, XJ128, XJ126, XJ118, XJ116, XJ122, XH993, XH992, XH968, XH991.
72 Squadron	XH434, XH438.	FAW.Mk.9	
85 Squadron	XH435.	25 Squadron	XH767, XH771, XH770, XH776, XH760, XH772, XH882, XH906, XH884, XH883, XH881, XH909, XH898, XH769, XH716, XH768, XH880.
87 Squadron	XH445.	11 Squadron	XH767, XH771, XH882, XH909, XH760, XH772, XH881, XH753, XH752, XH773, XH769, XH883, XH884, XH880, XH756, XH780, XH898, XH770, XH776, XH716, XH768, XH793, XH893, XH886, XH889, XH873, XH899, XH891, XH890, XH848, XH885, XH892, XH845, XH849, XH887, XH888, XH895, XH763, XH707, XH847, XH712, XH894.
151 Squadron	XH436.	64 Squadron	XH765, XH707, XH844, XH908, XH759, XH762, XH872, XH843, XH764, XH895, XH761, XH792, XH887, XH874, XH888, XH959, XH877, XH849, XH708, XH893, XH763, XH961, XH873, XH889, XH879, XH896, XH793, XH891, XH886, XH834, XH766, XH879, XH896, XH711, XH892, XH780, XH757, XH904, XH713, XH903, XH957, XH907, XH911, XH897, XH773, XH758, XH794, XH905, XH912, XH715.
Fighter Command Instrument Rating Squadron	XH433, XH438, XH436, XH395, XM336, XH397, XH443, XH392, XH444, XH396, XH435, XH432, XH437.	5 Squadron	XH780, XH757, XH752, XH957, XH713, XH903, XH758, XH897, XH907, XH911, XH753, XH715, XH773, XH762, XH912, XH958, XH905, XH904, XH756.
228 OCU	XH396, XH394, XH393, XH392, XH391, XH446.	29 Squadron	XH792, XH894, XH725, XH776, XH960, XH723, XH712, XH884, XH873, XH779, XH910, XH774, XH762, XH891, XH749, XH848, XH752, XH888, XH847, XH956, XH892, XH890, XH778, XH711, XH777, XH849, XH962, XH849, XH779, XH961, XH889, XH958, XH968, XH764, XH964, XH834, XH899, XH959, XH963, XH886.
228 OCU (after reformed in 1965)	XH395, XH397, XH392, XH435.	60 Squadron	XH842, XH895, XH725, XH843, XH759, XH721, XH719, XH959, XH747, XH961, XH749, XH792, XH719, XH833, XH961, XH717, XH846, XH885, XH910, XH769, XH793, XH777, XH893, XH763, XH835, XH833, XH877, XH841, XH785, XH908, XH956, XH788, XH839, XH779, XH766, XH872, XH955, XH879, XH724, XH751, XH766, XH960, XH722, XH836, XH876, XH896, XH707, XH722, XH964, XH887, XH787, XH707.
FAW.Mk.4		228 OCU	XH912, XH905, XH767, XH715, XH716, XH958, XH907, XH713, XH909, XH898, XH883.
All Weather Development Squadron, CFE	XA735, XA749, XA763, XA764.		
All Weather Combat School	XA730, XA753.		
141 Squadron	XA727, XA636, XA637, XA638, XA639, XA640, XA750, XA751, XA756, XA757, XA758, XA759, XA760, XA761, XA762, XA766, XA767.		
23 Squadron	XA631, XA722, XA726, XA727, XA728, XA729, XA730, XA731, XA732, XA733, XA734, XA736, XA737, XA752, XA753, XA754, XA755.		
41 Squadron	XA636, XA637, XA638, XA639, XA640, XA750, XA751, XA756, XA757, XA758, XA759, XA760, XA761, XA762, XA766, XA767.		
96 Squadron	XA750, XA762, XA749, XA721, XA630, XA629, XA735, XA763.		
3 Squadron	XA630, XA638, XA635, XA764, XA749, XA725.		
72 Squadron	XA729, XA753, XA736, XA754, XA726, XA733, XA752, XA727, XA755, XA737, XA728, XA731, XA730, XA722, XA631.		
11 Squadron	XA632, XA720, XA756, XA765, XA767, XA724, XA760, XA723, XA637, XA759, XA766, XA758, XA725, XA631, XA764, XA633.		
87 Squadron	XA636, XA639, XA733, XA757, XA761.		
FAW.Mk.5			
All Weather Development Squadron, CFE	XA642, XA657, XA648, XA643, XA659, XA660.		
Night Fighter Leader School	XA663, XA664, XA665, XA689, XA688, XA691, XA696, XA697, XA705, XA718, XA704 - later replaced by- XA700, XA646, XA652, XA653, XA656, XA688, XA701, XA702, XA703.		
151 Squadron	XA652, XA688, XA647, XA653, XA651, XA650, XA699, XA655, XH687, XA712, XH689, XA714, XA715, XA694, XA708, XA717, XA713, XH688, XA710, XH690, XA661, XA695, XA664, XA714, XA706, XA646, XA689, XA660,		
228 OCU			



received some FAW.Mk.9 aircraft and, in 1966, the unofficial title of No. 11 Squadron. When it disbanded in November 1966, it was the last unit to operate the Javelin regularly in Britain.

FAW.Mk.4 - A basic FAW.Mk.1 with Sa.6s and AI.17 radar but with the new flying tail. The first aircraft, XA629, was considered the prototype and flew on 19 September 1955, after being pushed up the production line to accelerate the programme. This step followed the tests undertaken with XA545. Fifty Mk.4s were built with production shared between Gloster and Armstrong Whitworth, Baginton. It was planned in February 1955 to share peak production of Mk.1 and Mk.2 aircraft between Air Service Training, Armstrong Whitworth and Gloster in the ratio of 20, 30 and 50 per cent respectively, but the various difficulties and constant updates to the aircraft prevented this. The first series aircraft flew on 27 February 1956, with CA Release cleared in December that year. The first squadron to receive the FAW.Mk.4, in February 1957, was No.141, initially at Horsham St Faith but soon after-

wards Coltishall, to be followed by Nos. 3, 11, 23, 41, 72, 87 (only one or two operated simultaneously and just five in total) and 96. The aircraft was now being used in the 'immediate readiness' role with aircraft alongside the runway ready to fly with the crew in their seats.

One modification made to XA629 was the fitting of an audible stall warning apparatus triggered by electro-mechanical vanes fixed on the wings. Then on 28 March 1956, it was flown with some large streamlined fairings known as Kuchemann 'carrots', initially on the wing trailing edges just inboard of the ailerons but later with additional smaller versions on the wing tip trailing edges. Their role was to reduce the effect of shock waves and cut airflow separation when flying at high subsonic speeds, so extending the buffet boundary. The idea was rejected as two rows of vortex generators along the outer leading edge plus a thickened trailing edge were found to be just as effective. The second method was designed to re-energise the boundary layer; it was also a cheaper modification and was utilised on all Javelins from the Mk.4 onwards. The usual quota of

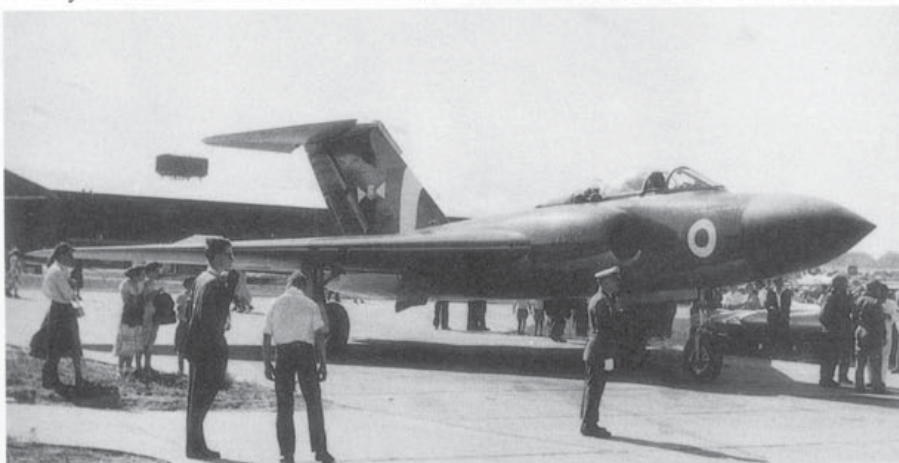
Based at RAF Laarbruch, Germany, No. 5 Squadron's Javelin FAW.Mk.5s such as this example XA658:E, contributed to the all-weather defence of the Nato front line. (MAP)

FAW.Mk.4s spent time on experimental duties including XA630 which cleared the pen-nib jet pipe arrangement and XA720, XA721 and XA723 sent to Canada for cold weather tests. XA763 and XA764 went to the Central Fighter Establishment (CFE).

FAW.Mk.5 - Again essentially an FAW.Mk.1 with AI.17 and flying tail, this version had a modified wing externally no different to the Mk.4's but carrying a total of 125gal (568 litres) of additional internal fuel to counter one consistent Javelin criticism, a lack of range. It was also the first Mark with provision for the four Firestreaks, but the weapons were never carried. XA641 was the first of 64 built, again split between Gloster and Armstrong Whitworth, and flew on 26 July 1956. Production models began flying from 24 August. First recipient was CFE, and then No. 151 Squadron at Leuchars, aircraft arriving from May 1957, to be followed by Nos. 5, 11, 23, 41, 72 and 87 Squadrons and 228 OCU. Movements of individual aircraft between units was extensive, in part because of the high number of different marks. For example, No. 23 Squadron's only FAW.Mk.5, together with the majority of its Mk.4s, transferred to No. 72 Squadron when No. 23 re-equipped with FAW.Mk.7s.

FAW.Mk.6 - The new wing and increased fuel that turned the Mk.1 into the Mk.5 when fitted to the Mk.2 produced the FAW.Mk.6; the AI.22 radar and standard Sa.6 were still

RAF Wethersfield was the scene of many an interesting air show in the 1960s. FAW.Mk.4 XA751:751 of No. 141 Squadron was one of the participants at a time when the squadron was not often seen on public display. (MAP)



Gloster Javelin Ground Instructional Airframes

Prototypes:- WT830 as 7485M (at Halton), WT836 - 7552M (Cosford), XD158 - 7592M (Halton).

FAW.Mk.1:- XA544 as 7558M (at St. Athan), XA549 - 7717M (Swanton Morley), XA551 - 7586M (Halton), XA553 - 7470M (Yatesbury), XA554 - 7662M (St. Athan), XA560 - 7619M (Henlow), XA563 - 7627M (Newton), XA564 - 7464M (Locking), XA567 - 7551M (Melksham), XA571 - 7663M (Halton), XA620 - 7723M (Cosford), XA627 - 7661M (St. Athan), XA628 - 7665M (Melksham).

FAW.Mk.2:- XA801 as 7739M (at Stafford - exhibit).

FAW.Mk.4:- XA634 as 7641M (at Melksham), XA755 - 7725M (St. Athan).

FAW.Mk.5:- XA699 as 7809M (at Locking and later Cosford), XA701 - 7765M (Bicester), XA706 - 7649M (Leeming).

FAW.Mk.6:- XA820 as 7752M (at Dishforth), XA821 - 7749M (Hartlebury - display).

FAW.Mk.7:- XH710 as 7748M (at Melksham), XH782 - 7797M (Halton), XH783 - 7798M (Halton), XH784 - 7799M (Halton), XH790 - 7808M (Yatesbury), XH900 - 7811M (St. Athan), XH901 - 7800M (Weeton), XH902 - 7801M (Weeton).

FAW.Mk.8:- XH972 as 7834M (at Newton), XH980 - 7867M (Stafford - exhibit), XH986 - 7842M (Swanton Morley), XH991 - 7831M (Henlow), XH992 - 7829M (Cosford), XJ116 - 7832M (Newton), XJ117 - 7833M (Newton).

FAW.Mk.9:- XH760 as 7892M (at Cranwell), XH767 - 7955M (Worcester), XH768 - 7929M (Cranwell), XH840 - 7740M (Luqa), XH848 - 7975M (Bicester), XH892 - 7892M (RAF Museum - display), XH903 - 7938M (Innsworth).

Some Javelin Gate Guardians

Serial	Mark	Station
XA549	FAW.Mk.1	Swanton Morley
XA553	FAW.Mk.1	Yatesbury, and later Stanmore Park
XA629	FAW.Mk.4	Ternhill
XA634	FAW.Mk.4	Leeming
XA706	FAW.Mk.5	Leeming
XA801	FAW.Mk.2	Stafford
XA820	FAW.Mk.6	Acklington
XA821	FAW.Mk.6	Hartlebury
XH764	FAW.Mk.9R	Manston
XH900	FAW.Mk.7	Swinderby
XH903	FAW.Mk.9	Innsworth
XH980	FAW.Mk.8	Stafford, and later West Raynham

in place. The 'prototype' XA815 flew on 15 January 1957. 33 Mk.6s were manufactured at Hucclecote and served from October 1957 with No. 89 Squadron (later renumbered 85), and then Nos. 29 and 46 Squadrons.

FAW.Mk.7 - This was the basic Mk.5 aircraft but was the first Javelin to receive uprated engines, the 11,000lb (48.9kN) thrust Sapphire Sa.7, and also a different nozzle and extended rear fuselage to help reduce drag. The AI.17 and four Aden were retained but, for the first time, four Firestreak AAMs were aboard, or instead four 100gal (455 litre) drop tanks could be attached to the underwing pylons. Production was underway before the missile installation was ready and nearly 30 machines had to be retro-fitted. Many improvements were also made to the flight-control system including a yaw stabilizer on the fully-powered hydraulically operated rudder.

The FAW.Mk.7 was to become the most common Javelin with 142 built split between the two production lines. First flight of the first production machine took place on 9 November 1956, but CA Release took just over another year. Some deliveries were made to the A&AEE throughout 1957 before starting in earnest to No. 33 Squadron in July 1958, and then Nos. 23, 25 and 64 Squadrons and the Guided Weapons Development Squadron (soon afterwards the No.1 Guided Weapons Trials Squadron - GWTS). A large number of Mk.7s were held back for trials and research including XH706 which assessed handling and the new auto-stabilizer and XH713 which undertook tropical testing in Bahrain during August 1957. XH754 was used from January 1960 by RAE Farnborough for rain dispersal trials as part of the TSR.2 programme, which included a detachment to Singapore in March 1961. Before production was completed, the reheated FAW.Mk.8 appeared which resulted in over 80 FAW.Mk.7s passing into storage at 5 MU, Kemble direct from manufacture; 116 of them were eventually converted into FAW.Mk.9s.

One Mk.7 was sent complete with

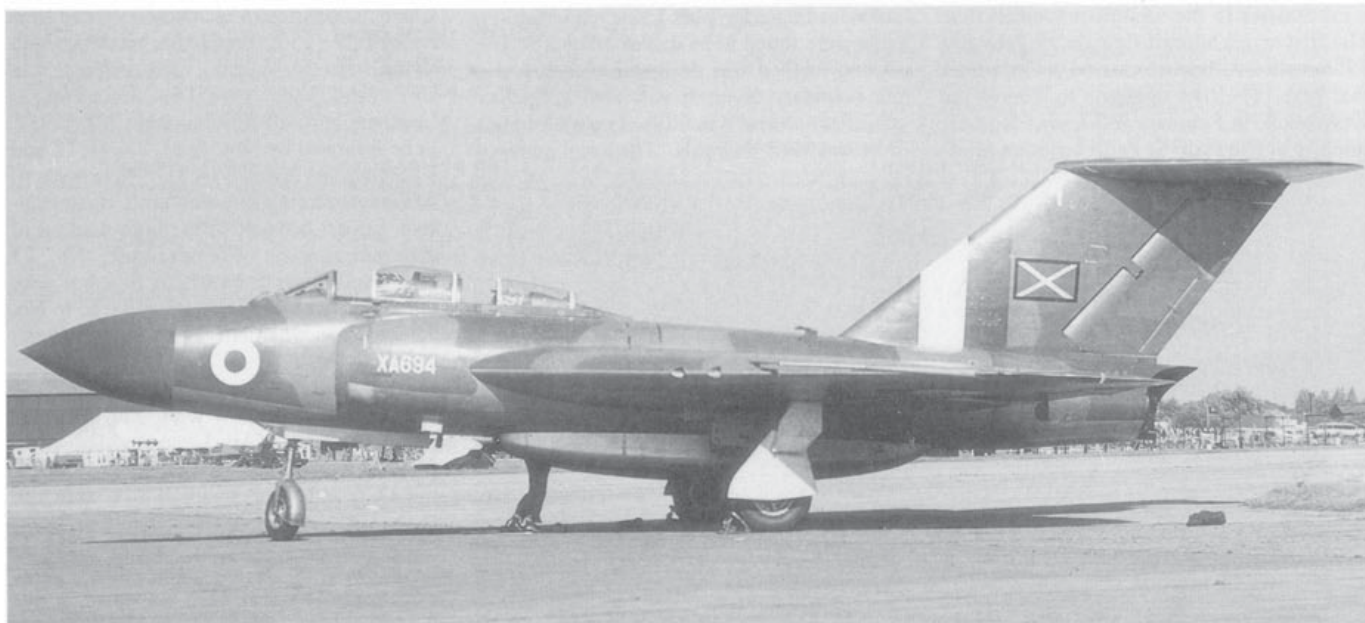
Gloster Aircraft Company Drawing and Project Numbers

- P.272** First project to F.44/46, 4.48.
- P.276** F.4/48 night fighter with Avon engines, early summer 1948. First G.A.5 drawing.
- P.280** F.4/48 night fighter with Sapphire engines, 23.7.48. Became G.A.5.
- P.319** Dual control F.4/48, became T.Mk.3, 6.50.
- P.322** F.4/48 Interceptor variant with Sapphire Sa.50s, 7.50.
- P.323** Long range fighter version of P.322, 7.50.
- P.325** High altitude escort fighter variant of standard F.4/48, 3.51.
- P.346/P.347/P.348/P.350** Photo-reconnaissance Javelin developments, 1952.
- P.356/P.364/P.370** G.A.6 Thin Wing Javelin proposals from 7.53.
- P.359** Javelin FAW.Mk.1 and 2.
- P.376** Final supersonic Thin Wing Javelin to F.153D, late 1955.
- P.382** FAW.Mk.7 Javelin fitted with Scorpion rockets, 2.57.

Firestreaks to the Paris Salon at Le Bourget and, being the only aircraft present fitted with missiles, generated great interest. Missile 'Sites' had to be established with the equipment to support the new marks and their guided weapons, the first to be operational being at RAF Coltishall. An example of the support given by Coltishall before other Sites were available was the airlifting of 52 missiles by No. 85 Squadron FAW.Mk.8 aircraft to arm No. 41 Squadron at Laarbruch on 25 September 1961. Firestreak was 'partially released' to the Service in August 1959, but it was not until 2 June 1960, that Fighter Command fired its first missile, a No. 23 Squadron Mk.7 being the lucky aircraft. GWTS got its first Mk.7 on 1 January 1959, the first Firestreak test firing destroying a Meteor drone on 21 December 1959.

FAW.Mk.8 - The last new-build Javelin, this was a FAW.Mk.6 with the 11,000lb (48.9kN) Sa.7 engine but now modified with limited reheat as the Sa.7R for a total thrust of 12,300lb (54.7kN). The reheat was only effective above a certain height, officially

No.151 Squadron at RAF Leuchars began its Javelin association with the FAW.Mk.5 seen here represented by XA694.T. (Eric Morgan)

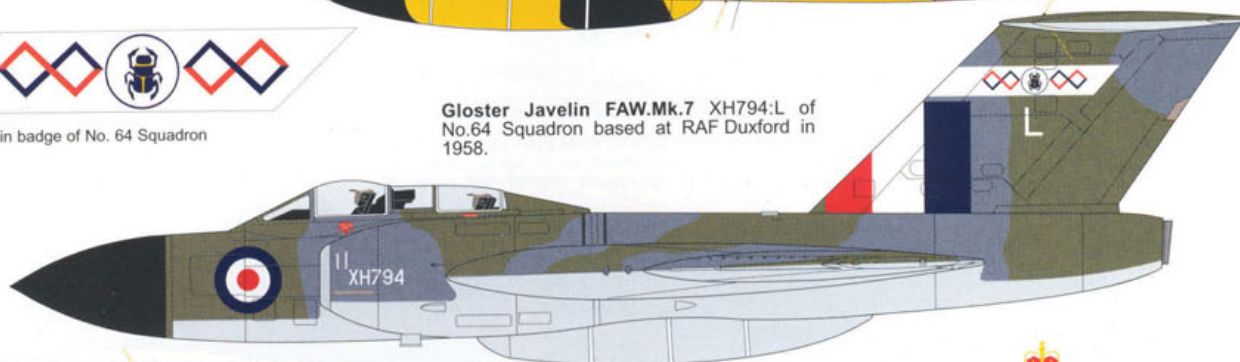


Gloster Javelin FAW.Mk.7 XH754 was used by the Royal Aircraft Establishment, Farnborough and its outstations for experimental flying from 1964 onwards. Its distinctive colour scheme was well known.



Fin badge of No. 64 Squadron

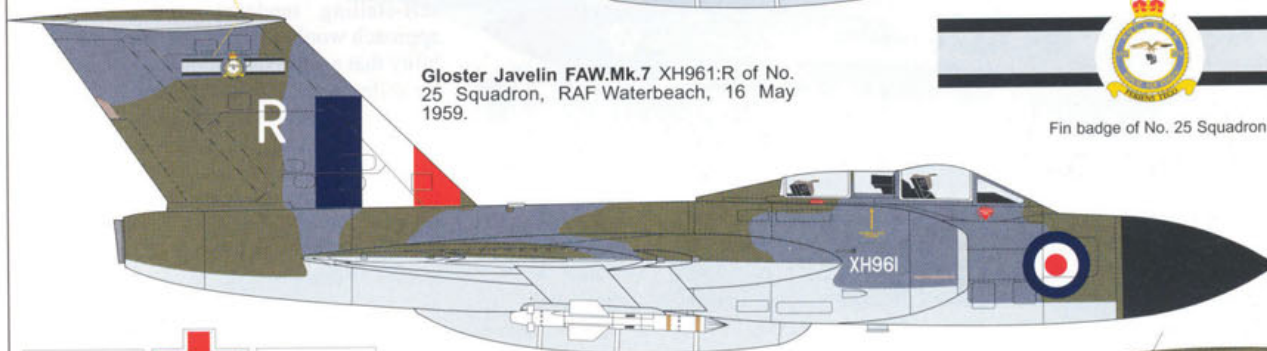
Gloster Javelin FAW.Mk.7 XH794:L of No.64 Squadron based at RAF Duxford in 1958.



Gloster Javelin FAW.Mk.7 XH961:R of No. 25 Squadron, RAF Waterbeach, 16 May 1959.

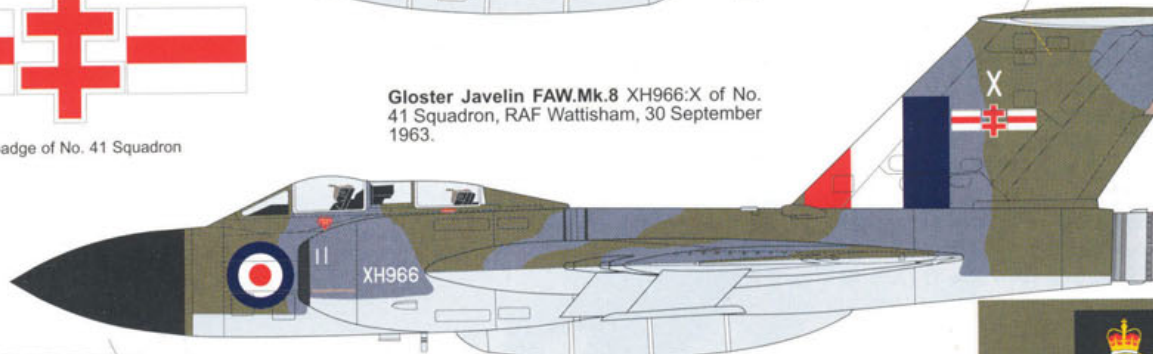


Fin badge of No. 25 Squadron



Fin badge of No. 41 Squadron

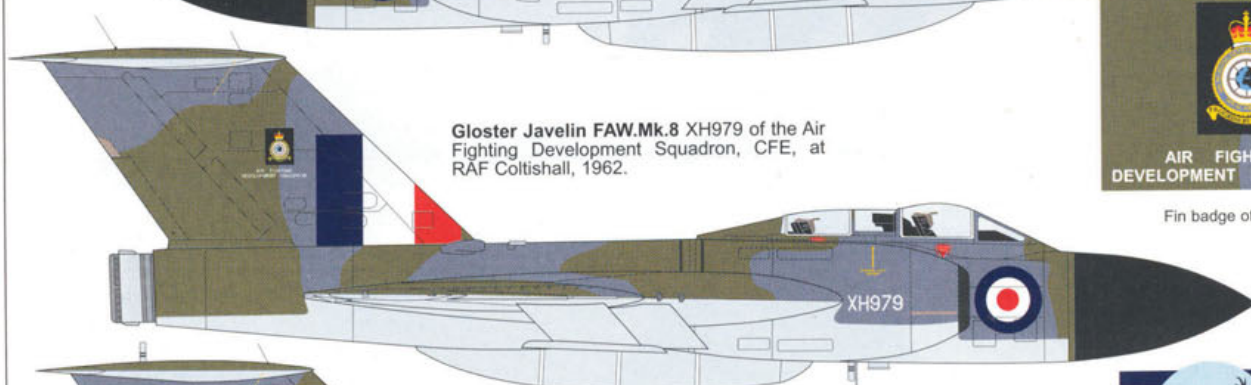
Gloster Javelin FAW.Mk.8 XH966:X of No. 41 Squadron, RAF Wattisham, 30 September 1963.



Gloster Javelin FAW.Mk.8 XH979 of the Air Fighting Development Squadron, CFE, at RAF Coltishall, 1962.



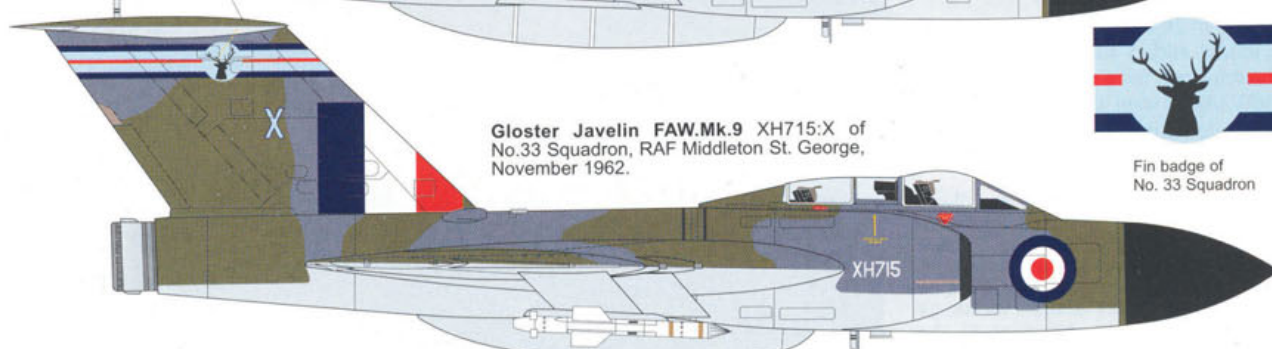
Fin badge of AFDS

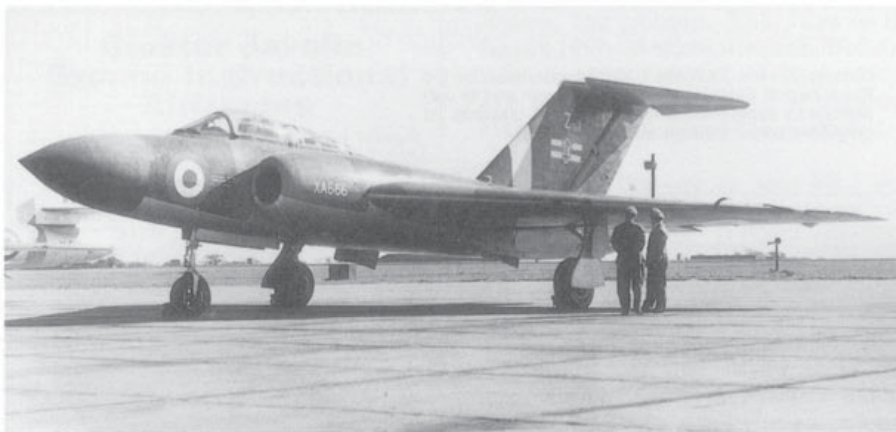


Gloster Javelin FAW.Mk.9 XH715:X of No.33 Squadron, RAF Middleton St. George, November 1962.



Fin badge of No. 33 Squadron





Two of the seven operational squadrons issued with the Javelin FAW.Mk.5 were Nos 41 (left) and 23 (lower left) whose serials respectively were XA666:Z and uncoded XA654. Recognition of the actual size of the Javelin can be seen by the people standing close by. (MAP)

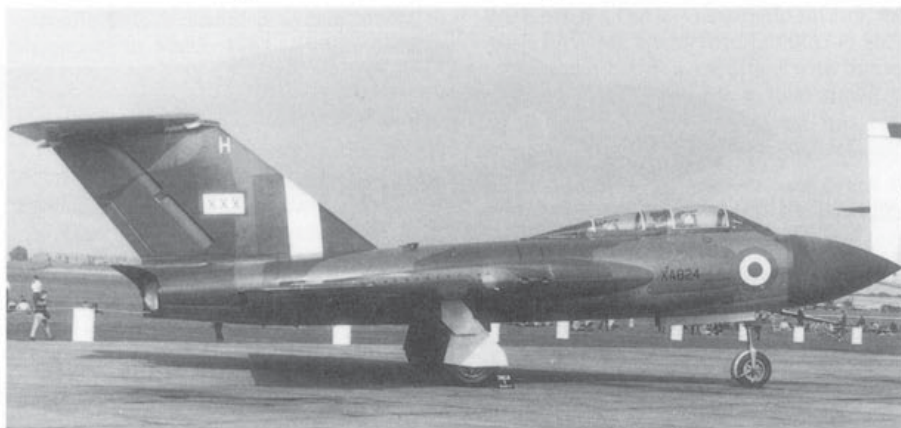


20,000ft (6,096m) though in practice about 8,000 to 10,000ft (2,438 to 3,048m), but helped address a weakness of the FAW.Mk.7 which was poor manoeuvrability at height. The FAW.Mk.8 had Firestreak while new aerodynamic improvements made to both Mk.8 and 9 included a drooped leading edge in the outer mainplane panels, a pitch stabiliser incorporated in the aileron system and an auto-stabilised rudder.

All 47 FAW.Mk.8s were built at Hucclecote, the first XH966 flying on 9 May 1958. XJ165 was the very last new-build Javelin, flown in August 1960, though FAW.Mk.9 conversion deliveries continued into 1961. Thirteen FAW.Mk.8s (XJ166 to XJ178) were cancelled in August 1960 during final assembly, the machines being cannibalised for spares and then broken up after the move to convert stored Mk.7s to the same standard. The first Mk.8 deliveries came in Spring 1959 to A&AEE for official handling and performance assessment, but the first Squadron to receive it, No.41 at Wattisham, did not get its aircraft until November. Aircraft also went to No. 85 Squadron besides those used by the manufacturer for auto-stabilizer testing, and XJ125 on Sapphire Sa.7R development.

FAW.Mk.9 - In January 1957 it was agreed that no marks earlier than the FAW.Mk.7 should be reheated, but the fitting of Sa.7Rs to 116 FAW.Mk.7s went ahead and proved to be a big undertaking, the work including adding the drooped leading edge plus vari-

able area nozzles. XH715 was the last conversion to be completed in December 1961. This final mark served first with No. 25 Squadron from December 1959 and then Nos. 5, 11, 23, 29, 33, 60 and 64. One, XH898 when serving at 228 OCU, was uniquely finished in non-standard natural metal and flown by Squadron Leader George H.Benson, the officer commanding the unit, whose initials appeared on the fin.



Upper right: By comparison only three squadrons were issued with the FAW.Mk.6 including XA824:H of No. 29 Squadron. (MAP) Right: Several of these ended up as instructional or maintenance airframes including those on gate guardian duties. XA821 retained its No. 29 Squadron markings when standing at the entrance to RAF Hartlebury. (Authors collection)

FLIGHT TESTING

During 1954 much anxiety centred on the Javelin's slow speed characteristics. The third production aircraft, XA546, crashed in the Bristol Channel on 21 October while conducting spinning tests and this emphasised the importance of the low speed investigation which, from then on, had priority over all other flight test work. The pilot, Flt.Lt. R.J.Ross died. By February 1955, instability at the stall, especially with flaps down, was seen as a fundamental feature of the design. On the landing approach a high rate of descent warned the pilot of an impending stall but at high altitude there were no landmarks available to judge the rate of descent. The aircraft had shown a self-stalling tendency and a stall on approach would probably be fatal; the possibility that a superstall might follow made little difference. The solution was the introduction of a stall warning device.

Other aerodynamic problems identified on the Javelin at this time included some disturbing features at high Mach numbers - nose down pitch at 0.88 Indicated Mach number (IMN) was followed by slight buffet at 0.90, rocking at 0.92, severe buffet at 0.94 and yaw at 0.97. After this, the aircraft passed smoothly to Mach 1.05 IMN. It was considered that all these effects were due to shock induced boundary separation, although at the time the manufacturers were concentrating on improving the flow over the wing and tail. There was a likelihood

Gloster Javelin FAW.Mk.9 XH721:MHM flown by Wing Commander Michael H. Miller commanding No. 60 Squadron, RAF Tengah, Singapore, November 1965 to October 1966.

Fin badge of No. 60 Squadron. Blue surround for B Flight



Gloster Javelin FAW.Mk.9 XH722:PS flown by Wing Commander John Peter Smith commanding No. 60 Squadron, RAF Tengah, Singapore, 1961 to 1963.

Gloster Javelin FAW.Mk.9 XH839:MHM flown by Wing Commander Michael H. Miller commanding No. 60 Squadron, RAF Tengah, Singapore, November 1966 to July 1967.

that the buffet and yaw would involve a serious risk of structural failure if the aircraft stayed within this speed band long enough.

In September 1956 the All Weather Development Squadron at Central Fighter Establishment, RAF West Raynham, completed its Tactical Trial on the FAW.Mk.1. The report, written by Wing Commander E. James, Officer Commanding AWDS, stated that the fighter's controls were light and well balanced at low and medium speeds but, as speed increased beyond 450 knots (518mph/834km/h) IAS, they became progressively stiffer until at the maximum permissible IAS of 535 knots (616mph/991km/h) the rudder became nearly uncontrollable and the elevators were heavy. Adequate manoeuvrability was experienced up to 40,000ft (12,192m) but above this height the speed could not be maintained in turns at large angles of bank without sacrificing height. For example, at 45,000ft (13,716m) and 0.91 IMN, a sustained turn at 30 degrees of bank was the maximum possible.

Limiting speeds and Mach numbers were - above 20,000ft (6,096m) Mach 0.93 or the onset of buffet, Mach 0.91 between 7,000ft (2,134m) and 20,000ft, and 535 knots IAS below 7,000ft. These figures could be reached and exceeded in level flight up to 35,000ft (10,668m) and, between 35,000

Underside view of FAW.7, XH754 showing target towing stripes and dayglo.



Upper surface view of FAW.4 XA723 showing dayglo areas.





Two of No. 23 Squadrons Javelin FAW.Mk.7s in formation. Both are armed with Firestreak missiles with the upper left aircraft having black painted ones which probably means that they are dummy rounds. (MoD)

and 40,000ft, Mach 0.93 could be achieved. Above that, Mach 0.92 was the best possible. Acceleration up to 35,000ft was good but fell away above that height until at 48,000ft (14,630m) it was impossible to accelerate from 0.71 IMN in level flight. This would make it necessary to maintain a high speed (at least Mach 0.85) until late in an interception.

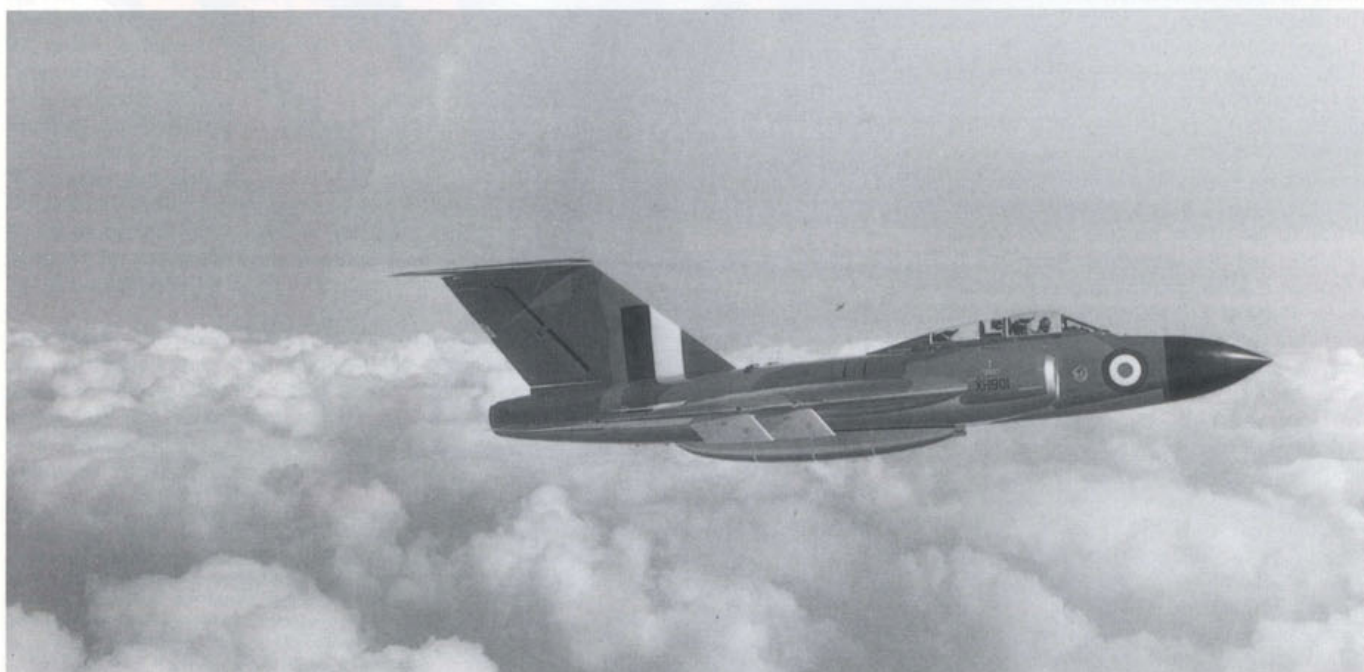
A report on the FAW.Mk.4 followed in March 1957. Here it was found that the

Mk.4 could intercept targets at Mach 0.85 and 45,000ft (13,716m), but was dependent on the amount of early warning given and the available fuel in bad weather. In addition, this was achieved 'in spite of, rather than because of, the performance of the AI.Mk.17 radar'. The range of the equipment was such that a successful interception depended initially on the Ground Control Interception (GCI) controller being absolutely precise in positioning the fighter and ordering it to turn. Improvements in this area were recommended (AI.17 was not yet up to the job). CFE found the FAW.Mk.4 to be no more manoeuvrable than the Mk.1 and its heavier elevator and apparently heavier

ailerons made it less pleasant and more tiring to fly, except above Mach 0.92 when the flying tail was a definite improvement. The least satisfactory manoeuvrability characteristic of the Javelin was found to be the rapidity with which speed dropped off in turns and when the nose was well above the horizon.

On the Mk.4, limiting speed above 35,000ft (10,668m) was Mach 1.04 (achieved in a dive from 45,000ft). Maximum level speed at high altitude was

Javelin FAW.Mk.7 XH901 seen in manufacturer's markings. This aircraft was retained for trials and then went on to serve with No. 1 Guided Weapons Trials Squadron (MoD)



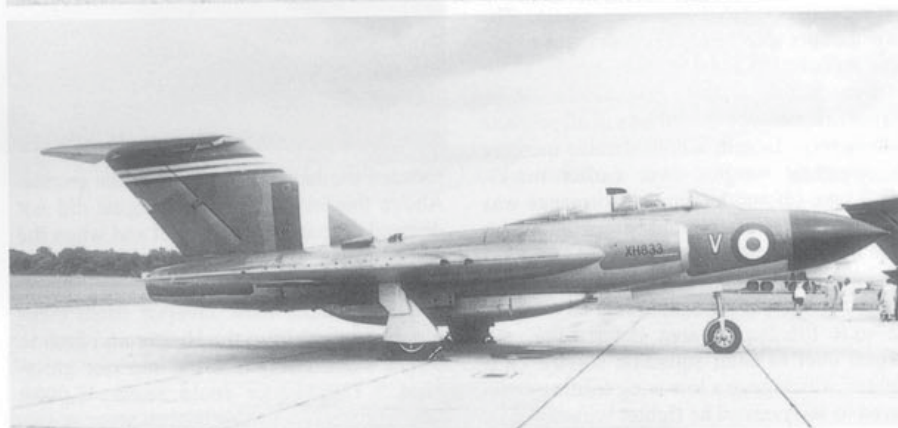
The Javelin FAW.Mk.7 was the most prolific of all marks of this aircraft, some 142 being built both at Hucclecote and Baginton. Two of the squadrons using them were, top, XH958:M of No. 23 Squadron and, lower right, XH833:V of No. 33 Squadron. (MAP)

actually less than the Mk.1 - Mach 0.88 to 0.89 at 48,000ft (14,630m), though Mach 0.92 at 40,000ft (12,192m) was possible. At heights up to 30,000ft (9,144m) the aircraft accelerated well but above this the time to accelerate in level flight became progressively larger and was more than the Mk.1 (the Mk.4 was slightly heavier). At 45,000ft the Mk.4 took one minute 22 seconds to accelerate from Mach 0.85 to 0.90, the equivalent figure for the Mk.1 being 54 seconds - a very important factor in perfecting interception techniques. Acceleration in a dive was described as rapid.

By now A&AEE, Boscombe Down, was providing its own reports on the Javelin. Tests on the FAW.Mk.1 between July 1955 and March 1956 revealed the type as generally easy to fly but deficient in several operationally important areas - strong pro-spin tendencies at the stall with inadequate stall warning (confirming previous work), inadequate longitudinal control and severely restricted lateral control at high speeds, poor dynamic directional stability especially at high altitude, presence of buffet in level flight above Mach 0.90 and serious icing and misting troubles. It was hoped that the developments by then underway (flying tail, yaw damper, stall warning etc.) would cure most of these problems on later marks. (One possible cure considered for the yaw problem was a cranked fin proposed in February 1955, it was not adopted here but did get used on the Thin Wing Javelin).

However, the Javelin was praised for its effective airbrakes, good asymmetric char-

acteristics and no engine problems with or without gun firing (there had been considerable troubles with Aden gun gas ingestion by the Avon engines of the Hunter day fighter). From the performance aspect the Mk.1 theoretically met the Operational Requirement of intercepting bombers flying at 40,000ft (12,192m) and speeds up to Mach 0.80, but by the standards of the day its performance and weapon system were considered inadequate. The restricted CA Release was only given for a small number of FAW.Mk.1s to enable early Service experience to be obtained.



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The FAW.Mk.4 was test flown at A&AEE between June 1956 and July 1957, the flying tail, stall warning system and vortex generators all new from the Mk.1. Improved longitudinal control was appreciable under all conditions but disappointingly small at high Mach numbers; in most other respects the FAW.Mk.4 was similar to the Mk.1. A major criticism was unacceptable lateral and directional stability above Mach 0.95 when carrying drop tanks and a pitch damper was highly desirable below Mach 0.90 to allow satisfactory gun aiming. The handling characteristics of FAW.Mk.2, 5 and 6 aircraft were



Javelin FAW.Mk.9 XH890:M of No. 23 Squadron in plan view showing the two ventral tanks and four Firestreak missiles. Fuel is being vented from the outlet between the tanks. (MoD)

found to be little different from the Mk.4.

A&AEE got its hands on the FAW.Mk.7 in August 1957 for an assessment that lasted until April 1958, the principle changes being Sa.7 engines, a yaw damper and full power rudder. Despite a 15 per cent increase in take-off weight over the Mk.4, altitude capability without external stores was about 5,000ft (1,524m) higher than the earlier model and just sufficient to attain 50,000ft (15,240m). At that height however, there was very little margin of thrust available for acceleration, and buffet free 'g' for manoeuvring was very small. Full power was essential for most of the time at this altitude. The yaw damper gave great improvement to lateral and directional stability compared to earlier marks while behaviour with Firestreak missiles aboard was in all respects satisfactory. Despite a considerable increase in operating weights over earlier marks, Mk.7 take-off and landing performance was such that the aircraft could be operated with ease from airfields with 2,000 yard (1,829m) runways.

The Javelin was remarkable for its massive 927sq.ft (86.2sq.m) area delta wing, the largest ever to enter squadron service on a fighter, which gave a low wing loading compared to its rivals. The fighter with the lowest wing loading would be expected to have the advantage in manoeuvrability at all heights regardless of thrust to weight ratio. However, the early marks did lack some manoeuvrability at height while a wing thickness/chord (t/c) ratio of 10 per cent at the root to 8.9 per cent at the tip helped to prevent pure supersonic capability on the level. The reheated marks improved some performance aspects above about 10,000ft (3,048m) but their top speed proved to be slightly less than the early versions. The FAW.Mks.8 and 9 could reach 610 knots, Mach 0.92 (702mph/1,130km/h) at sea level compared to 616 knots, Mach 0.925 (709mph/1,141km/h) for Mks.1, 2 and 7.

In truth, the reheat system was in need of re-design. Reheat could be engaged at sea level but the Sa.7R engine was fed by a fuel pump which had a constant output and such action below about 8,000 to 10,000ft (2,438 to 3,048m) cut the quantity of fuel available to the combustion chamber and hence



reduced the basic cold thrust of the engine. Above this height the main engine did not demand the same level of fuel and when the pump output exceeded demand, spare fuel became available to light the reheat.

Nevertheless, most Javelins could comfortably out-perform the Hunter on climb to height while always having superior armament. The Hunter could reach 45,000ft (13,716m) with ease but lacked some stability above 40,000ft (12,192m) when later Javelins were stable enough aerodynamically to go into combat. Published figures for time to 45,000ft are Hunter F.Mk.1 (Avon RA.7) - 11.65 minutes, F.Mk.2 (Sapphire Sa.6) - 9.3, F.Mk.3 (experimental only with reheated RA.7R) - 5.7, F.Mk.6 (Avon RA.28) - 7.1; Javelin FAW.Mk.1 (Sapphire Sa.6) - 9.8 minutes, FAW.Mk.4 (Sa.6) - 8.0, FAW.Mk.7 (Sa.7) - 6.6. For comparison, the de Havilland Sea Vixen FAW.Mk.1, developed out of the DH.110, could reach 40,000ft in 6.6 minutes. The reheated Sa.7R FAW.Mk.9 Javelin could reach 50,000ft (15,240m) in 9.25 minutes.

SERVICE EXPERIENCE

The Javelin never tasted real fighter-to-fighter combat so its capabilities were not tested to the ultimate. But it did get its chance to 'fight' in numerous exercises, and was able to exert an influence in several

potential areas of conflict. An annual UK air exercise held in October 1955 called *Exercise Beware* was the first opportunity the Javelin had to prove itself. Two Mk.1s (XA554 and XA559) took part flying out of Coltishall and the 'enemy' included Canberra bombers which were successfully intercepted and 'destroyed' 100 miles (161km) out to sea.

One potentially serious situation was the Unilateral (one-sided) Declaration of Independence (UDI) from Britain by the minority ruling party in Rhodesia in November 1965. This saw Javelin FAW.Mk.9s of No. 29 Squadron moved to Ndola and Lusaka in the neighbouring country of Zambia to make border patrol flights well into 1966. Had full scale conflict broken out, their opposition would have been Rhodesian FGA.Mk.9 Hunters delivered in 1963, but fortunately this never materialised.

For several years until 1967, No. 29 Squadron was based in Cyprus where some effort was put into what was essentially a combat situation. Turkey began to rattle its sabre over its claims towards the island in the mid-1960s and numerous Javelin flights were made buzzing Turkish submarines or chasing away Turkish Air Force aircraft attempting to break into Cypriot airspace. Even Egypt tried to test the Javelin's response by approaching the island, but recovered to home ground the instant the missile armed fighters scrambled. No. 29 Squadron at first flew out of Nicosia, but then moved to Akrotiri, and was also to make several interceptions of Russian Tupolev Tu-16 *Badger* bombers on route to Egypt.

Most Javelins however, were deployed in the *Cold War* Air Defence role in squadrons split between Britain and stations in West Germany such as Bruggen and Geilenkirchen. For example, the FAW.Mk.4s of Nos. 3, 11, 87 and 96 Squadrons all operated in Germany, Nos. 23, 41, 72 and 141 in the UK at Coltishall, Church Fenton and Leconfield; the FAW.Mk.5s of Nos. 5, 11

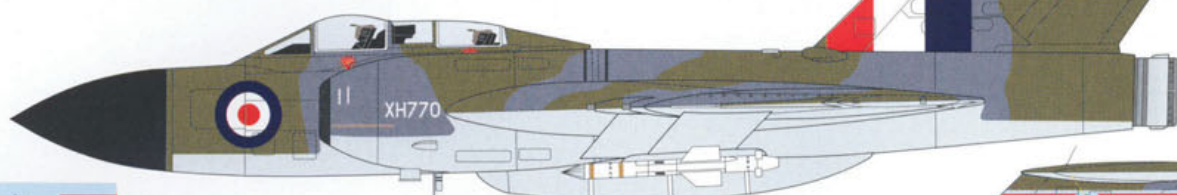
Javelin FAW.Mk.9 XH889 of No. 29 Squadron in Cyprus sunshine whilst the squadron was deployed to Akrotiri. This picture shows the use of the underwing pylons to carry extra long range tanks. (A.W.Hall)





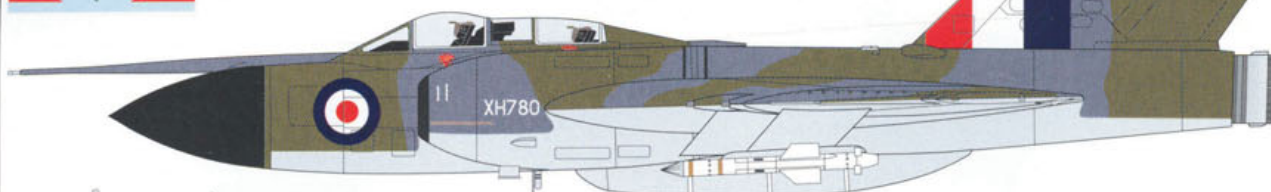
Fin badge of No. 11 Squadron

Gloster Javelin FAW.Mk.9 XH770:K of No. 11 Squadron, RAF Geilenkirchen, Germany, 1964.

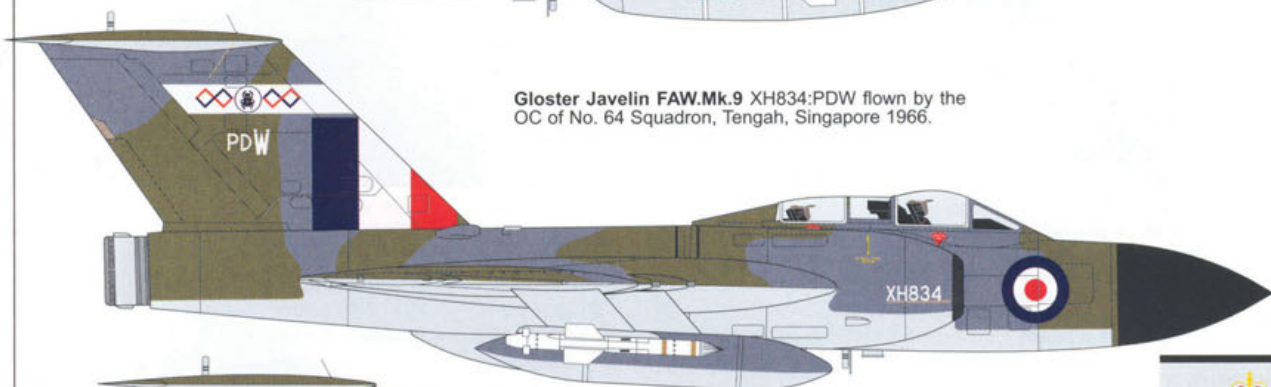


Fin badge of No. 5 Squadron

Gloster Javelin FAW.Mk.9R XH780:A of No. 5 Squadron, RAF Geilenkirchen, Germany, 1963.



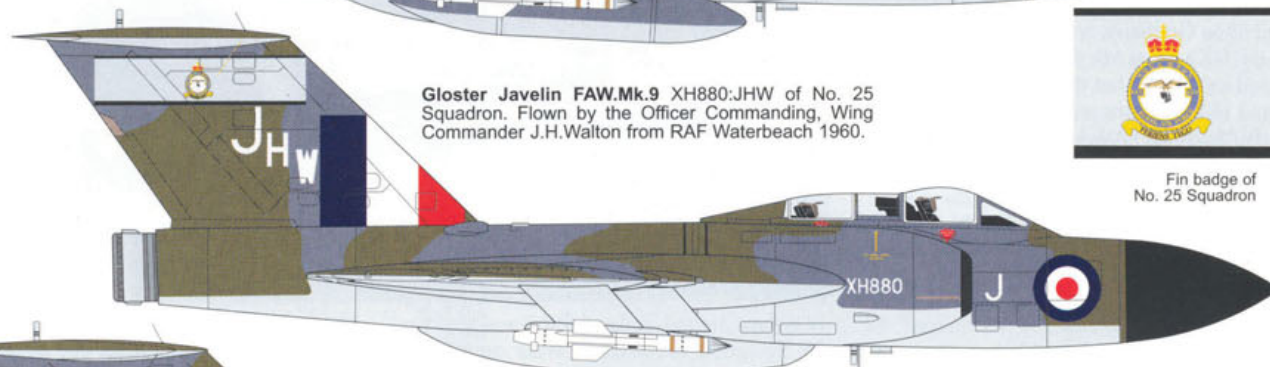
Gloster Javelin FAW.Mk.9 XH834:PDW flown by the OC of No. 64 Squadron, Tengah, Singapore 1966.



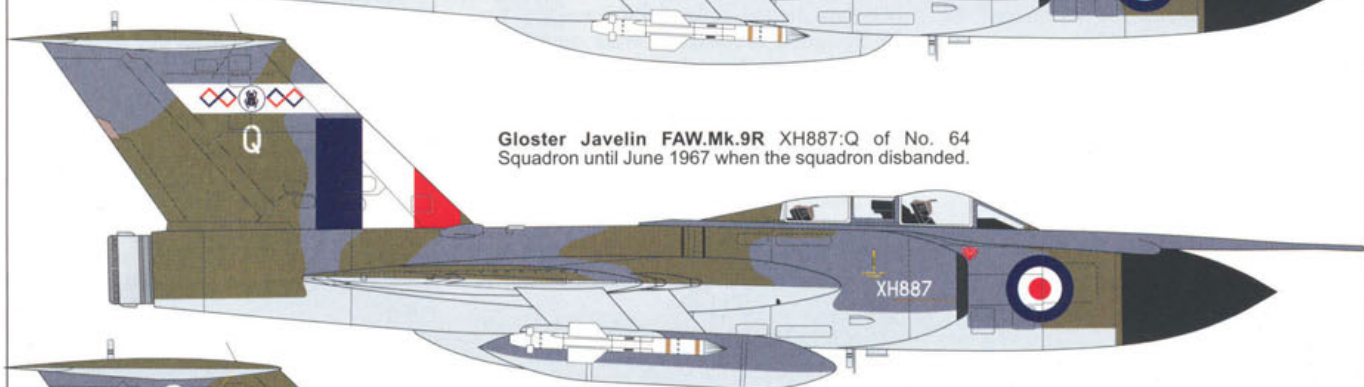
Gloster Javelin FAW.Mk.9 XH880:JHW of No. 25 Squadron. Flown by the Officer Commanding, Wing Commander J.H.Walton from RAF Waterbeach 1960.



Fin badge of No. 25 Squadron



Gloster Javelin FAW.Mk.9R XH887:Q of No. 64 Squadron until June 1967 when the squadron disbanded.



Gloster Javelin FAW.Mk.9 XH889:O flown by Wing Commander A.J.Owen commanding No.23 Squadron at RAF Middleton St. George, June 1963.



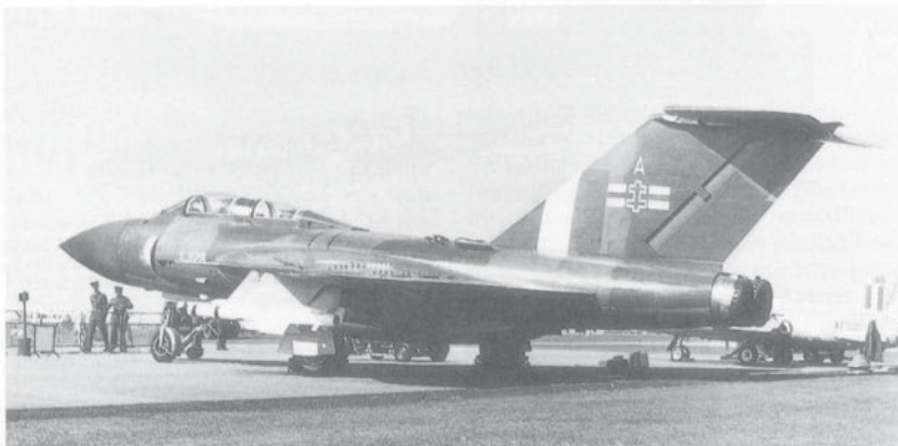


Above: An impressive formation of No. 33 Squadron Javelin FAW.Mk.7s probably over the north Yorkshire coastline as the squadron was stationed at Middleton St. George at the time. The squadron disbanded in November 1962. (MoD) Right: No.41 Squadron's Firestreak armed Javelin FAW.Mk.8 XJ129:A (MAP)

and 87 in Germany, and Nos. 41, 72 and 151 in the UK. Most Mk.6, 7 and 8 aircraft were based in the UK, but the FAW.Mk.9s of Nos. 5 and 11 Squadrons went to Germany. In the early days of FAW.Mk.1 service, the Air Fighting Development Squadron was based at Coltishall.

During the 1960s the Javelin was progressively replaced in the air defence role by the English Electric Lightning, the final fully operational UK Squadron being No. 23 at Leuchars which exchanged its aircraft for Lightnings in October 1964. Those in Germany lasted a while longer as No. 11 Squadron at Geilenkirchen did not give its aircraft up until February 1966. No. 29 Squadron in Cyprus flew Javelins until April 1967 but the final Javelin operations took place when Nos. 60 and 64 Squadrons moved to Malaya to guard that country's airspace against Indonesia.

Raids into Sarawak by Indonesian guerril-

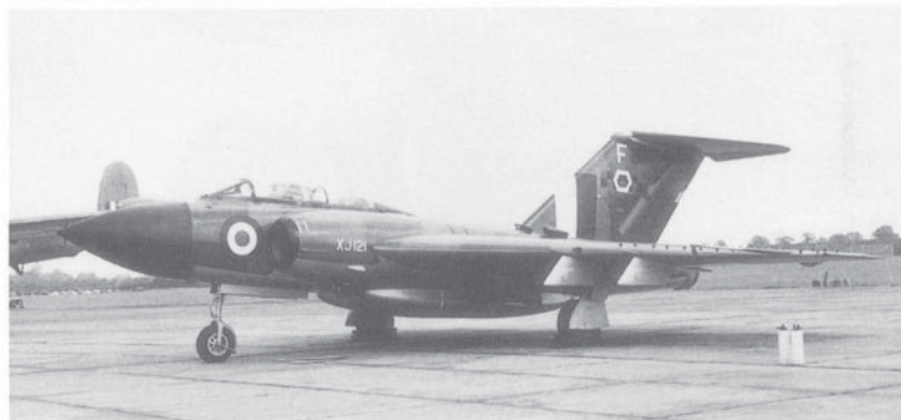


la groups started in April 1963 and two No. 60 Squadron FAW.Mk.9s were among the first aircraft dispatched to Labuan and Kuching. The rest of No. 60 Squadron followed with No. 64 Squadron also arriving in due course. No. 64 began its operations by deploying six aircraft from RAF Binbrook, Lincolnshire, on a rotation basis before it disbanded to reform at RAF Tengah in April 1965. An escalation of the conflict saw regular Indonesian forces become involved in

1964 and the Javelins, Hunters and Sea Vixens also present, began low level patrols along Indonesia's border. During September, a No. 60 Squadron Javelin forced an Indonesian C-130 Hercules to crash when taking avoidance action. Later an Air Defence Identification Zone was established over West Malaysia where all unidentified intruders were intercepted including, on one occasion, a Tupolev Tu-16 by another No. 60 Squadron aircraft. The Indonesian Air Force boasted MiG-19s and MiG-21s, but also ageing P-51 Mustangs, B-25 Mitchells and B-26 Invaders. Finally a peace agreement was signed and the security forces began to leave. No.64 Squadron disbanded at Tengah in Singapore in June 1967 but No.60 continued on to 30 April 1968, before disbanding as the last Javelin squadron. These operations probably extended the Javelin's flying career by a year.

Shortage of range was a problem with early Javelins and was not solved until the large ventral 'bosom' tanks were introduced.

Apart from No. 41 Squadron the only other FAW.Mk.8 equipped Javelin unit was No. 85 Squadron. Their XJ121:F is seen here. (MAP)



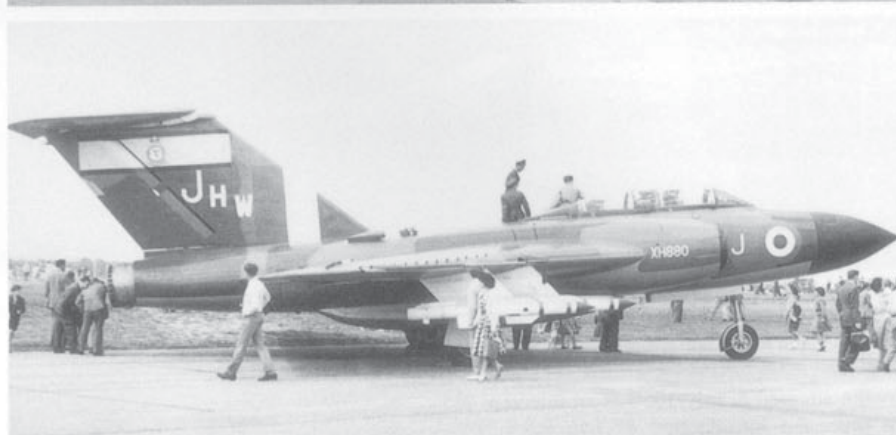
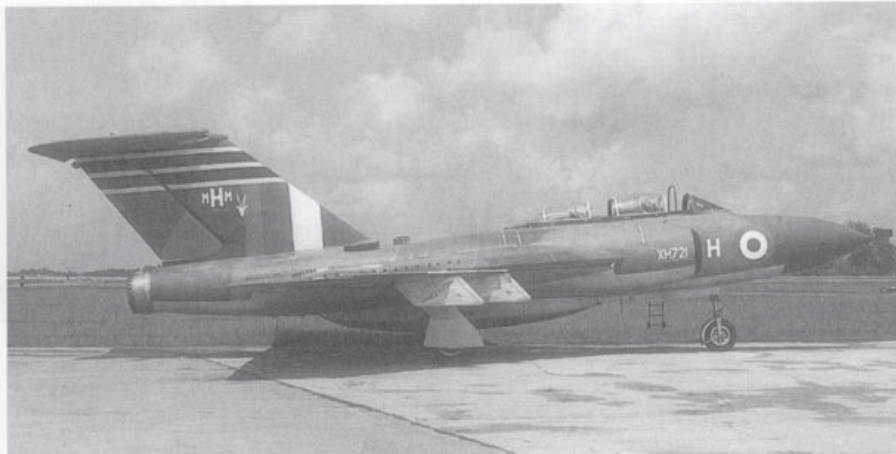
Individual aircraft markings became standard on some Javelin squadrons especially those that served in the Far East. Right: No. 60 Squadron's Commanding Officer, Wing Commander Michael H. Miller had his initials painted on XH721:H before the squadron left for Singapore. Lower right: Nearer to home, Wing Commander J.H. Walton's initials appeared on Javelin FAW.Mk.9XH880:J of No. 25 Squadron when based at RAF Waterbeach in 1960. (MAP)

In October 1957 an inadvertent release of these tanks resulted in a restriction being imposed to prohibit their carriage until specially tested release slips were fitted to service aircraft. But getting aircraft out to trouble spots anywhere in the world necessitated an important addition to the Javelin's capability, in-flight refuelling.

XA634, a Mk.4, was fitted with a wing probe by Airwork Ltd and first tested with a Canberra tanker in 1957. These hook-up trials were 'dry', no fuel was passed to the fighter. Two further aircraft, XH780 and XH965, a Mk.7 and a Mk.9, made more tests in 1959 and 1960 respectively with a 20ft (6.1m) long fuselage mounted probe of ghastly appearance fitted to the starboard side of the cockpit, but it proved a success and was eventually fitted to over 40 Mk.9s as FAW.Mk.9(F/R)s. The first squadron equipped with flight refuelable aircraft was No.23 which dispatched four Mk.9s on a non-stop proving flight to Singapore in October 1960, demonstrating at the same time how Britain could re-enforce overseas bases swiftly. Valiant tankers topped up the Javelins on the way. With the in-flight refuelling probe in position, speed was limited to 450 knots (518mph/834km/h).

The Gloster Javelin finally clocked up 12 years of squadron service with the Royal Air

XH767 after conversion to FAW.Mk.9 standard is seen here with just one pair of Firestreaks as 'F' of 228 OCU at Leuchars in 1965-66. It is interesting that it still retains its No. 11 (Shadow) Squadron badge on the fin (Eric Morgan).

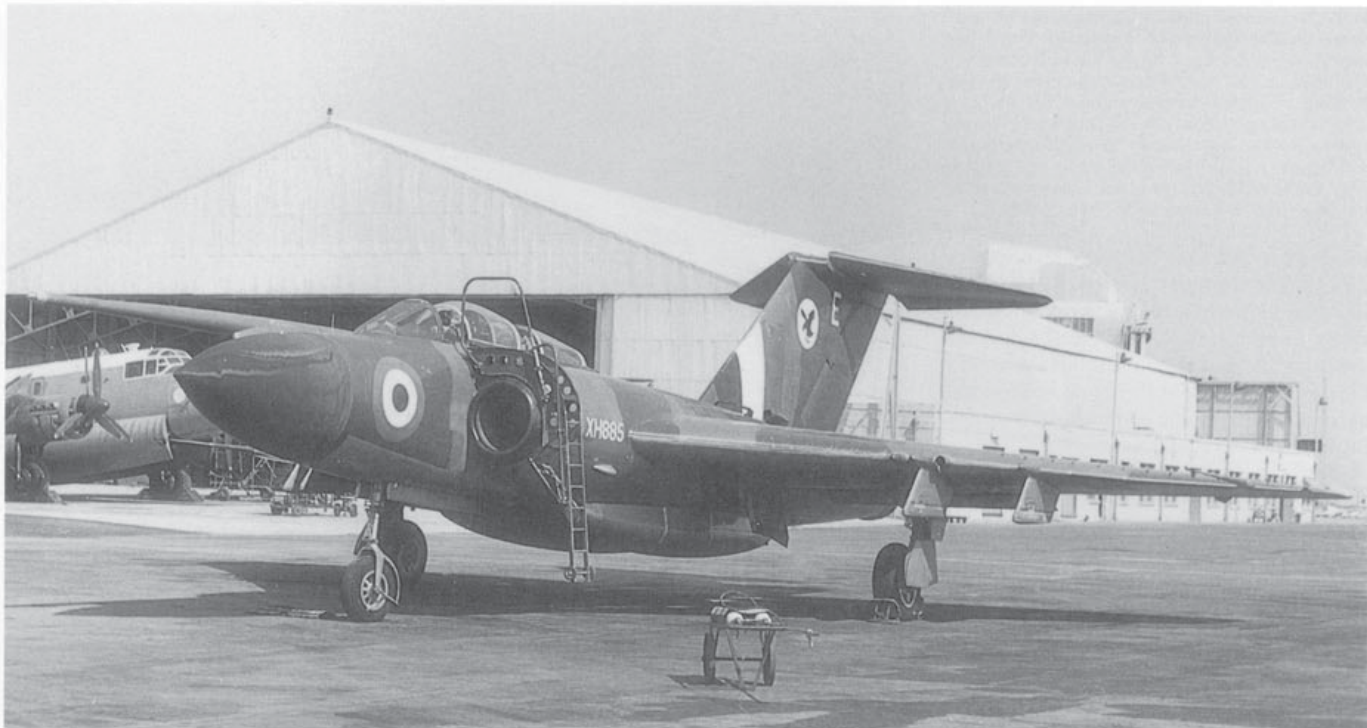


Force although many airframes actually lived very short lives. Most units disbanded on or about 1965. On withdrawal, numerous examples passed to Maintenance Units before being Struck Off Charge and scrapped but some did find further use as Ground Instructional Airframes at a variety of RAF stations. A good number were also employed as Gate Guards and several went to museums including one which is currently on show at Rimini, Italy.

POSSIBLE VARIANTS

An early Javelin development was the P.325 high-altitude fighter of 1951 with an increased span of 66ft (20.1m) and designed to escort the Vickers Valiant bomber. Sapphire Sa.3s were fitted while more wing fuel and bigger drop tanks gave sufficient for a range of 3,300 miles (5,310km) plus ten minutes combat. The P.322 was a basic

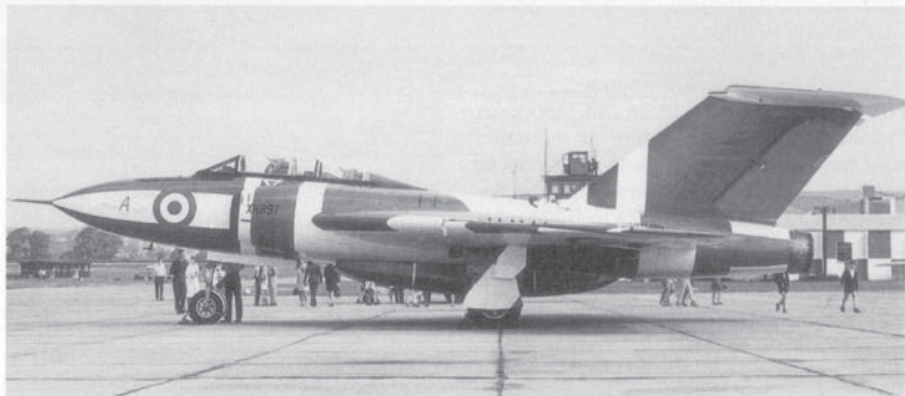




Possibly taken at Luqa, Malta on detachment, this No.23 Squadron FAW.Mk.9R shows off its long refuelling probe and the crew entry ladder. (MAP).

Javelin adapted in July 1950 as an interceptor with the introduction of two 9,750lb (43.4kN) thrust Sapphire Sa.50s. There was minimal structural alteration for a 30 per cent increase in thrust and an all-up-weight of 26,500lb (12,020kg). Estimated sea level speed was 610 knots (702mph/1,130km/h) Mach 0.92 and 540 knots (622mph/1,001km/h) Mach 0.94 at 50,000ft (15,240m). Rate of climb at sea level was 19,800ft/min (6,035m/min) and 40,000ft (12,192m) could be reached in 5.8 minutes. In June 1952 the Air Staff requested an F.4/48 all-weather interceptor development with improved performance and capable of carrying two Red Dean air-to-air missiles (which at this date was rather smaller than the massive weapon later put together by

Preparing to leave their UK base at Binbrook to reinforce the RAF's commitment to Far East security, No. 64 Squadron's Javelins are equipped with two long range tanks and two Firestreaks for the journey which was in-flight refuelled on the way. (MoD)



Vickers). Also required was a photo-reconnaissance version set out in OR.309 and PR.118 but cancelled in November 1953.

The Gloster G.A.6 Thin Wing or Super Javelin fighter programme began as the P.356 in July 1953 with the original Javelin fuselage attached to a new wing and new engines. Draft Specification F.118D and P was issued for what was still a subsonic aircraft (central number 118 was used several times). Alternative weapon loads comprised two Red Dean (now a much bigger weapon),

The multi-coloured Javelin FAW.Mk.9 XH897, that flew on a number of assorted experimental tasks when operated by A Flight, Fighter Test Squadron, A&AEE, Boscombe Down during the 1960s. It is seen at an RAF Chivenor Battle of Britain Open Day. (A.W.Hall)

four Firestreak or two of each, plus four Aden cannon and AI.18 radar, power coming from a Bristol Olympus 6 of 16,000lb (71.1kN) thrust. The specification was later renumbered F.153D and one prototype, XG336, was ordered in March 1954 with Sa.7 Sapphires. A development batch of 18

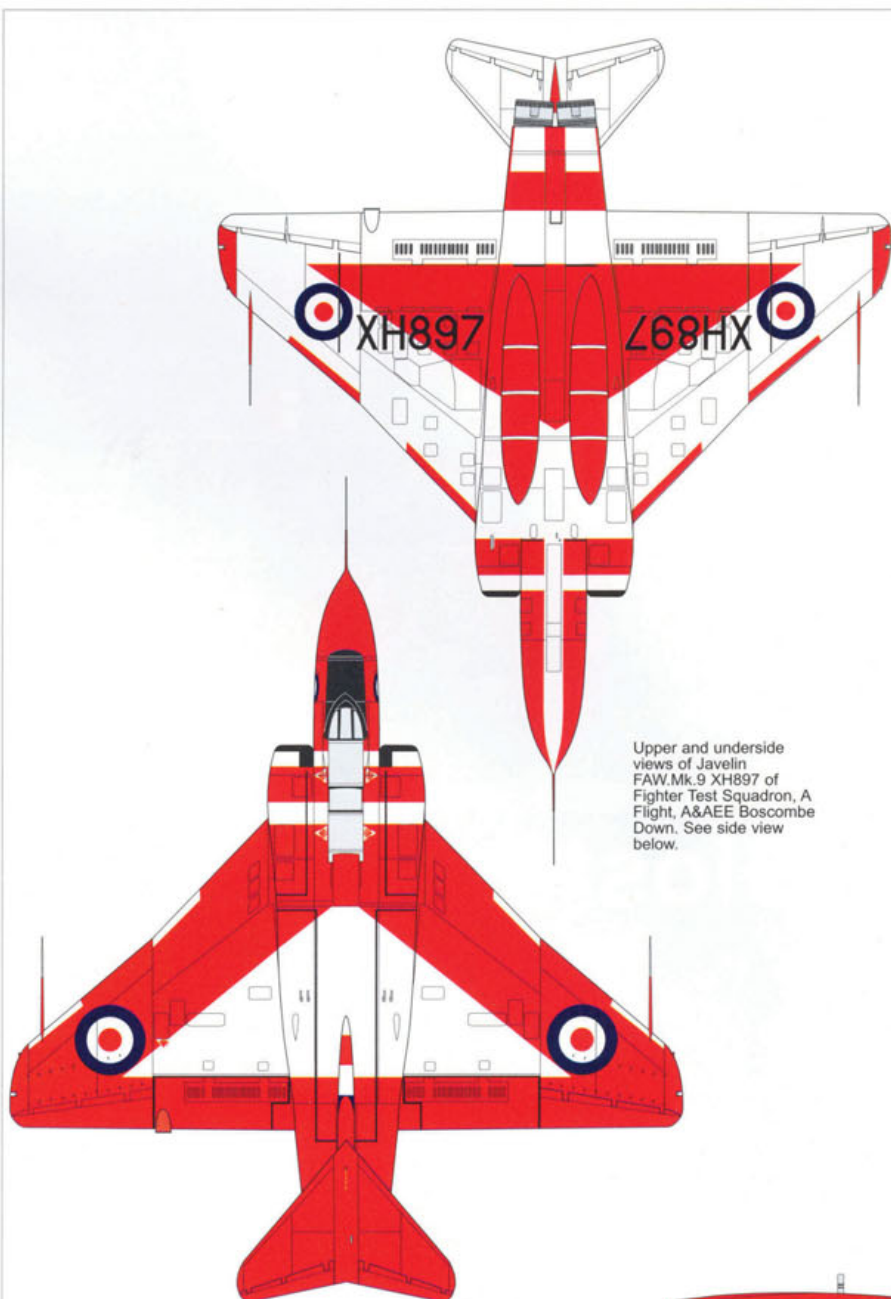


aircraft received approval in January 1955 (serials XJ836 to XJ842 and XJ877 to XJ887) and production was to start in 1958. (Note:- official sources which state XG336 was allocated to the prototype also show the same serial was given to, and later flown on, an English Electric F.Mk.1 Lightning in February 1954. It is possible this discrepancy will never be resolved).

Because of the need to accommodate expected improvements in enemy bombers, the whole Thin Wing Javelin (TWJ) concept changed from being a standard Javelin with new wings to an all-new aircraft that looked similar to the original. The final layout was the P.376 of late 1955, a huge fully supersonic fighter with two Red Deans and an Olympus 21 for a maximum Mach 1.82 at 36,000ft (10,973m). Intercepting bombers was to be its primary role. However, in late 1956 the Ministry of Supply became aware of the existence and far superior capability of the Avro Canada CF-105 Arrow, and also realised that on service entry in 1961 the TWJ would not be capable of dealing with Mach 2 bombers. Therefore, both Thin Wing Javelin and Red Dean were axed on 31 May, 1956, when XG336, under construction in the Experimental Shop, was apparently 60 per cent complete. At that stage the planned flight date was December 1958.

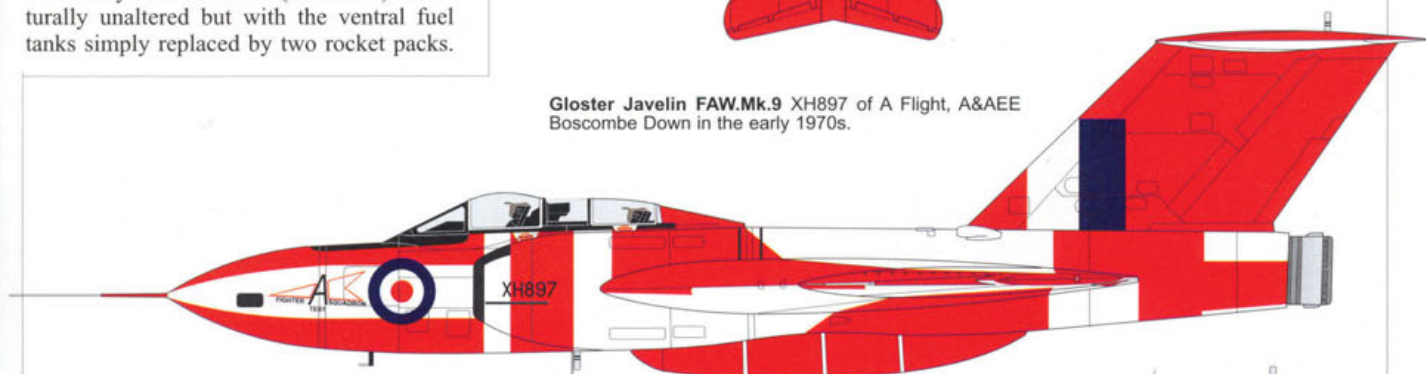
There was also a 'Canberra Replacement' bomber version of the TWJ first considered by the Air Staff in early summer 1955. It was intended to exploit to the full the aircraft's potential low level performance and a draft Operational Requirement OR.328 was first raised in July, but abandoned in March 1956 once the difficulties of adapting a fighter to a low level bomber role had become clear.

Possibly the last 'Javelin' project, dated February 1957, was the P.382 with two 2,250lb (10kN) Napier Scorpion rockets in an under fuselage pack to improve climb rate, operating height and acceleration. It was really a basic Mk.7 (no reheat) structurally unaltered but with the ventral fuel tanks simply replaced by two rocket packs.

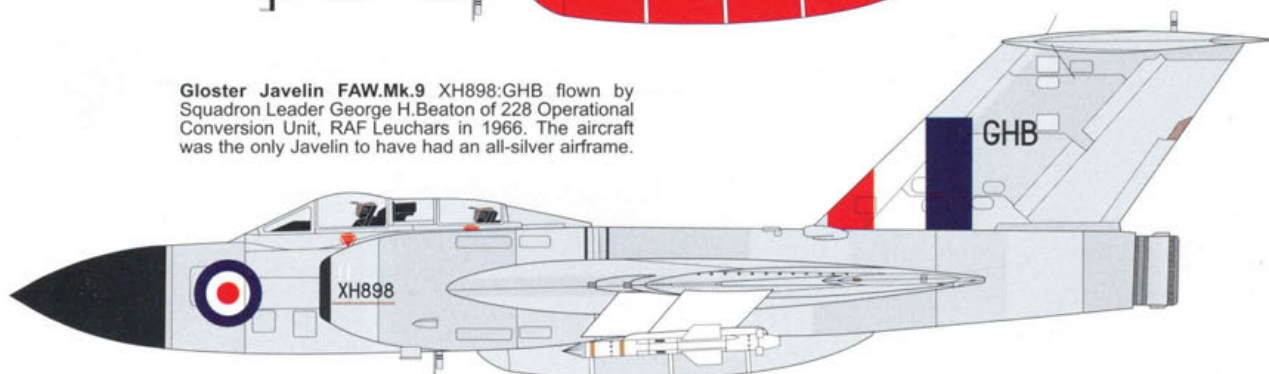


Upper and underside views of Javelin FAW.Mk.9 XH897 of Fighter Test Squadron, A Flight, A&AEE Boscombe Down. See side view below.

Gloster Javelin FAW.Mk.9 XH897 of A Flight, A&AEE Boscombe Down in the early 1970s.



Gloster Javelin FAW.Mk.9 XH898:GHB flown by Squadron Leader George H. Beaton of 228 Operational Conversion Unit, RAF Leuchars in 1966. The aircraft was the only Javelin to have had an all-silver airframe.





Gloster Javelin T.Mk.3 XH445-Z of No.64 Squadron when based at Tengah, Singapore in 1966. At least one T.3 was attached to each operational squadron for training and instrument checks. (Derek James)

Gloster Javelin in detail

Pictures by the author and via Derek N. James



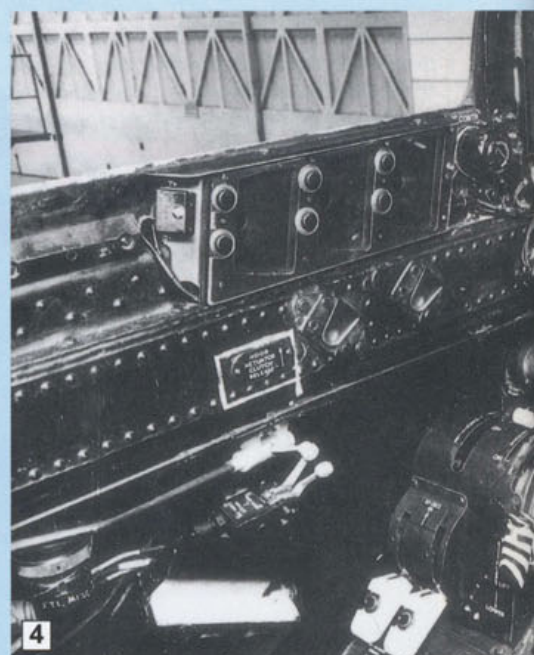
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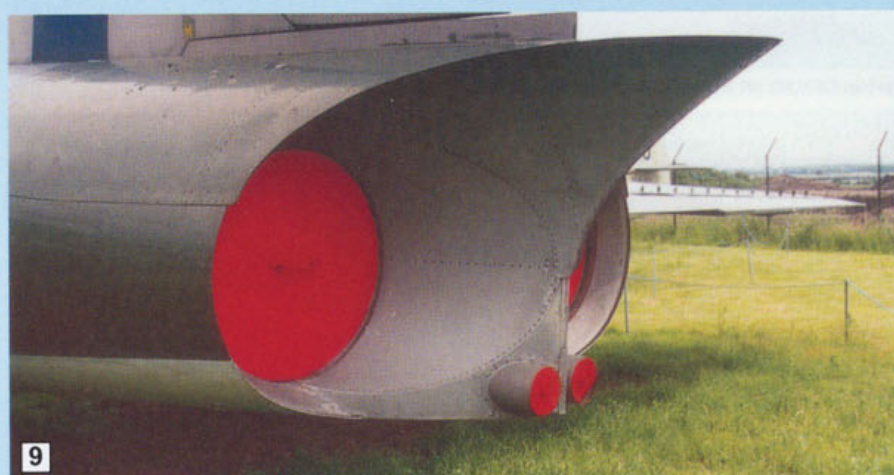


4



A selection of pictures showing an FAW.Mk5 - including ailerons and flaps, pen nib jet pipe fairing, main and nose wheel legs, cockpit and intake, fuselage underside, wing, cockpit interior and tail arrangements.

1. The canopy and engine intake. This also shows the small whip aerial near the wing leading edge. 2. Port side main wheel and undercarriage leg shows simple uncluttered construction. 3. Fuselage underside showing the starboard undercarriage, camouflage demarcation and several small intakes. The flaps are in the down position. 4. Cockpit interior. Predominant colour was black with red, white and yellow knobs to switches, throttle, undercarriage and other systems. (via Derek James) 5. Air brakes and flaps. Unusually the flaps are midway along the wing's cord allowing the air brakes to be positioned closer to the trailing edge. Both exerted a powerful usefulness in the Javelin's manoeuvrability. 6. In this view of the Javelin's nosewheel the leg is collapsed probably due to the lack of hydraulic fluid. 7. The all-flying tail showing the hinge point of the tailplane. The Javelin's four 30mm cannon were placed well out on the wing. 8. The canopy and windscreen with its windscreen wiper. 9. The unique pen-nib jet pipe fairing over the jet exhaust was a peculiarity of the earlier marks of Javelin before the fitting of the more powerful Sapphire engines and reheat. Compare this view with the one on the next page showing the same view of the Mk.9.

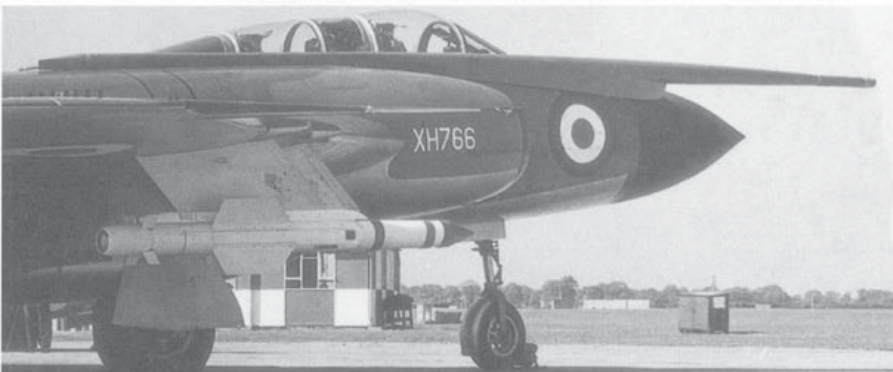




Above: Front view showing fully extended nose wheel. (Author) Below: Reheat extension on jet exhaust of a Javelin FAW Mk.9. (A.W.Hall)



Javelin FAW Mk.9R XH766 of No.64 Squadron showing the in-flight refuelling boom. (Author)



Estimated time to 50,000ft (15,240m) when igniting the Scorpions at sea level was about 4.3 minutes and radius of turn with boost (time to convert to a reciprocal course) was also roughly halved to about a minute. A prototype was offered for flight by end 1957.

IN CONCLUSION

For a first hand feel of the Javelin, the author sought the opinions of Brian Carroll who accrued over 1,000 hours on Mk.5 and Mk.9 aircraft with Nos.151 and 29 Squadrons. He felt the Javelin was a very comfortable aircraft to fly with a big cockpit, well displayed instruments and good all-round visibility, essential in a fighter, and in the combat situations in Cyprus he always had complete confidence in the aircraft. Having a Navigator in the back helped to *check six* which was also important.

There were weaknesses that were far too restrictive. Above 20,000ft (6,096m) and Mach 0.95, pilots were limited to 3g manoeuvres if the ventral tanks had any fuel in them and only 4g when empty, hardly enough in a combat situation. The power controls were such that it was easy to over-cook things with the result that much time was spent staying within limits rather than concentrating on the opposition. Aircraft size and radar signature were large, negating any chance of surprise, but the efficiency of the airbrakes was legendary and allowed for quite spectacular tactical recoveries to be made. A descent from a high level of around 36,000ft (10,973m) could begin only 10 to 12 miles (16 to 19km) from the runway threshold yet still allow a straight run in to break from about one mile (1.6km), holding high speed all the way. The chance of anything following such a recovery was practically nil; only the Hunter with full flap lowered was nearly able to stay with it.

Javelin plus marks were two engines and good single engine performance, fully powered, well balanced controls with duplicated hydraulics, a good armament of guns and four missiles with radar (it was a very stable gun platform), reasonable endurance, wheels up landings allowed in emergencies (ventral tanks jettisoned first) and excellent airbrakes giving 1g retardation and extremely effective aerodynamic braking.

Negatives were a lack of thrust with reheat only useable when fuel pump output exceeded normal engine demands, a complex fuel system where it was possible to cross transfer in such a way as to starve both engines, restricted flight envelope with looping, stalling and spinning prohibited (unreal for a fighter), low level speed restricted to 535 knots (616mph/991km/h), 'g' limits too low (5.5 to as little as 3 in some flight conditions), no spin recovery chute (a useful addition in combat) and inverted flight time limited to 15 seconds.

Brian Carroll attended the All Weather Fighter Combat School at West Raynham and at the end of the course led 16 Javelins and 20 Hunters against targets in Germany, losing only one of each (on film) while fighting their way through the best 2nd Tactical Air Force could provide. Against the Hunter in one to one and two against two combat, the Javelin came away with honours



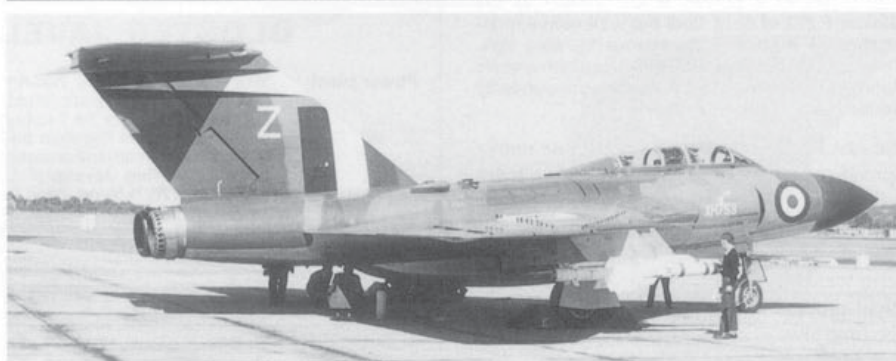
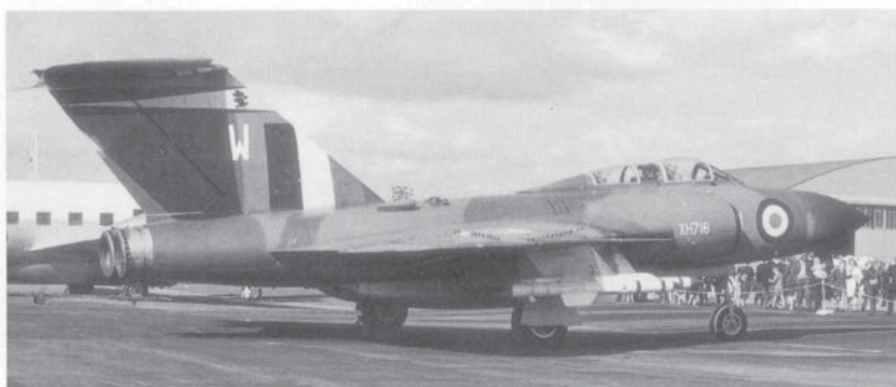
Above: An attractive in-flight picture of a Javelin FAW.Mk.9, XH966, which was retained by Gloster Aircraft for Firestreak trials before going to No. 41 Squadron. Right: Javelin FAW.Mk.9 XH716:W of No. 11 Squadron at RAF Gaydon Battle of Britain Open Day 19 September 1964. (R.W.Cranham). Lower right: Javelin FAW.Mk.9 XH753:Z showing the variations in No. 11 Squadron markings on the fin when compared to the illustration above. (MAP)

even. The effective slow down from the barn door brakes could force a fly-through, while the head-up collimator displayed through the gunsight proved invaluable when a target attempted evasion by entering cloud.

Air-to-air combat between different types of aircraft is very much horses for courses; fighters that dominate at low level can be found wanting against the same opponent at medium to high level. But the Javelin's great naval rival, the Sea Vixen, could usually come out best at most heights since the RAF machine was minimum speed limited and the Sea Vixen could scissor around at slow speed; the Javelin's big advantage here was its cannon where the Vixen had none. The Javelin could match a Hunter above 20,000ft (6,096m) because at high level it could out-turn it.

The fact that the Javelin remained on RAF strength for 12 years shows it was good enough to do the job required. Restrictions in the flight envelope did not help the Javelin to be a dogfighter, but as a bomber interceptor this was not so big a problem. Firestreaks could be fired at far greater range than the Aden cannon and, controlled effectively, the Javelin could intercept any V-bomber with or without the need for AAMs. Fortunately, it never had to fire its weapons in anger. It appears that no effort was made to fit the improved Red Top missile.

Many modifications were needed to clear



Gloster Javelin kits, decals and accessories

List current to October 1998

Scale	Type	Manufacturer	Reference	Remarks
1:72	Gloster Javelin	Aeroclub	ABC031	Canopies
1:72	Gloster Javelin	Airwaves	AEC72133	Etched brass airbrakes
1:72	Gloster Javelin FAW9/9R	Airwaves	AEC72135	Etched brass conversion parts
1:72	Gloster Javelin FAW9/9R	Airfix	AX04045	Injection moulded kit
1:72	Gloster Javelin T.3	Heller	AX04042	Injection moulded kit. Also marketed under Airfix label.
1:72	Gloster Javelin	Chematic	CH72324	Injection moulded kit
1:72	Gloster Javelin FAW1/4/5	Maintrack	MK7216	Resin conversion parts
1:72	Gloster Javelin FAW2/6	Maintrack	MK7217	Resin conversion parts
1:72	Gloster Javelin FAW7/9	Plastyk	PYS008	Injection moulded kit
1:72	Gloster Javelin	Testors	TES526	Injection moulded kit now deleted
1:48	Gloster Javelin FAW9	Dynavector	DYN4805	Vacuform with metal parts

No specialist decal sheets are known to have been issued for the Javelin



The end of the line. Maintenance airframes - 1. FAW.Mk.1, 7663M ex-XA571 of No. 87 Squadron at Halton. 2. FAW.Mk.8 7829M ex-XH992 at Cosford. 3. Southend Museum had XH768, ex-Cranwell, 7929M. Javelins sold for scrap 4. FAW.Mk.8 XH991 was formerly with No.41 Squadron.



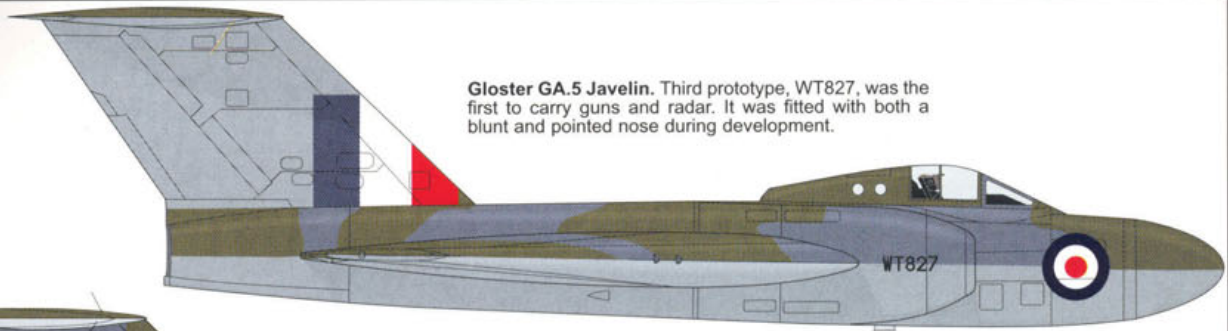
Two views of a project model similar to the Gloster P.272 of April 1948 but with conventional ailerons replacing the all-moving wing tips. The model belongs to the Gloucestershire Aviation Collection's Jet Age Museum currently housed at Staverton. (Author)

the Javelin for service; a total of nine marks spread over just 430 production aeroplanes tells its own story. But a constant influence on military aircraft design in the 1950s was fear of another European conflict. The short term was always a big factor in the development process and what kit was available at the time always counted, one reason why the Air Staff persevered with the Javelin. The loudest criticism concerned its flying capabilities, but that misses the point for once the aircraft's limitations had been established, it was possible to use it in a way that prevented the machine from going beyond them. Thanks to the missile armament, it possessed a quite formidable combat potential which was available in all weathers. Many within the RAF were happy with the Javelin because it was just what they wanted to knock down Soviet bombers, but there were others who did feel the DH.110 would have been a better choice.

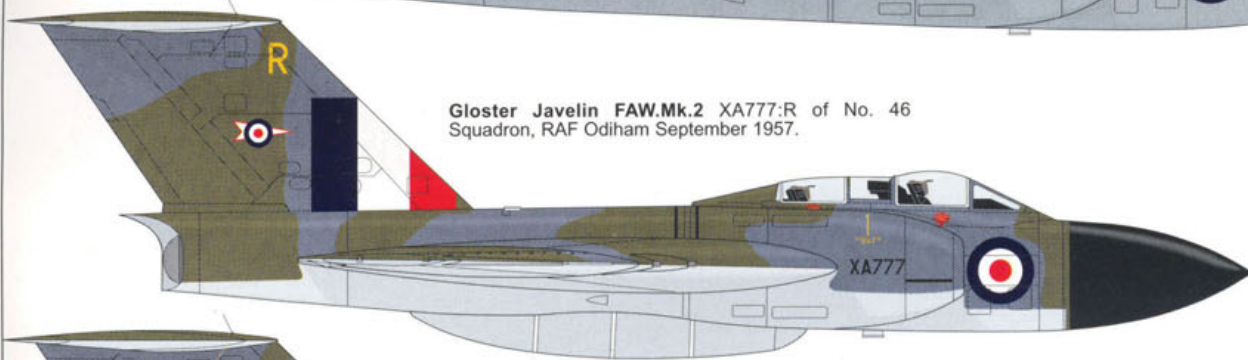
GLOSTER JAVELIN SPECIFICATION

Power plant:	Mks.1, 2, 3, 4, 5 and 6. Two Armstrong Siddeley Sapphire Sa.6 turbojets each rated at 8,300lb (36.9kN) static thrust; Mk. 7 Two Sapphire Sa.7 turbojets rated at 11,000 lb (48.9kN) static thrust. Mks. 8 and 9 Two Sapphire Sa.7R turbojets rated at 11,000 lb thrust dry and 12,300 lb (54.7kN) with limited reheat applied at height. GA.6 Thin Wing Javelin (P.376) Two Bristol Olympus Ol.21R turbojets rated at 28,500 lb (126.7kN) reheated thrust.
Performance:	Maximum level speed: FAW.Mks. 1 and 2: 709 mph (1,141 km/h) at sea level, 622 mph (1,001 km/h) Mach 0.94 at 40,000ft (12,192m) T.Mk.3: 650 mph (1,046 km/h) at sea level. FAW.Mks. 8 and 9: 702 mph (1,130 km/h) at sea level, 616 mph (991 km/h) Mach 0.93 at 45,000 ft (13,716m) P.376: (Estimated) Mach 1.82 at 36,000 ft (10,973m) Maximum permissible dive speed: Mach 1.08. Time to altitude: FAW.Mks. 1 and 2 - 9.8 minutes to 45,000 ft (13,716m). T.Mk. 3 - 22 minutes to 45,000 ft. FAW.Mk.7 - 6.6 minutes to 45,000 ft. FAW.Mks. 8 and 9 - 7.24 minutes to 40,000ft (12,192m) 9.25 minutes to 50,000 ft (15,240m). P.376 (Estimated) - 8.4 minutes to 50,000ft. Absolute ceiling: FAW.Mks. 1 and 2 - 55,000ft (16,764m). FAW Mks.8 and 9 - 54,000 ft (16,459m). P.376 (Estimated) - 58,000 ft (17,678m)
All-up-weight:	(All shown with two ventral tanks) FAW.Mk.1 - 36,500 lb (16,556 kgs). FAW.Mk.2 - 37,000 lb (16,783 kgs). T.Mk.3 - 43,000 lb (19,505 kgs). FAW.Mk.8 - 42,510 lb (19,283 kgs). FAW.Mk. 9 - 43,165 lb (19,580 kgs). P.376 (Estimated) - 60,300 lb (27,352 kgs)
Dimensions:	All Marks of Javelin: Span: 52.0ft (15.8m). Overall length: 56.33 ft (17.2m). FAW.Mks.2, 6 and 8 - 55.2 ft (16.8m). T.Mk.3 - 60.0ft (18.3m). FAW.Mk.9 - 56.75ft (17.3m). Height: 16.0ft (4.9m). Wing area: 927 sq ft (86.2 sq.m) P.376 - Span 60.8ft (18.5m), Overall length 72.0ft (21.9m), Height 12.0ft. (3.7m), Wing area 1,235 sq.ft (114.9 sq.m)
Armament:	All marks of Javelin - Four 30-mm Aden cannon; FAW.Mks 7, 8 and 9 - Four Firestreak AAM; P.376 Two Red Dean AAM.

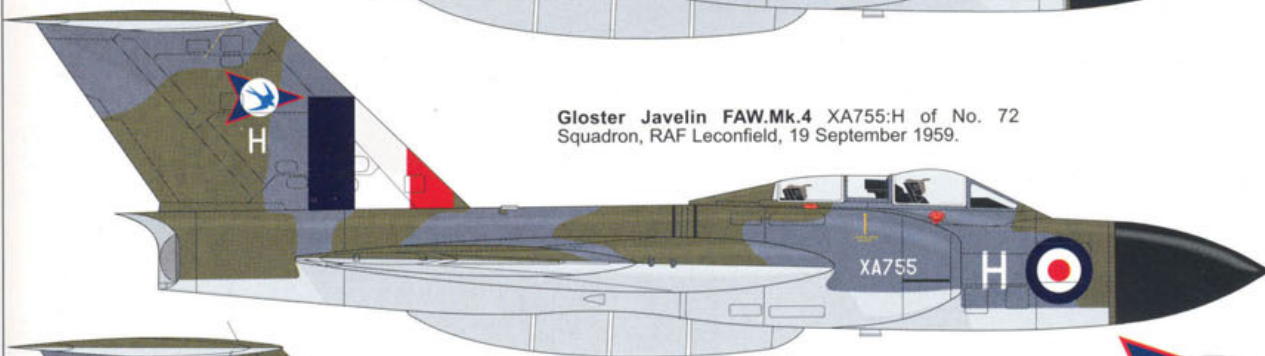
Gloster GA.5 Javelin. Third prototype, WT827, was the first to carry guns and radar. It was fitted with both a blunt and pointed nose during development.



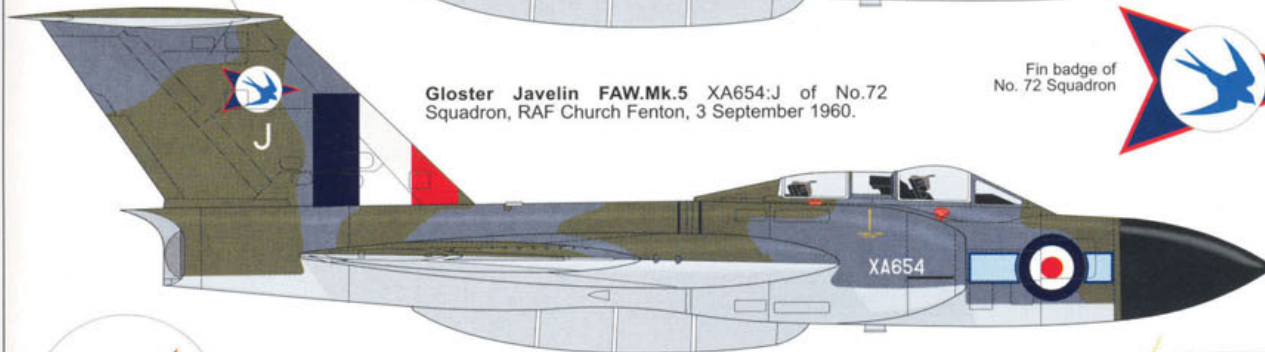
Gloster Javelin FAW.Mk.2 XA777:R of No. 46 Squadron, RAF Odiham September 1957.



Gloster Javelin FAW.Mk.4 XA755:H of No. 72 Squadron, RAF Leconfield, 19 September 1959.



Gloster Javelin FAW.Mk.5 XA654:J of No.72 Squadron, RAF Church Fenton, 3 September 1960.



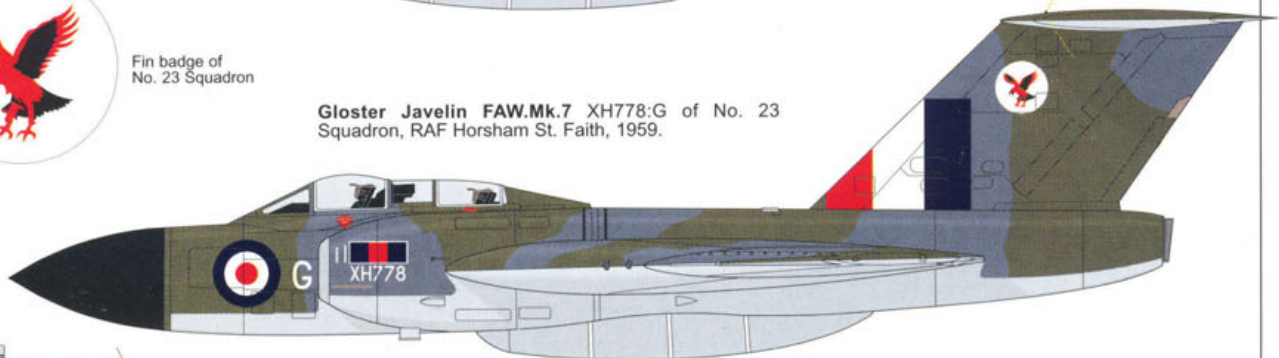
Fin badge of No. 72 Squadron



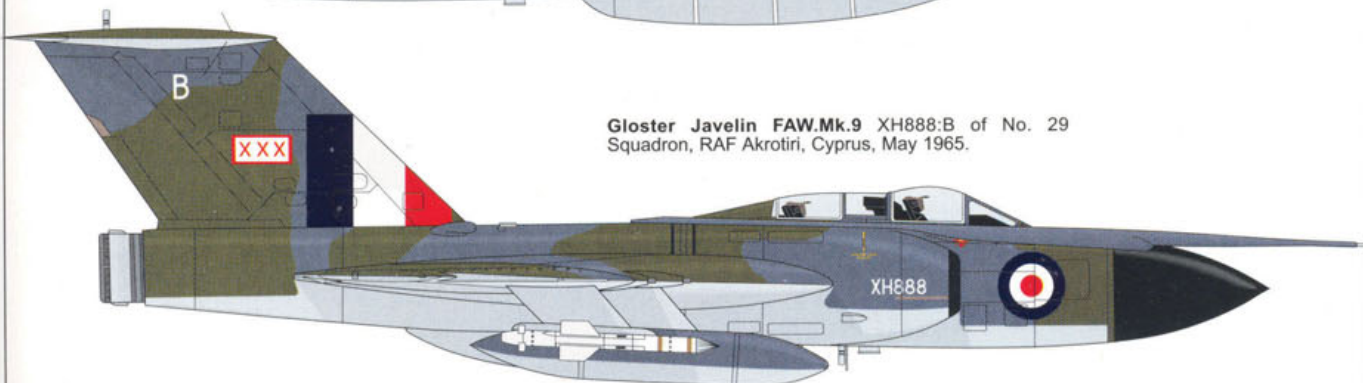
Fin badge of No. 23 Squadron



Gloster Javelin FAW.Mk.7 XH778:G of No. 23 Squadron, RAF Horsham St. Faith, 1959.



Gloster Javelin FAW.Mk.9 XH888:B of No. 29 Squadron, RAF Akrotiri, Cyprus, May 1965.



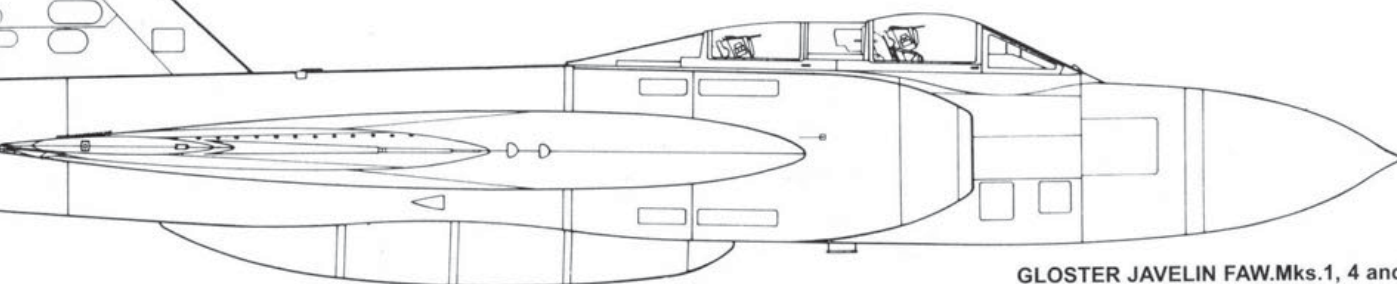


Two views of No.64 Squadron Javelin FAW.Mk.9s. Both were taken when the squadron deployed to Tengah, Singapore where they assisted in putting in force the UK government's policies in the Far East. In both pictures the in-flight refuelling boom has been removed but the possible use

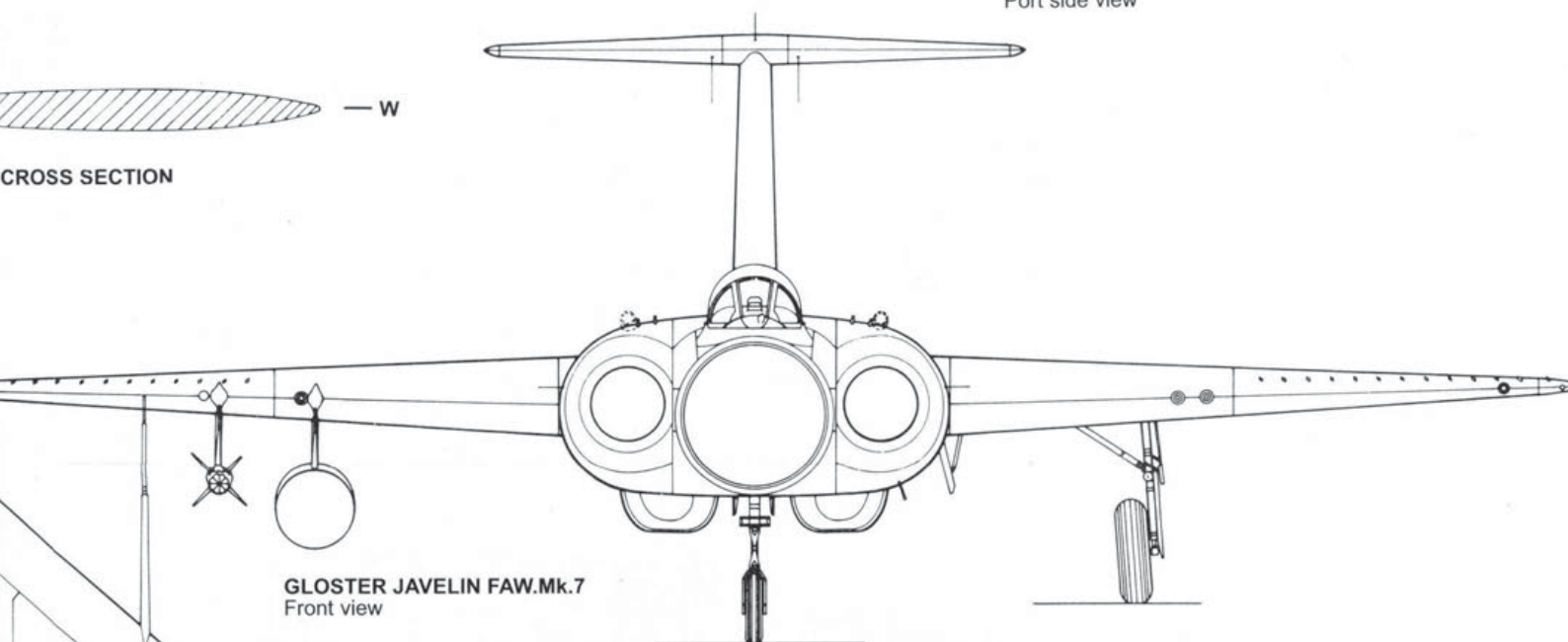
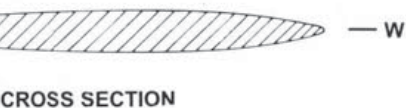
of long range tanks maintained, especially in the picture above where only one Firestreak is shown under each wing. No. 64 Squadron's deployment lasted until 16 June 1967 when it was almost the last front-line Javelin squadron to disband. (MoD above, Derek James, below)



GLOSTER JAVELIN FAW.Mks 1 to 9R

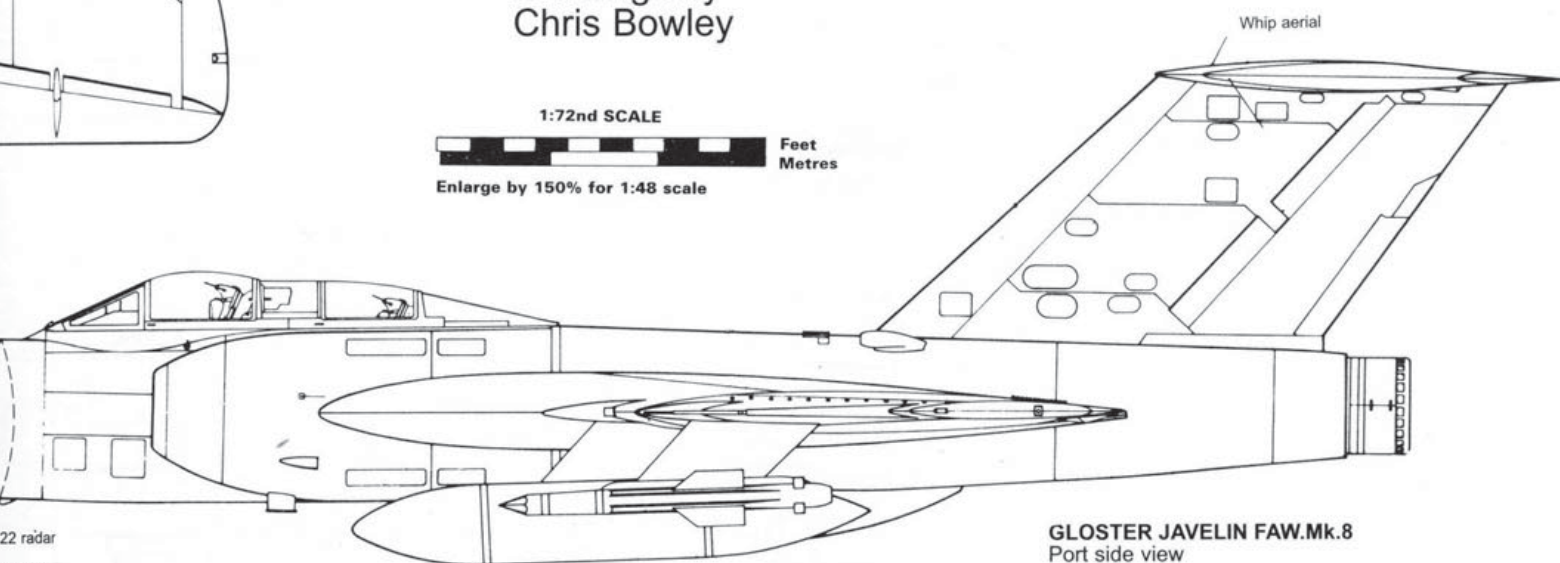
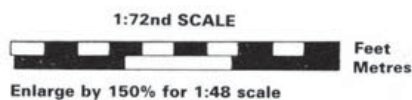


GLOSTER JAVELIN FAW.Mks.1, 4 and 5
Port side view



GLOSTER JAVELIN FAW.Mk.7
Front view

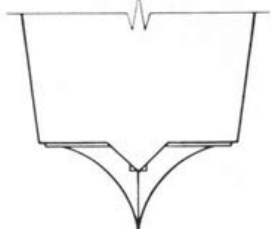
Drawings by
Chris Bowley



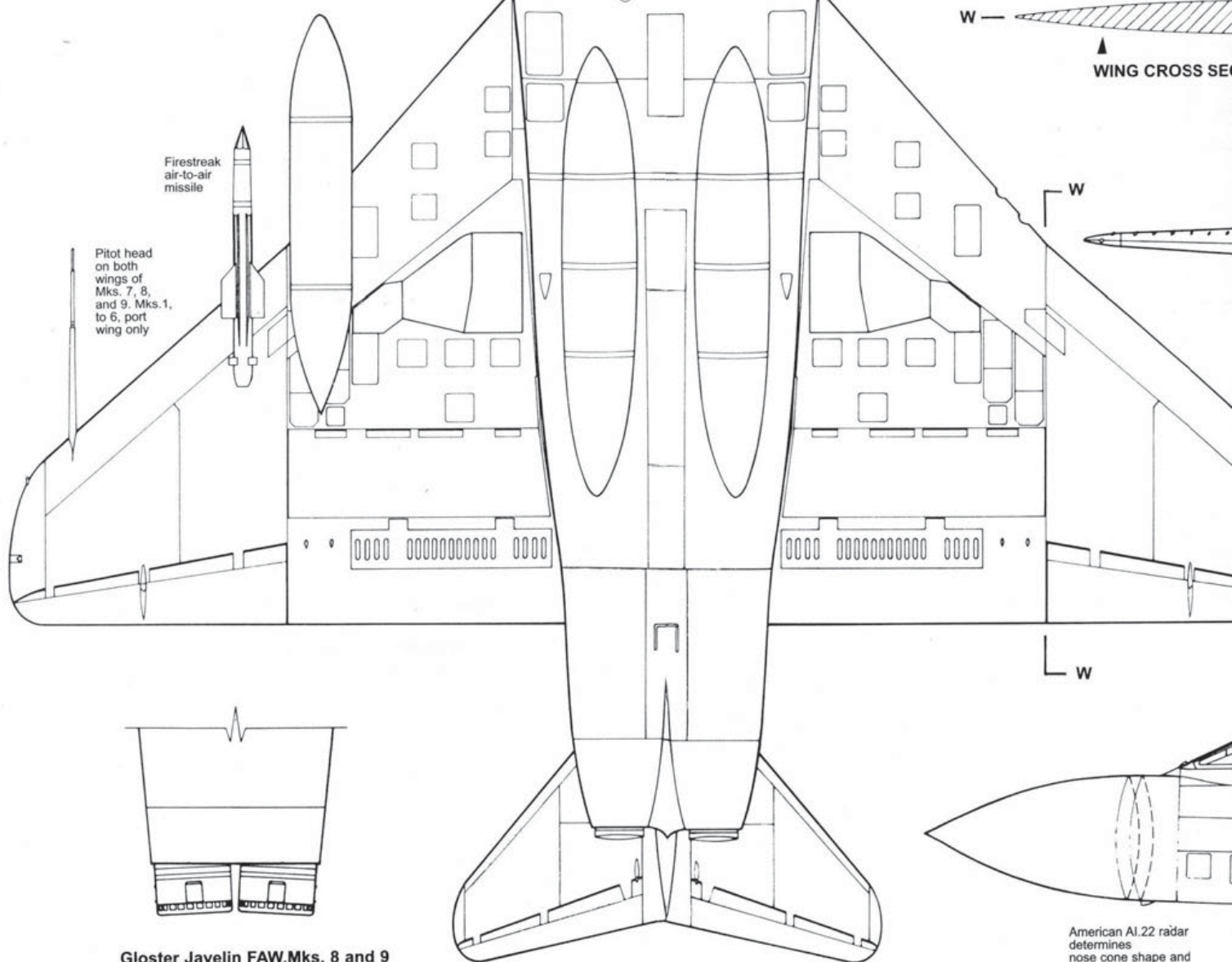
GLOSTER JAVELIN FAW.Mk.8
Port side view

22 radar
shape and
2, 6 and 8

Gloster Javelin FAW Mks. 1 to 6
Underside view of pen-knib fairing
on jet exhaust



GLOSTER JAVELIN FAW.Mk.7
Underside plan view



Firestreak
air-to-air
missile

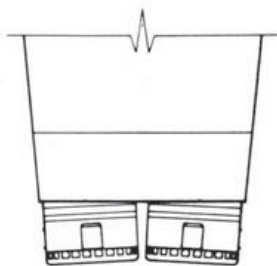
Pitot head
on both
wings of
Mks. 7, 8,
and 9. Mks.1,
to 6, port
wing only

W —  **WING CROSS SECTION**

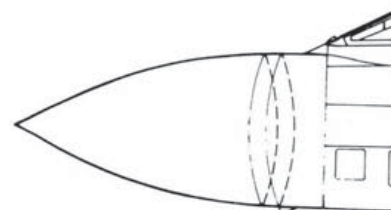
W

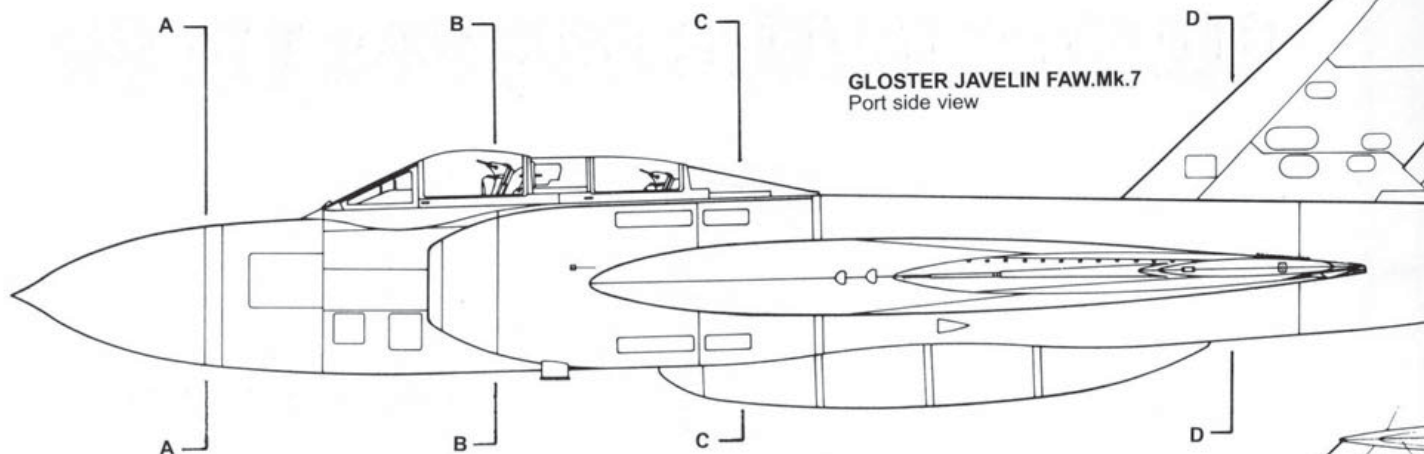
w

Gloster Javelin FAW.Mks. 8 and 9
Scrap view of afterburners

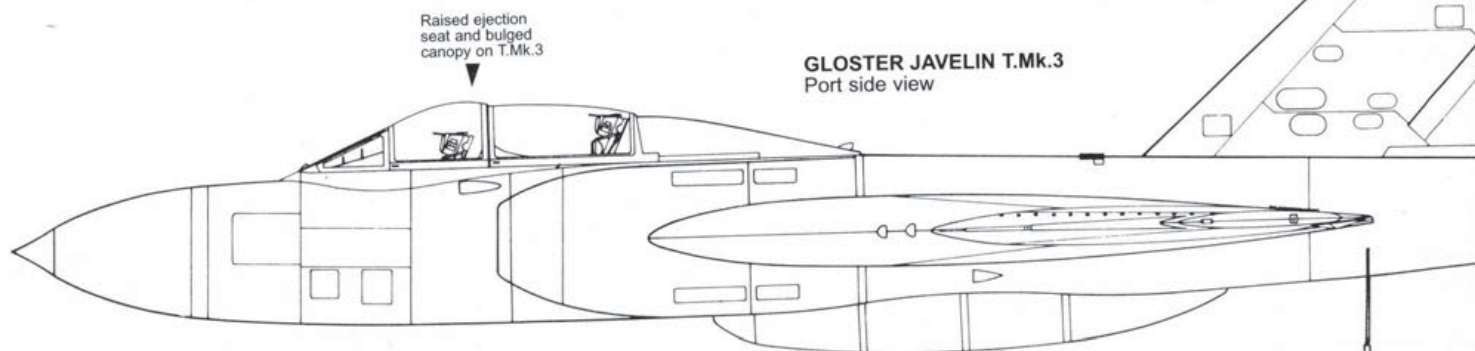


American AI.22 radar
determines
nose cone shape and
oblique joint
on FAW Mks.2, 6 and 8





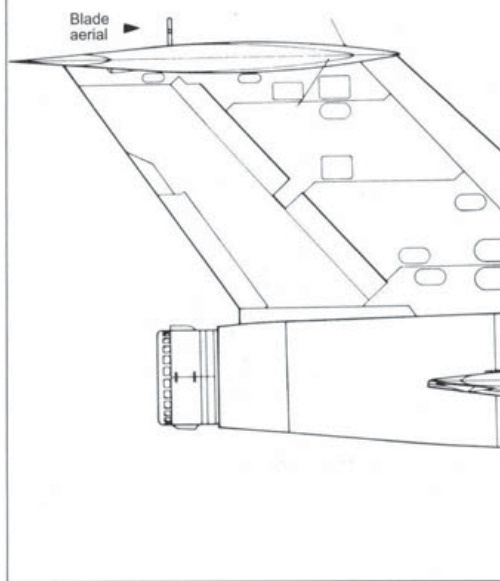
GLOSTER JAVELIN FAW.Mk.7
Port side view



GLOSTER JAVELIN T.Mk.3
Port side view

Gloster JAVELIN

Drawings by Chris Bowley



GLOSTER JAVELIN FAW.Mk.9R
Starboard side view

1:72nd SCALE
Feet
Metres
Enlarge by 150% for 1:48 scale

Ram air
intakes

