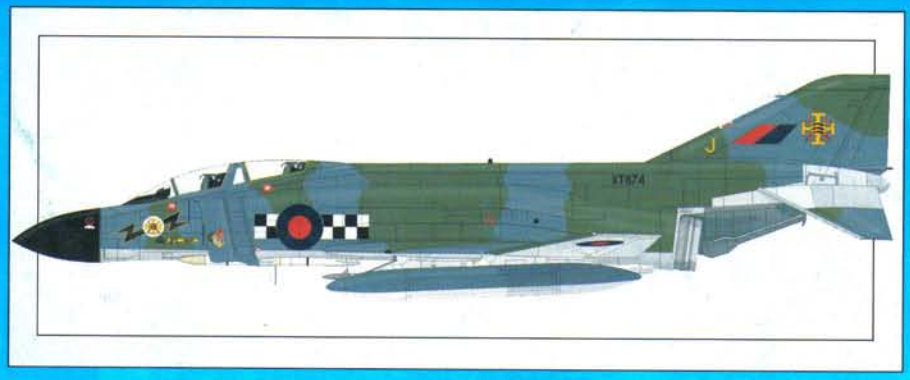


WARPAINT SERIES No. 31

McDonnell Douglas F-4K and F-4M PHANTOM

BY STEVE HAZELL

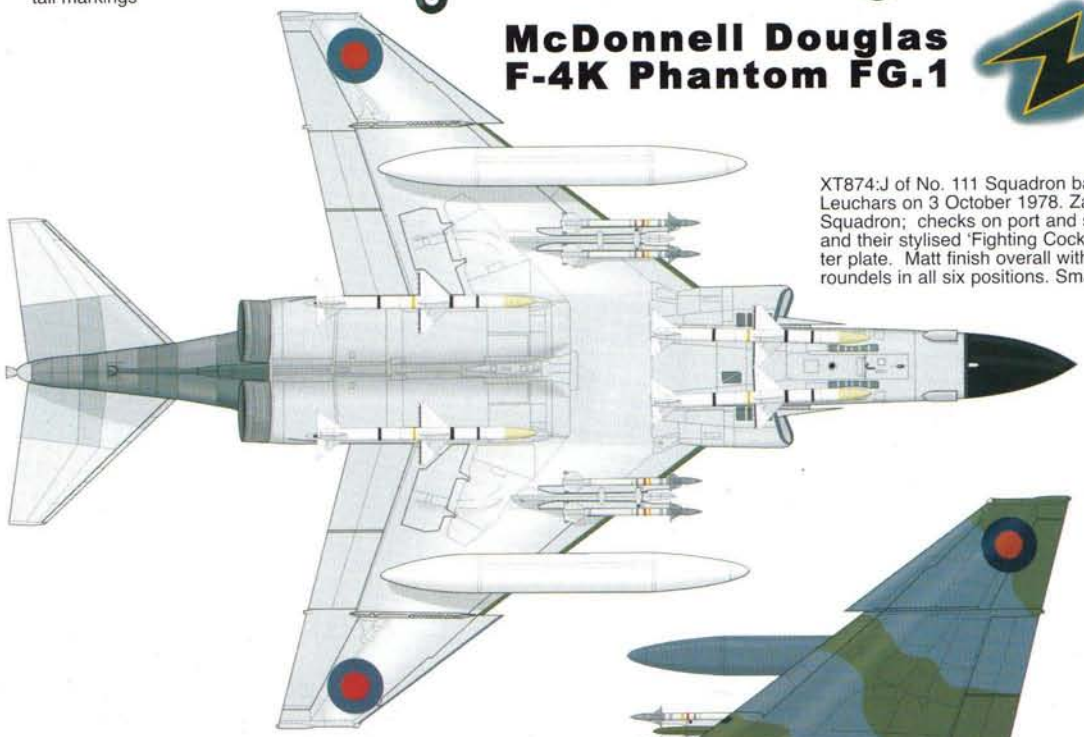
Two of 892 Squadron's Phantom FG.1s in a low fly-past over Luqa airfield, Malta when shore-based from HMS Ark Royal. The squadron's Omega badge on the tail was indicative of this squadron being the last fixed wing fighter unit in the Royal Navy before the arrival of the Sea Harrier. (Godfrey Mangion)

No. 111 Squadron's tail markings

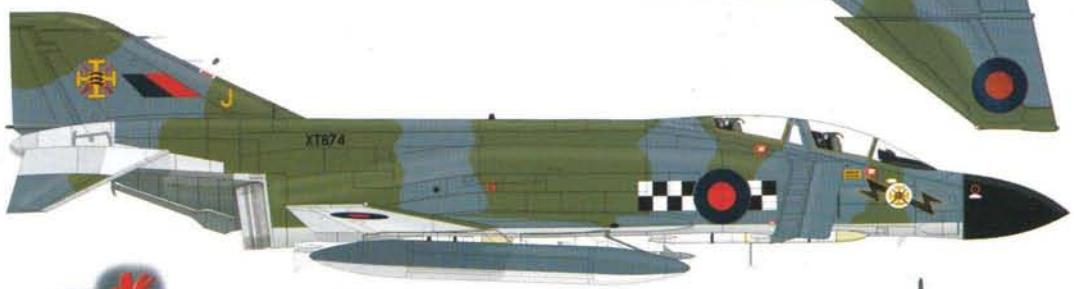
McDonnell Douglas F-4K Phantom FG.1

No. 111 Squadron's nose markings

XT874:J of No. 111 Squadron based at RAF Leuchars on 3 October 1978. Zapped by No. 43 Squadron; checks on port and starboard sides and their stylised 'Fighting Cock' on the port splitter plate. Matt finish overall with Tactical Type 'D' roundels in all six positions. Small yellow code



Drawings by David Howley



Black and White checks and No. 43 Squadron's stylised 'Fighting Cock' zap

By Steve Hazell

McDonnell Douglas F-4K and F-4M PHANTOM

The 1960s were years of increasing political tension around the world. Throughout the decade the military strength of the Soviet Union continued to grow at an alarming rate and the USSR made no secret of its aim to rival the USA as a global superpower. The early years saw the Cold War reach new levels of tension between East and West, to be followed by the progressive spread of the Southeast Asia War in which the USA in particular played an ever more active part. During these years Britain maintained a policy of actively protecting its interests around the world and this required armed forces capable of being deployed anywhere, independent of NATO support. Despite the growing need to control spending the Conservative government of the day placed a high priority upon modernising Britain's armed forces, particularly the Royal Navy and Royal Air Force, to counter the perceived threats to Britain's colonial and Commonwealth interests and to support its international treaty obligations.

An important part of this programme was the acquisition of supersonic strike fighters to replace the de Havilland Sea Vixen air defence fighter and Supermarine Scimitar strike fighter in the Fleet Air Arm, and the Hawker Hunter ground attack fighter in the RAF. There were also plans to replace Britain's existing aircraft carriers with the larger CVA-01 Class of strike carrier from which the naval aeroplane would operate.

Early in 1963 political and financial considerations led to the vertical take-off and landing Hawker P.1154 being chosen to fulfil the needs of both services in the hope that a common type would keep costs down. Each service was to have a different version specifically tailored to its needs and by mid 1963 the designs had been frozen. Full development work was authorised and the

This RAF Germany Phantom has a full war load of four Sparow and four Sidewinder missiles, long range tanks and a SUU-23A cannon on the centre line station. (RAF MUseum)

First flight of the Royal Navy's F-4K Phantom was made at the St.Louis plant of McDonnell Aircraft Corporation on 27 June 1966. Serialled XT595, it underwent a period of extended Spey 201 engine runs before the flight.

The first prototype of the F-4M for the RAF, XT852, seen tucking up the undercarriage during its flight testing in America. Two dummy Sparrow missiles on the forward fuselage stations house flight test instruments.

eventual production run for both services was expected to reach several hundred aircraft.

However, it soon became apparent that a single type could not meet the services' particular requirements without severely compromising the aircraft's performance. Almost from the beginning the Admiralty voiced its reluctance to acquire the P.1154(RN), and with 1968 set as the target date for deliveries of the naval fighter to begin, time did not favour the P.1154(RN) or its proposed Bristol Siddeley BS.100 vectored thrust engine. The RAF could just accept the proposed time schedule for its P.1154(RAF) but if the proposed naval version indeed proved unsuitable then the RN would have to order an alternative aircraft, one already in production, without delay. The obvious candidate was the McDonnell F-4 Phantom II then in production for the US Navy and during 1963 the Admiralty prepared its case for abandoning the P.1154(RN) and ordering instead the Phantom as the RN's next generation fleet fighter. Inevitably this policy would mean that planned procurement of the P.1154 would be reduced and unit costs would rise, making it a less attractive proposition for the RAF, so that service also began to consider the Phantom as an alternative should the Admiralty pull out of the P.1154 programme.

McDonnell publicity photograph of F-4M prototype XT852 in full RAF camouflage seen at the time of its roll out at St.Louis. Dummy missiles and the wing hard points have been added before the first flight.

ORIGINS OF THE PHANTOM

During 1953 the McDonnell Aircraft Corporation had begun a private venture study to produce a twin-engined, supersonic, all-weather version of its F3H Demon fighter then in production for the US Navy. This design failed to win a production contract, which went instead to the Chance Vought F8U Crusader, but McDonnell persevered with the design, re-submitting it the following year as a long range, all-weather, naval attack aircraft. In October 1954 the USN Bureau of Aeronautics ordered two flying prototypes of this design now designated YAH-1, but stipulated some design changes as well, notably the fitting of General Electric J79 turbojet engines equipped with afterburners.

The following year however, the USN revised the specification. What was now wanted was a high-altitude, long range, all-weather interceptor capable of sustained supersonic speed, carrying a long range, all-missile armament and a second crew member to operate the weapons system. McDonnell duly amended its design and in July 1955 the two YAH-1s were re-designated XF4H-1s and five YF4H-1 development aircraft were added to the contract. At the end of 1956 a further 16 development aircraft were ordered and the name Phantom II adopted, the original FH-1 Phantom having long since been retired from service.

The first XF4H-1 made its maiden flight on 27 May 1958 and by the end of the year the Phantom II had been selected as the next US Navy fleet fighter and ordered in to full production. Deliveries of the first production aircraft, the interim F4H-1F, began late

F-4K and F-4M Phantom camouflage and markings

Drawings by David Howley

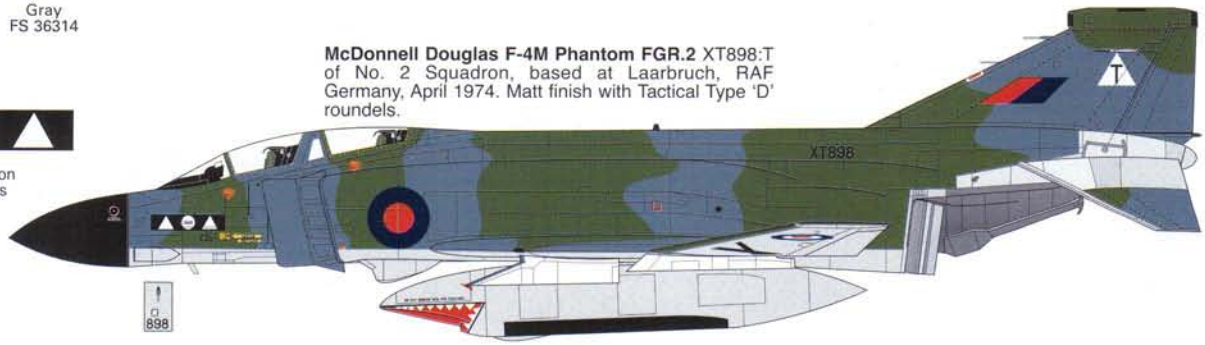
F-4K and F-4M PHANTOM COLOUR KEY

Black	White	Yellow	Post Office Red BS 538	Roundel Blue BS 110	Aluminium	Dark Green BS 641	Extra Dark Sea Grey BS 641	Dark Sea Grey BS 638	Medium Sea Grey BS 637	Light A/c Grey BS 627	Camouflage Grey BS 626

Gray FS 36270	Gray FS 36314

No. 2 Squadron nose markings

McDonnell Douglas F-4M Phantom FGR.2 XT898:T of No. 2 Squadron, based at Laarbruch, RAF Germany, April 1974. Matt finish with Tactical Type 'D' roundels.

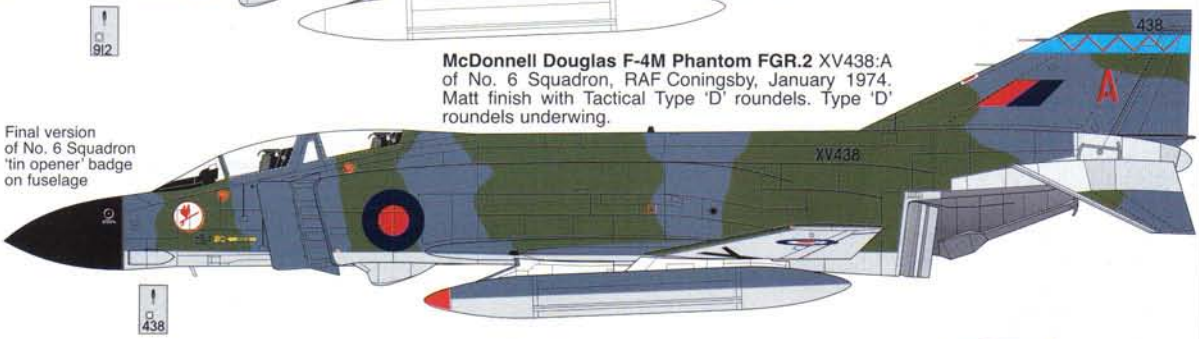


Original No. 6 Squadron 'tin opener' badge on fin

McDonnell Douglas F-4M Phantom FGR.2 XT912 of No. 6 Squadron based at RAF Coningsby, mid-1969. Original gloss finish, Type 'D' roundels.

Final version of No. 6 Squadron 'tin opener' badge on fuselage

McDonnell Douglas F-4M Phantom FGR.2 XV438:A of No. 6 Squadron, RAF Coningsby, January 1974. Matt finish with Tactical Type 'D' roundels. Type 'D' roundels underwing.

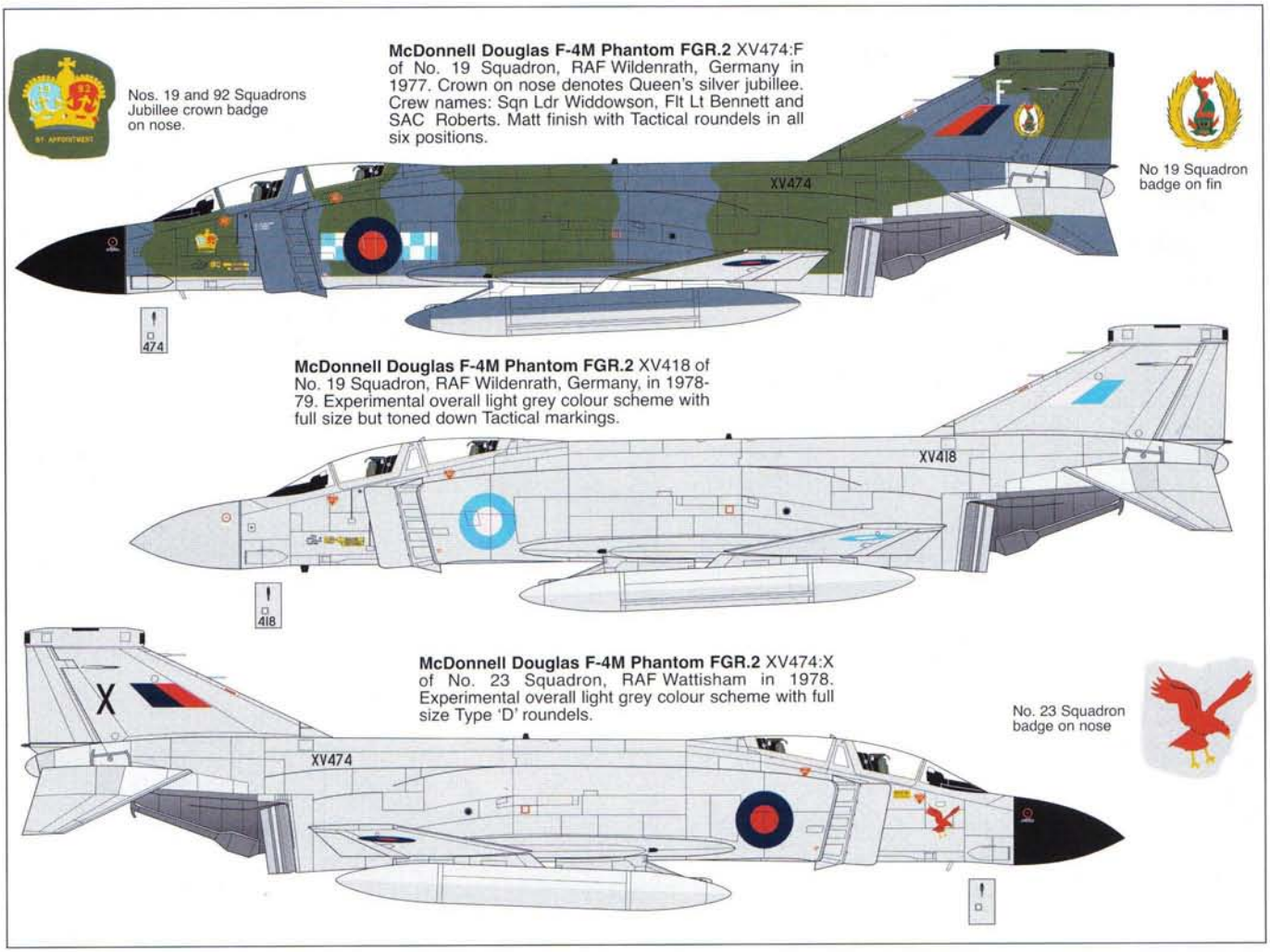


No. 14 Squadron nose markings

McDonnell Douglas F-4M Phantom FGR.2 XV432 of No. 14 Squadron based at RAF Bruggen, Germany in 1975. Fin marking has 18 blue diamonds. Matt finish with Tactical Type 'D' roundels. Type 'D' roundels underwing.

No. 17 Squadron badge on nose

McDonnell Douglas F-4M Phantom FGR.2 XV468 of No. 17 Squadron based at RAF Bruggen, Germany in 1970. Original gloss finish Type 'D' roundels in all six positions.



One of the early Phantom FGR.2s to be delivered was XV406 which went to British Aerospace at Holme-on-Spalding Moor for the evaluation of the reconnaissance pack seen hung on the centre line station. It eventually became a maintenance airframe as 9098M. (BAe)

in 1960, to be followed in June 1961 by the F4H-1 equipped to full production standard. By now the USAF was also taking notice of the Phantom and during 1961 evaluated the type as a potential interceptor fighter. Such was the type's remarkable performance for those times that the following year the USAF also ordered the Phantom into production in two basic versions. The F-110A was to become the service's standard interceptor fighter and ground attack aircraft whilst the RF-110A would equip the USAF's tactical reconnaissance squadrons. Meanwhile Phantom deliveries continued to the USN and also to the US Marine Corps which used the F4H-1 and later the F4H-1P as well, a reconnaissance version similar to the RF-110A.

In September 1962 the US Department of Defense introduced a tri-service aircraft designation system under which all the Phantom IIs became the F-4. The naval and Marine Corps aircraft became the F-4A, F-4B and RF-4B, whilst the USAF examples were designated the F-4C and RF-4C. With time other variants of the Phantom appeared for all three services, reflecting changes in equipment for specific roles as well as airframe and engine modifications to improve performance. The naval F-4B was replaced on the production line by the F-4J, the first

Two of the first three Phantom FG.1s for the Royal Navy were met by Sea Vixens that they were about to replace at RNAS Yeovilton on 29 April 1968. (Peter March)

of which flew in May 1966 and which in its turn became the USN's and USMC's standard front-line Phantom.

Despite the Phantom's success at home McDonnell still had to find its first foreign customer for the type. Clearly this would have to be a nation approved of by the US government and, in the first instance at least, one operating aircraft carriers, so the choice was limited. France and Britain both had aircraft carriers but each country also had an aircraft industry that at the time seemed able to satisfy the needs of its own armed forces. Nevertheless McDonnell made several approaches to the British government and the Admiralty who at least gave them a hearing.

From late 1959 McDonnell started a series of presentation papers based upon the F-4B aimed at keeping British interest in the Phantom alive. The company appreciated that if the Phantom were to be able to fly from existing British aircraft carriers, which were significantly smaller than those used by the USN, radical changes would have to be made. Catapult launches from shorter catapults meant the aircraft would require high lift devices and additional engine power, so suitable leading edge slats and a taller nosewheel oleo were designed. McDonnell also began talks with Rolls-Royce in 1960 with a proposal to fit the Spey engine with afterburner in place of the J79. The company hoped thereby to make the aircraft more attractive to the British government and to get a prestigious British company to lobby for its interests in Europe.

Prototypes and development

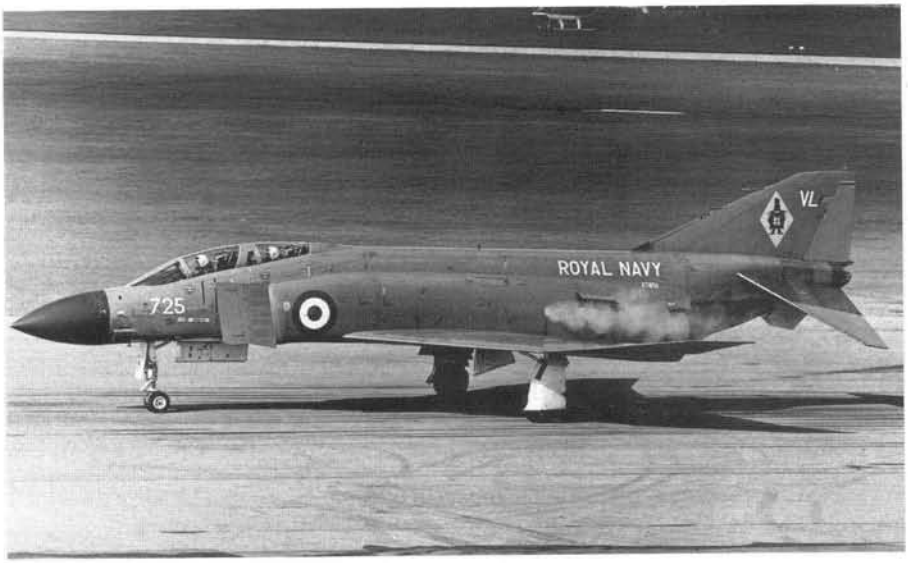
VICTORY OUT OF DEFEAT

As part of its sales drive McDonnell let a Royal Navy pilot fly the F4H-1 during 1960, and the following year the Phantom which had been demonstrated at the Paris Air Show stopped off at Royal Naval Air Station Yeovilton, headquarters of the Fleet Air Arm, on its way back to the United States.

During the next two years the company also offered Phantoms to carry out trials and demonstrations for the Admiralty to show their compatibility with British ships and requirements, but without any obvious interest being shown. Eventually, despite McDonnell's best efforts, the British government announced in 1963 that the Hawker P.1154 would be the next RN and RAF supersonic fighter, and that seemed to be an end to the matter. However, by the following year the idea of a single fighter type for both the RN and RAF had raised sufficient problems for the Admiralty to opt instead for the Spey-engined Phantom.

By February 1964 the Admiralty had evidently made its case for buying the Phantom because the government announced in Parliament that it was no longer practicable to have one aircraft type to serve the needs of both the RN and RAF. The best course of action now was to build a simplified P.1154 for the RAF as a replacement for its ground attack Hunters and to cancel the P.1154(RN), buying instead a modified version of the F-4 Phantom powered by Rolls-Royce Spey engines to meet the Royal Navy's needs. The Spey engine was selected because it already powered the definitive version of the RN's new strike aircraft the Hawker-Siddeley Buccaneer S.2, and dealing with a single type of jet engine aboard ship was a distinct advantage. By May 1964 it had been decided that the first flight of the prototype British Phantom would be in June 1966, and that deliveries to the Fleet Air Arm would begin in April the following

Right: Although high altitude weather on 29 April 1968 was unsurpassed for the arrival of the first Phantom FG.1s for the Royal Navy, it was a different story on Yeovilton's runway where rain greeted the three aircraft. Below: XT858, XT859 and XT860 were the first three which then joined 700P Squadron tasked with the type's intensive flying trials. (Peter March)



Appearing at the 1968 Farnborough air show Phantom FG.1 XT589:725-VL, one of the first to arrive in the UK, sports the 700P Squadron tail markings. On the point of take off, the side panels on the fuselage are open and a plume of smoke is being generated from one of them.

The first deck landings of the Phantom were carried out in the English Channel on board *HMS Eagle*, fresh from her last refit, in June 1969.

year. Two prototypes to be based upon the latest F-4J version then being developed for the US Navy were ordered in July 1964, followed later by two pre-production development aircraft. This RN version of the Phantom was assigned the US designation F-4K.

Meanwhile work continued on the P.1154(RAF) for whilst the Admiralty was happy with the Spey Phantom the RAF was not. Not being involved with flight deck operations the RAF had no need of the extra take-off performance promised by the Spey installation and unlike the RN did not use the engine already. The engine was also most efficient at lower levels whereas the RAF was looking for high performance at altitude as well.

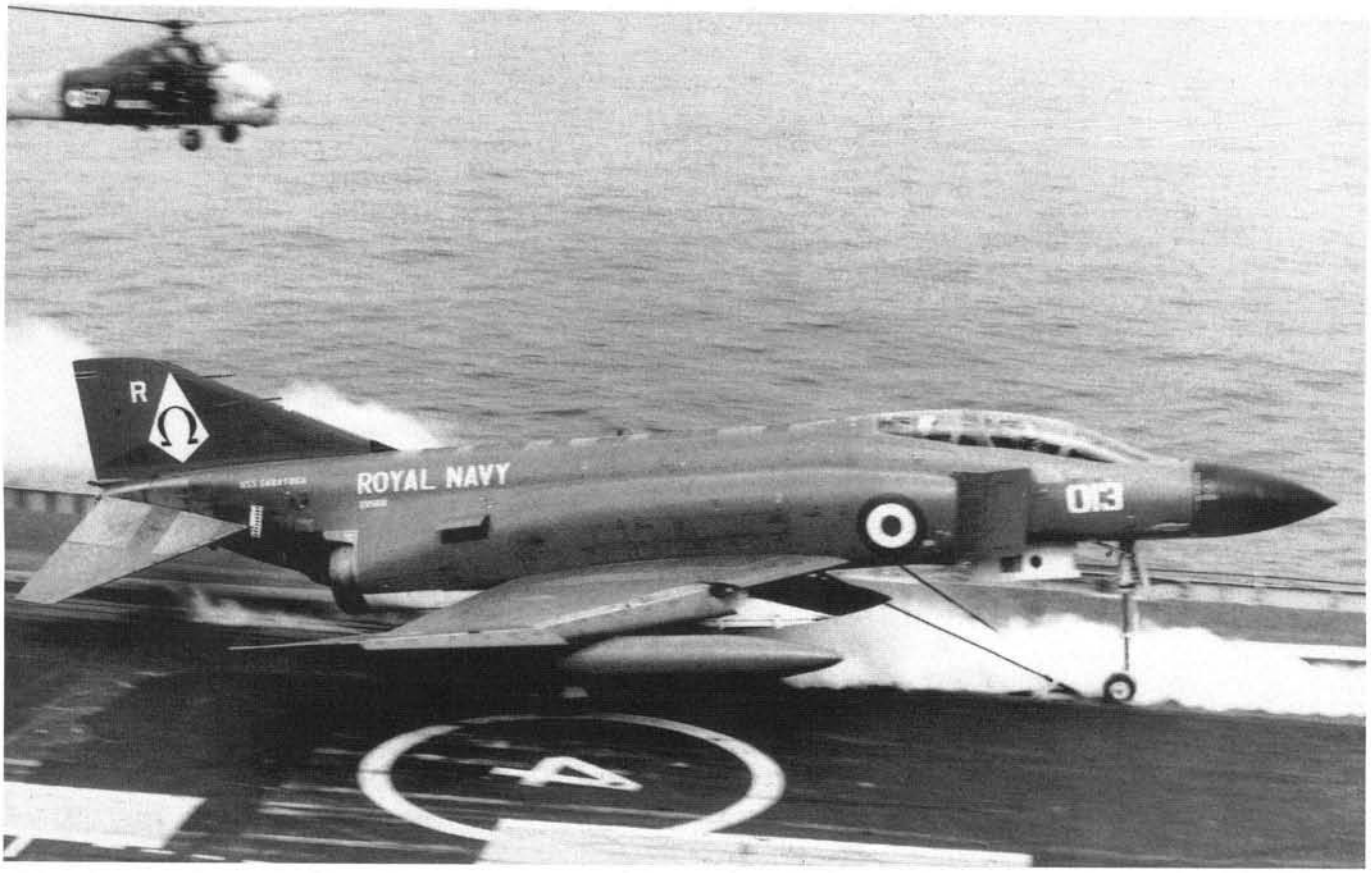
As far as the British government was concerned using the Spey engine made good sense and gave much needed work to Rolls-Royce but it did significantly increased the cost of the aircraft. Britain may have become the first export customer for the Phantom but further customers would almost certainly choose the cheaper J79-powered versions actively being promoted by the US government, leaving Britain to pay for the aircraft and engine development costs alone. On grounds of cost alone the RAF preferred the J79-powered Phantom because it could have bought three for the price of two Spey-powered aircraft, and General Electric was also promising even more powerful versions of the J79 in the future.

In October 1964 however, existing defence procurement plans were thrown in to disarray with the Labour Party victory in the British General Election. Whilst in Opposition Labour had made it clear that if elected it would completely reassess Britain's defence policy with a view to reducing significantly the country's world commitments and armed forces. It would also restructure the British aerospace industry which it considered to be too inefficient and run more for the benefit of its shareholders than for the good of the country. Once in office the party was as good as its manifesto promises and thorough reviews of Britain's foreign policy, armed forces and aviation industry began.

THE AXE FALLS

The 1965 Defence Review announced that Britain would give up its commitments east of Suez and concentrate upon the Atlantic region and the NATO Alliance. Drastic reductions in the armed forces were

After use with 700P Squadron some of its Phantoms were turned over to 767 Squadron which then took on the task of training all aircrew destined for 892 Squadron, the Navy's only operational Phantom unit. 767's distinctive tail badge is shown to advantage in this picture taken at Yeovilton of XT867:152-VL.



Some of the Navy's early Phantoms conducted sea trials on board *USS Saratoga* in the Mediterranean soon after 892 Squadron formed at Yeovilton in March 1969. This picture taken in October the same year shows XV589 with the name *USS Saratoga* painted on the rear fuselage following a period of cross-decking operations. (A.W.Hall)

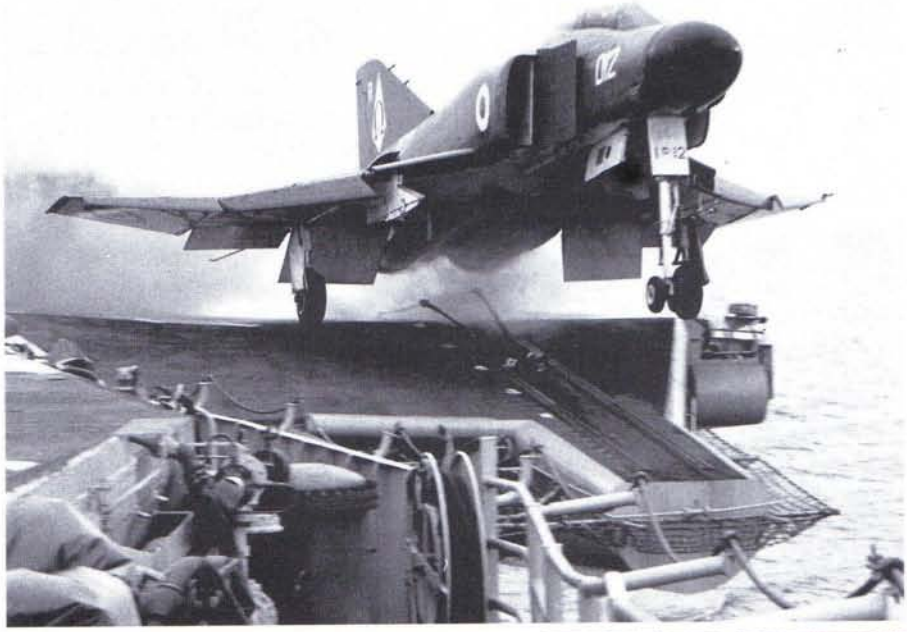
When 892 Squadron formed they were given side code numbers from 001 to 014. These two pictures show XV565 as 001 but at the beginning of its service on board *HMS Ark Royal* (below) and XT868 based at Leuchars. The picture above also shows the '77' Queen's Silver Jubilee marking that appeared on the nose for a brief period. (APN and A.W.Hall)

announced together with cancellations of numerous important military projects, including both the CVA-01 fixed-wing aircraft carriers and the P.1154(RAF). Paradoxically as the RN requirement for Phantoms was all but eliminated the RAF was told it would receive Phantoms as Hunter replacements, with the first arriving in January 1967. Thus by 1965, in the space of less than two years, the McDonnell F-4 Phantom II had been selected to become one of Britain's main combat aircraft for the foreseeable future. Despite earlier, cogent arguments to the contrary, politicians now dictated that the RN and RAF would indeed share a common aircraft type, like it or not!

The CVA-01 programme may had been cancelled but it was recognised that some form of naval air power would still be necessary to cover Britain's withdrawal from the Far East, particularly once the RAF started vacating its bases east of Suez. Accordingly it was decided that *HMS Eagle* and *HMS Ark Royal*, the RN's two largest aircraft carriers, would undergo major refits to enable them to operate the Phantom and so make an useful contribution to NATO until the end of their useful lives in the late 1970s. The number of naval Phantom F-4Ks planned was therefore reduced in stages from the 150 envisaged following the cancellation of the P.1154, to 48 operational aircraft to equip the two Carrier Air Groups and a training squadron.

However plans were again revised, largely on cost grounds, and it was decided not to

Above: Last days at Yeovilton. One of 892's Phantom FG.1s being serviced at the Somerset base before the move to Leuchars in Scotland. (A.W.Hall) Below: With the nose oleo extended and the leading edge slats in the drooped position one of 892 Squadron's Phantom FG.1s seen being propelled off of *HMS Ark Royal's* flight deck with the strop just having disengaged. (MoD)



give *HMS Eagle* the full refit but to concentrate resources upon *HMS Ark Royal* which would then continue in service until the end of 1972. *HMS Eagle* would instead be given a partial refit, sufficient to enable her to cover the British withdrawal from the Far East with her existing air group, on completion of which she would be scrapped and her squadrons disbanded. Even so, in one of the ironies which abound in the story of the British Phantom, it was *HMS Eagle* which became the first RN vessel to operate the type at sea, albeit for a short period of sea trials only.

This final change in policy resulted in 20 of the naval Phantoms being reassigned to the RAF before they had been delivered to equip an air defence squadron, part of who's task would be to defend RN vessels operating in north-west European waters. This would leave 28 RN Phantoms to support *HMS Ark Royal* until she paid off. Somewhat surprisingly this policy of phasing out the RN's fixed-wing aircraft carriers was not changed when a Conservative government was elected in 1969, although *HMS Ark Royal* was given a temporary reprieve when the date for her withdrawal was delayed until the end of 1978.

BRITISH PHANTOMS TAKE SHAPE

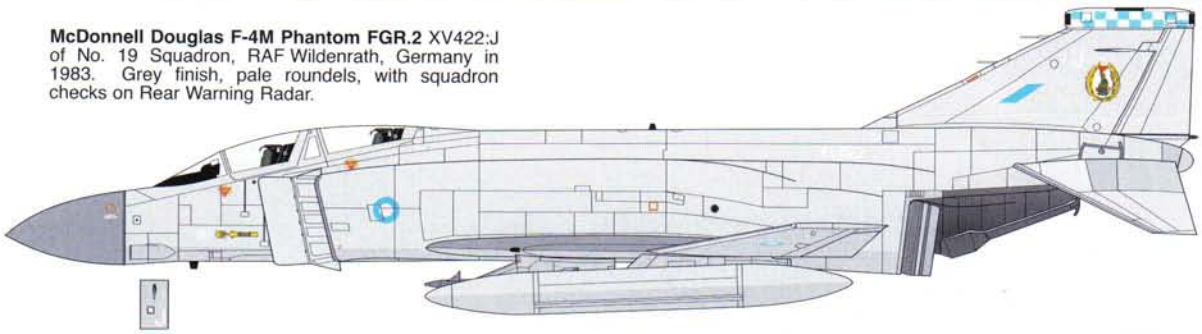
In February 1965 a memorandum of understanding with the US government was announced for the RAF version of the Phantom, the F-4M, to be fitted with as much British equipment as was practicable up to a limit of half the value of the airframe. This 'Anglicisation' policy would also apply to the F-4K, and inevitably it contributed to making the British aeroplanes the most expensive Phantoms built. By this time development costs of the after-burning Spey were mounting alarmingly, so in order to remain within budget Rolls-Royce had to make the engine cheaper. This was achieved at the expense of performance at higher engine speeds, something, which dogged the British Phantoms throughout their service, but this was accepted by the government which finally announced its decision to equip both the F-4K and F-4M with Spey engines late in 1965.

Besides the Spey engines British companies also successfully tendered to supply other major and minor pieces of equipment for the F-4K/M as well as some airframe components. In most cases these items were shipped to the McDonnell plant at St Louis for incorporation into the aircraft on the production line.

Airframe assemblies included the rear fuselage, vertical and horizontal tail surfaces, inboard wing leading edges and various access doors and panels, all made by the British Aircraft Corporation at Preston, the outer wing panels which were built by Short Brothers and Harland at Belfast, and the internal fuel tanks. The larger items of equipment which were also British-made included the Martin Baker Mark 5 ejection

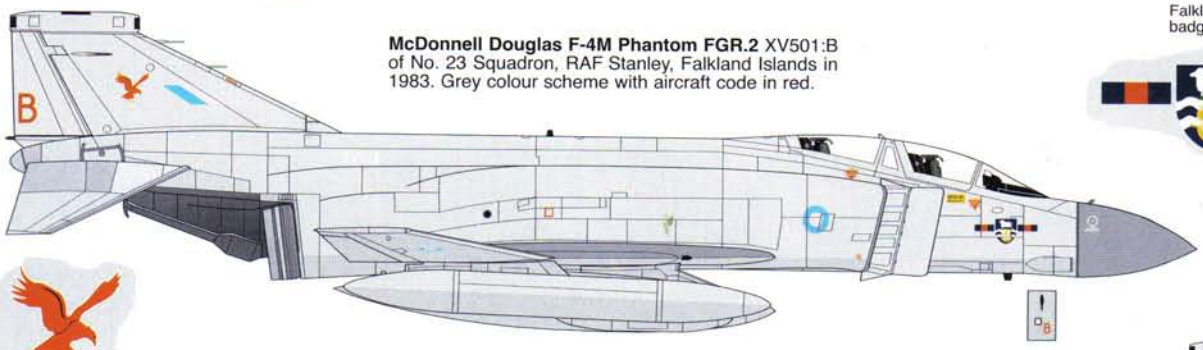
***HMS Ark Royal* was a frequent visitor to the Mediterranean as well as the USA. The ship is seen berthed at Kalkara Creek, Malta, with two of 892 Squadron's Phantoms on the rear of the flight deck. (G.Mangion)**

McDonnell Douglas F-4M Phantom FGR.2 XV422:J of No. 19 Squadron, RAF Wildenrath, Germany in 1983. Grey finish, pale roundels, with squadron checks on Rear Warning Radar.



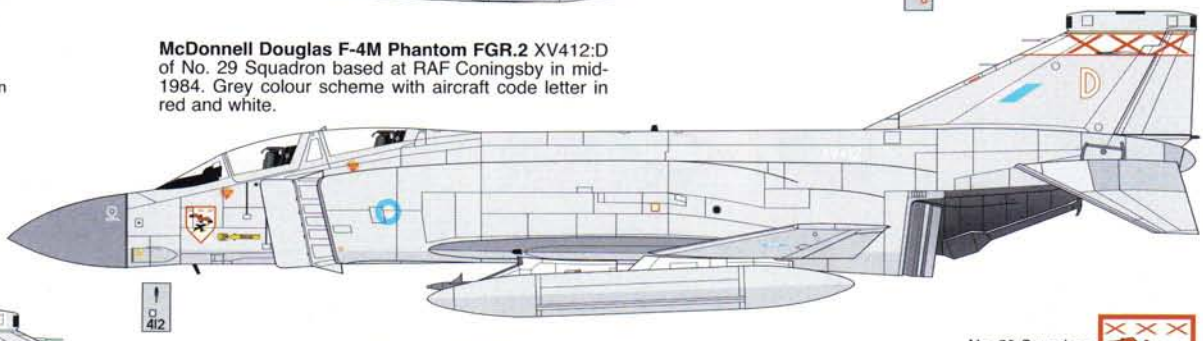
Falkland Islands badge on nose

McDonnell Douglas F-4M Phantom FGR.2 XV501:B of No. 23 Squadron, RAF Stanley, Falkland Islands in 1983. Grey colour scheme with aircraft code in red.

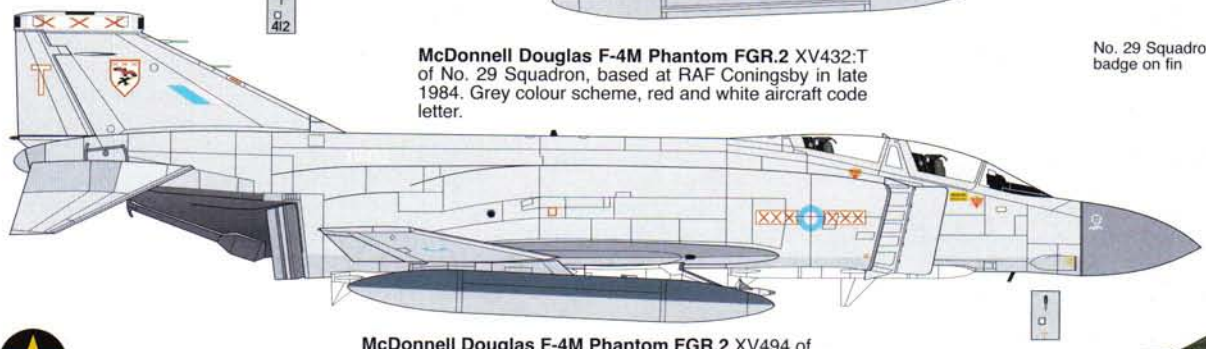


No. 23 Squadron badge on fin

McDonnell Douglas F-4M Phantom FGR.2 XV412:D of No. 29 Squadron based at RAF Coningsby in mid-1984. Grey colour scheme with aircraft code letter in red and white.



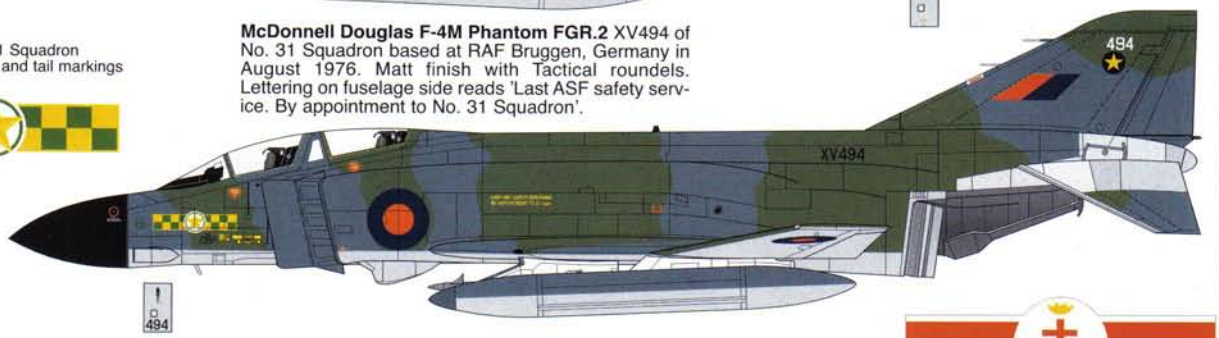
McDonnell Douglas F-4M Phantom FGR.2 XV432:T of No. 29 Squadron, based at RAF Coningsby in late 1984. Grey colour scheme, red and white aircraft code letter.



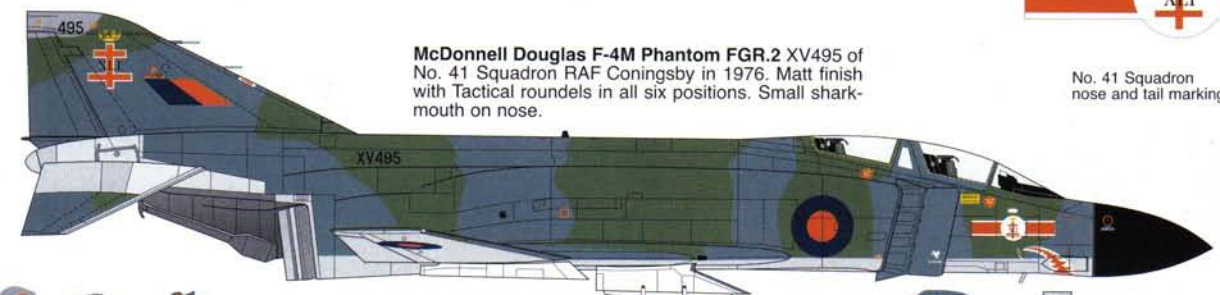
No. 29 Squadron badge on fin

No.31 Squadron nose and tail markings

McDonnell Douglas F-4M Phantom FGR.2 XV494 of No. 31 Squadron based at RAF Bruggen, Germany in August 1976. Matt finish with Tactical roundels. Lettering on fuselage side reads 'Last ASF safety service. By appointment to No. 31 Squadron'.

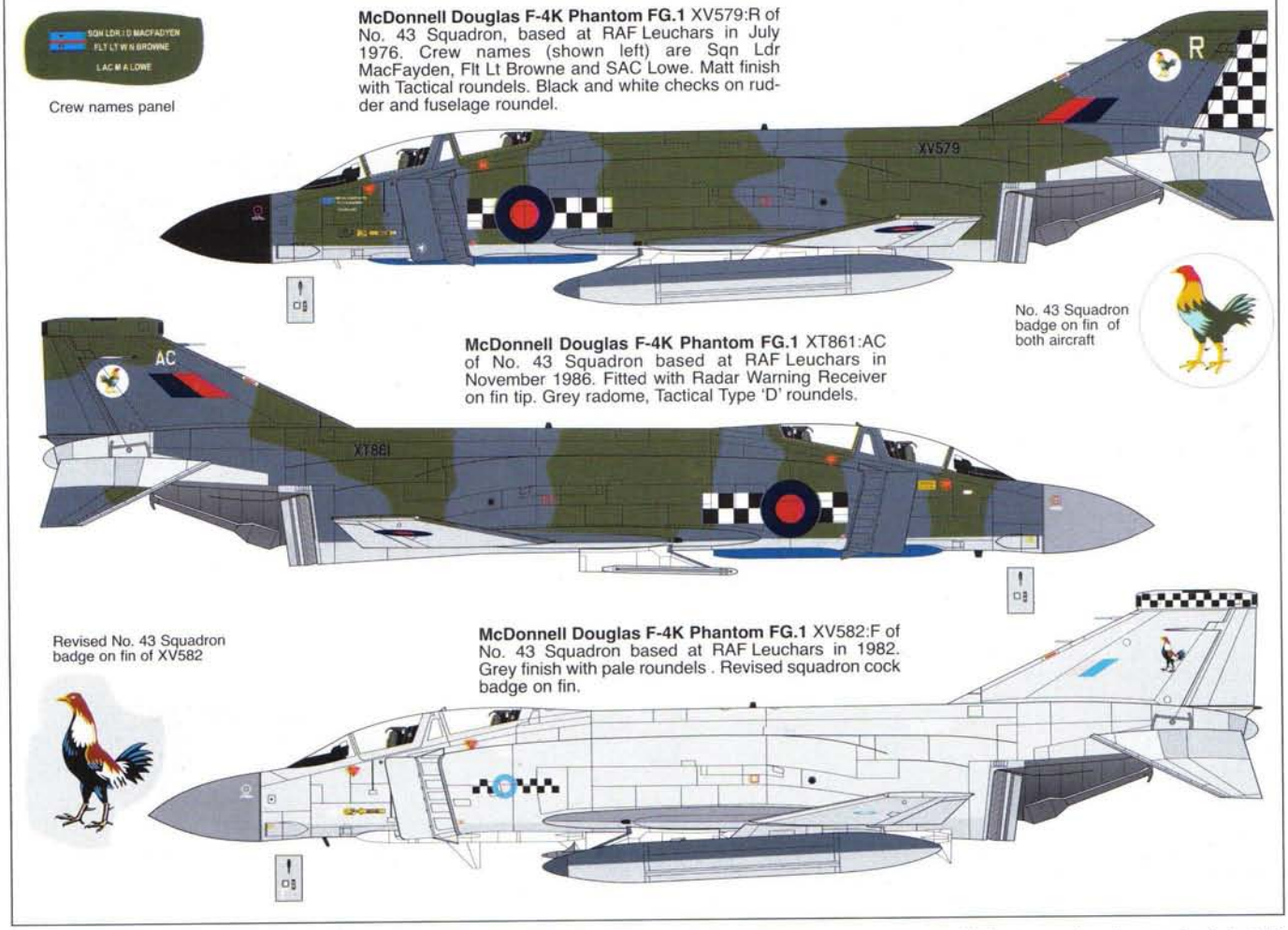


McDonnell Douglas F-4M Phantom FGR.2 XV495 of No. 41 Squadron RAF Coningsby in 1976. Matt finish with Tactical roundels in all six positions. Small shark-mouth on nose.



No. 41 Squadron nose and tail markings

Four zaps appeared on various parts of the fuselage on this aircraft



seats (which were already standard in US Phantoms), the radios and IFF (Identification Friend or Foe), and the radar altimeter and INAS (Inertial Navigation and Attack System) for the F-4M. The INAS was built by Ferranti and, like the Phantom's IFF equipment, was based upon that which was being developed for the TSR-2, another of the aircraft projects cancelled by the Labour Government. The navigation computer and autopilot were licensed versions of American equipment and were built by Marconi Avionics.

The Phantom's air intercept (AI) radar built by Ferranti was a license-built version of the Westinghouse AN/APQ-59 radar used in the AN/AWG-10 fire control system fitted to American F-4Js, with various modifications. The British variants of the AN/AWG-10 were designated AWG-11 and AWG-12 for the F-4K and F-4M respectively, reflecting the different requirements of the two services. The RN primarily wanted a long-range air intercept radar system whilst the RAF's main requirement at this early stage was for a ground attack/mapping radar. The Phantom's main armament, its AIM-7 Sparrow and AIM-9 Sidewinder guided missiles, were all to be bought direct from the

Top left: Wearing an Omega badge based on that of 892 Squadron, this Phantom FG.1 XT866:W was part of the Phantom Training Flight based at Leuchars. Notice that for a short period these aircraft were given individual code letters on top of the fin. Left: Phantom FG.1 XV587:010-R seen ashore with a Small Bomb Carrier under the port wing and one 4 lb. bomb attached. (Both G. Mangion)

With its tail brake parachute streamed Phantom FG.1 XV587:010-R completes its landing run when shore based at RAF Luqa, Malta. The starboard drop tank shows signs of considerable erosion of the basic Dark Sea Grey colour. (G.Mangion)

USA. In 1966 it was agreed with McDonnell that Hawker-Siddeley Aviation at Brough would provide all in-service support for the British Phantom fleet, including spares supply, major overhaul and modifications, a role eventually taken over by British Aerospace (BAe). Flight testing would be done at the company's Holme-on-Spalding-Moor airfield nearby, with aircraft being moved there by road from Brough. When Holme airfield was closed in 1983 flight testing was carried out from Brough then also RAF Scampton.

Since the first British specification for the Phantom was for the RN's F-4K, this version also formed the basis of the RAF's F-4M. The two marks did differ externally in some minor respects, but generally it was the electronic equipment fit that identified each. Besides adapting the basic F-4J design to accommodate the Spey engine with its larger intakes and afterburners McDonnell also had to amend production drawings to accept the other items of British equipment.

To give the F-4K the additional lift required for take-off from British carriers a nosewheel oleo capable of extending 40 inches (101 cm) was fitted to increase the aircraft's angle of attack once loaded on the catapult. The high-lift devices fitted to the wings consisted of larger leading edge slats

Right: Phantom FG.1 XT867:013-R of 892 Squadron seen landing at Luqa airfield, Malta. Note the partially repeated code on the flaps and the red section in front of the Omega badge. Below: Cross decking between the Phantoms of 892 Squadron on Ark Royal and US Navy carriers of the 6th Fleet in the Mediterranean was a common occurance. In this case the aircraft, XT860:014-R, had been zapped on the fin by VF-11, the 'Red Rippers' (Both G.Mangion)

For the Ark Royal's last Mediterranean cruise and before the decommissioning of both the ship and 892 Squadron, the latter adopted a highly colourful nose badge in late 1978, shown here in close up.

and drooped ailerons, both with blown-air boundary layer control to minimise breakaway of the streamlines passing over the wing surfaces, and these devices also reduced approach speeds during landing.

The airframe also had to be strengthened to withstand the heavier aircraft's more violent deceleration during arrested landings on the shorter British flight decks, and a larger arrester hook stressed to 4.8g was fitted. Additionally the wings and under-wing pylons were strengthened to permit the carriage of 1,000 lb bombs and specialist ground attack weapons which were generally heavier than those used by the US forces. The F-4K also had inverted slotted leading edges to the tailplane (stabilator) to create downward thrust and initiate rotation once the main wheels had left the flight deck. The F-4M lacked the slotted stabilator and extending nose oleo, having instead the standard F-4C nosewheel unit fitted, but did incorporate the wing leading edge slats and blown ailerons.

Because the Spey engine had hitherto not had an afterburner and not been capable of supersonic flight, extensive tests were necessary to establish both the performance and the safety of the improved engine before it could be put into full production. The first static test of the Spey 201 engine was carried out in April 1965 and by June of that year had successfully delivered its promised 12,000 lb of static thrust and exceeded its average designed thrust in afterburner. During October 1965 the engine was cleared for flight and deliveries began to St Louis in early February the following year.

The first prototype F-4K, XT595, had been rolled out at St Louis towards the end of 1964 but in the absence of engines aerodynamic testing had to be carried out in a wind tunnel, paying particular attention to the main air intakes and the fuselage contouring around the exhausts. There then followed a period of extensive ground testing but little more could be achieved until the aircraft had its engines. Once these had been received and installed ground runs began and the aircraft eventually made its maiden flight on 27 June 1966.

DELIVERIES TO BRITAIN BEGIN

The prototype F-4K was very much a hybrid and the intention was to keep it as a test airframe. For this reason it carried US instrumentation replacing much of the planned British electronic equipment and, initially at least, instead of its radar had calibration equipment mounted in the nose together with a long instrumentation probe. The second YF-4K flew for the first time on 30 August 1966 and also carried test equipment in the nose together with the associated nose probe. Like XT595, the second prototype and the two F-4K pre-production aeroplanes which followed were primarily intended as trials and development aircraft so were not representative of the operational F-4Ks. The prototypes were eventually intended to be assigned to engine development flying whilst the pre-production F-4Ks, or Phantom FG.1s as they were now designated, were for systems and weapons trials with both the UK manufacturers and the Aeroplane and Armament Experimental Establishment (A&AEE) at Boscombe Down, Wiltshire. Production aircraft would also be used for specific trials as necessary, but these would eventually be brought up to full operational standard and issued to squadrons, as indeed was XT598 the second

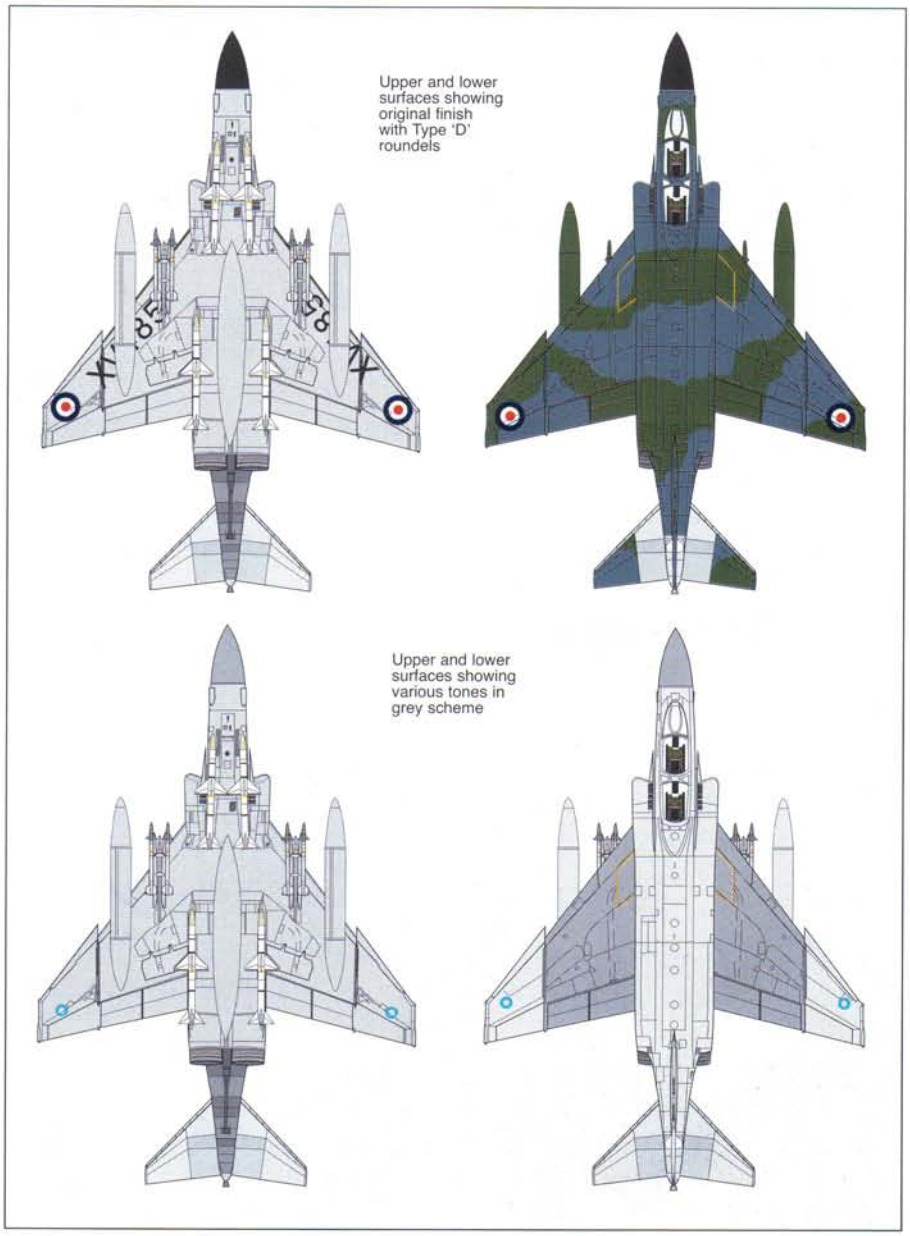
Strop fitted, oleo leg extended and ready for launch. A dramatic view of one of 892 Squadron's Phantom FG.1s on Ark Royal's port side catapult. (MoD)

One of 892's Phantom FG.1s during the final cruise of Ark Royal seen over the ship's round down with the arrester hook lowered, flaps and leading edge slats extended, and about to take one of the arrester wires. (MoD)

pre-production aircraft.

Before long the test flights began to identify problems with both the Spey 201 engine and its afterburner installation, although these were not unexpected for a first generation turbofan engine. The Spey had greater power and more thrust than the J79 but tests showed up a marked lag between throttle movement and engine response, something most undesirable particularly for a carrier-borne jet. Problems were also encountered with the afterburner which lost efficiency with altitude, evidently due to erratic fuel supply and incomplete combustion. However, the greater fuel economy of the Spey over the J79 was confirmed, as was its better low level performance and acceleration. Even so, in view of the serious shortcomings identified the Ministry of Defence (MoD) formally notified Rolls-Royce that the Spey 201 installation was unacceptable and that urgent improvements were required before the test programme could be completed.

Accordingly XT858, the second production Phantom FG.1, was delivered to Hucknall in July 1967 so that Rolls-Royce could work to remedy the problems that much more quickly. Meanwhile development flying continued in the USA at St Louis as well as at Edwards Air Force Base, California, and the Naval Air Test Center, Patuxent River, Maryland. As no major new problems were encountered production aircraft, both FG.1s and FGR.2s for the RAF, followed the development airframes down the assembly line, all initially fitted with Spey 201 engines. Rolls-Royce remedied the Spey 201's problem with the Spey 202 and this engine was eventually fitted to all the early aircraft as it became available.



RN PHANTOM SQUADRONS AND UNITS

ROYAL NAVY

Squadron	Type	Representative serials
700P Squadron Formed 30 April 1968 at RNAS Yeovilton with Phantom FG.1s. Disbanded 31 March 1969.	Phantom FG.1	XT862:722-VL, XT863:723-VL, XT864:724-VL,XT859:725-VL,XT860:726-VL, XT861:727.
767 Squadron Formed 14 January 1969 at RNAS Yeovilton with Phantom FG.1s. Disbanded 1 August 1972.	Phantom FG.1	1969 XT868:153-VL, XV572:156, XV579:157-VL. 1970 XT866:158-VL, XT873:155-VL. 1971 XT863:150-VL, XT865:156-VL. 1972 XT859:155-VL, XV867:152-VL.
892 Squadron Formed 31 March 1969 at RNAS Yeovilton with Phantom FG.1s for *HMS Ark Royal.* To RAF Leuchars 17 July 1972. Disbanded 15 December 1978.	Phantom FG.1	1969 XT859:001-R, XT860:002-R, XT861:003-R. 1970 XV567:011-R, XV569:013-R, XV570:014-R. 1971 XV565:001-R, XV590:001-R, XV591:006-R. 1972 XT860:014-R, XT870:001-R, XT871:007-R. 1973 XT867:013-R, XT872:005-R, XV588:010-R. 1974 XT868:006-R, XV568:003-R, XV592:004-R. 1975 XT863:001-R, XT867:013-R, XV567:002-R. 1976 XT864:007-R, XT865:004-R, XV589:011-R. 1977 XT868:001-R, XV568:002-R, XV587:010-R. 1978 XT863:014-R, XT870:012-R, XV590:001-R.

The company continued development of the Spey to improve performance, particularly for the Phantom FG.1 installation which required a fast-response afterburner to cope with flight deck operations, but this led to further delays in the Phantom being cleared for service use. Even then all FG.1s and FGR.2s were subject to a permanent speed limit of Mach 1.9 as against the Mach 2.1 of the J79-powered F-4J, and the British Phantoms were always destined to have a slower speed at altitude and a lower ceiling than their US contemporaries. Despite the best efforts of Rolls-Royce and McDonnell it proved impossible to overcome the basic causes which were the significant increase in drag caused by the adaptation of the original area-ruled F-4 after fuselage to take the afterburning Spey, and the 20 per cent larger air intakes required for the turbofan engine.

Once sufficient trials had been undertaken in the USA it was possible to move some to Britain, and following suitable preparation XT597 was delivered to the A&AEE in 1967 to begin its service evaluation by the Naval Test Squadron. However, because at the time Britain had no aircraft carrier capable of operating the Phantom initial flight deck trials were carried out in the USA.

The first arrested landings were undertaken ashore at Patuxent River in January 1968, followed shortly afterwards by a series of catapult take-offs from the dummy deck at the USN's test facility at Lakehurst, New Jersey. Embarked trials were satisfactorily conducted aboard *USS Coral Sea* off California during mid-July, and operational sea trials were carried out as part of 767 Squadron's work-up, aboard *USS Saratoga* that October. Thereafter progressively more of the Phantom trials programme was transferred to the UK as aircraft deliveries gained momentum.

Simultaneously with the aircraft and engine trials, development work was under

Left: A redundant strop falling into the sea after launching Phantom FG.1 coded 007 of 892 Squadron from the waist catapult on board HMS Ark Royal (MoD) Below: The power of the Phantom can be seen in this view of one of 892's aircraft taking off from RAF Luqa with full reheat (G.Mangion)

XT597 was one of a number of Phantoms that were in use with the Experimental Establishments. The 'raspberry ripple' colour scheme has been applied and the name 'A&AEE Boscombe Down' painted on the fuselage sides. (A.W.Hall)

way at the Royal Aircraft Establishment, notably at RAE Bedford, into the specialist flight deck machinery and equipment required by the Phantom FG.1. Improved arrester gear had been under development since the early 1960s together with a roller system for automatically centring aircraft on the catapult track ready for launch, as well as strengthened emergency barriers. Also a water-cooled flight deck launch area and jet blast deflectors were designed to dissipate the intense heat generated by the Phantom's afterburners during launch, heat which soon would have buckled even armoured deck plating. Specific catapult fittings also had to be designed for the Phantom, notably the side tracks to take the runners for the bridle retrieval system, the 'strop-catcher', previously not used on RN vessels, and periodically Phantom FG.1s were deployed to Bedford to test the various innovations being worked on there.

Royal Navy Phantom FG.1s

BETTER LATE THAN NEVER

Despite being several years late in entering service, mainly due to the problems encountered with the Spey 201 and afterburner, delivery of its first production Phantom FG.1s was eagerly awaited by the Fleet Air Arm. Finally, on 29 April 1968, three aeroplanes were delivered to RNAS Yeovilton from St Louis, flown by company pilots. The following day XT858, XT859 and XT860 were taken on charge by 700P Squadron which commissioned that day tasked with carrying out the type's intensive flying trials, and using aircrew who had undergone conversion in the USA or served with USN Phantom squadrons as exchange officers.

Aside from evaluating all aspects of the new type and writing the necessary operational procedures, 700P Squadron was also tasked with producing the training programme for both air and ground crews in readiness for the formation of 767 Squadron, the RN's dedicated Phantom training unit, during 1969. On frequent occasions aircraft were also detached to various establishments for specific trials, as with XT872 which went to RAE Bedford on 27 November 1968 for catapult and arrester gear work. The squadron also provided the Phantom demonstrator for the 1968 Farnborough Air Show.

When the period of intensive flying trials was completed 700P Squadron transferred three Phantoms and personnel to 767 Squadron which formed at Yeovilton on 14 January 1969, and then disbanded on 31 March when 892 Squadron formed and took over the remainder of its aircraft and crews. The latter unit was destined to be the RN's only front-line Phantom squadron and the Fleet Air Arm's last conventional fixed-wing fighter squadron (hence the Omega tail emblem it adopted) and was assigned to the *HMS Ark Royal* air group.

Whilst the RN's two squadrons were establishing themselves the first sea trials of the Phantom aboard a British ship took place with *HMS Eagle*, fresh from her last refit. In March 1969 Phantoms from Boscombe Down performed carrier-controlled approaches and roller landings whilst the ship was operating in the English Channel, then in June three aircraft embarked for a series of arrested landings and catapult launches. These were necessarily brief to avoid damage to the flight deck, something which had occurred aboard the USN vessels during the more protracted flight deck trials carried out the previous year.

No. 228 Operational Conversion Unit for the RAF's Phantom FGR.2s was formed on 1 August 1968 at RAF Coningsby and the first Press day was held on a wet and windy 14 January 1969 after the full complement of 18 aircraft had been delivered. (A.W.Hall)

Two more pictures of the first Phantom FGR.2s for the RAF at the Coningsby Press day in 1969. Each was in pristine condition and the aircrew and ground tradesmen were stationed by each to answer questions. (A.W.Hall)

Throughout its three years of existence 767 squadron was based at RNAS Yeovilton and was tasked with training all Phantom FG.1 aircrew and maintenance personnel, both RN and RAF. Accordingly up to six of the aircraft used were loaned by the RAF and retained their RAF camouflage finish to which were applied RN codes and squadron markings. The squadron worked closely with the Air Direction School, also based at Yeovilton, for air intercept training, and made frequent use of the ranges in the Bristol Channel for bombing and rocket firings.

Aircraft were also regularly sent to RAE Bedford so the crews could experience catapult launches and arrested landings before having to do them for real at sea. Once *HMS Ark Royal* had been commissioned in 1970 following her refit, 767 Squadron crews were also able to carry out deck landing practice aboard whenever the ship's programme permitted.

As part of the run-down of the fixed wing Fleet Air Arm the RAF took over the training task from 1972. Accordingly 767 Squadron was disbanded on 1 August of that year, passing its aircraft over to the RAF, and a core of its naval personnel moved north to RAF Leuchars to form the basis of a small RAF unit tasked with continuing Phantom FG.1 training. During its existence 767 Squadron trained over 100 RN, RAF and foreign exchange aircrew and lost only one aircraft, XT876 which crashed into the sea off Trevose Head, Cornwall, on 10 January 1972.

FRONT LINE OPERATIONS

Before the formation of 892 Squadron at Yeovilton on 31 March 1969 a stock of Phantom FG.1s had been delivered to the Naval Aircraft Support Unit (NASU) at Yeovilton to be prepared for front-line service. These were then steadily added to the aircraft inherited from 700P Squadron which had formed the nucleus of the new unit, as the squadron undertook an intensive work-up period at Yeovilton. This culminated in a week's deployment aboard the *USS Saratoga* in the Mediterranean in October 1969.

During the work-up period 892 Squadron gained much publicity by participating in the Daily Mail Transatlantic Air Race, held in early May 1969 to commemorate the 50th anniversary of Alcock and Brown's epic flight. Prizes were awarded based upon the fastest time taken for a person to get from the top of the Empire State Building in New York to the top of the Post Office Tower in London, or vice versa, using any means of transport available. The race, referred to by the RN as 'Royal Blue', took place during 4-11 May and 892 Squadron entered three aircraft and crews, each of which would make one attempt.

Their method was to use a motor cycle then helicopter to take the observer from the Empire State Building to Floyd Bennett NAS where he would board the Phantom and fly east to the British Aircraft Corporation airfield at Wisley, the aircraft being refuelled en-route by RAF Victors. At Wisley the observer would again transfer to a helicopter which would fly him to the foot of the Post Office Tower, and from there on he was on his own!

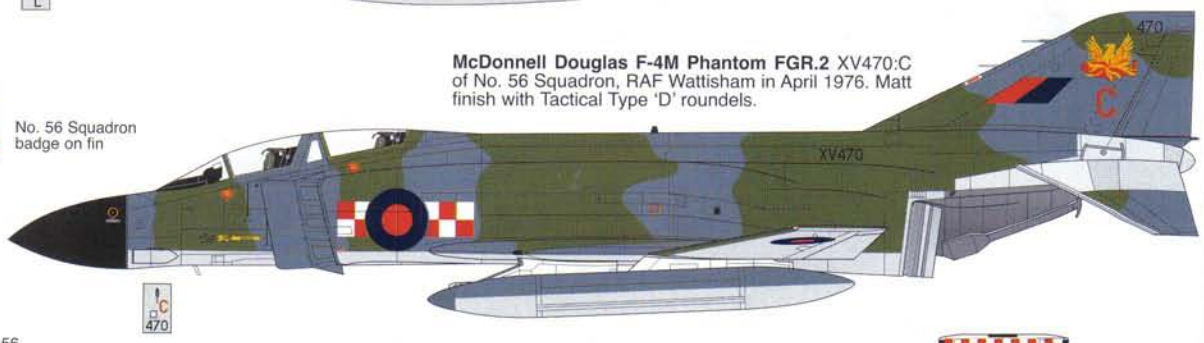
The British crews went on 4, 7 and 11 May

No. 54 Squadron badge on nose

McDonnell Douglas F-4M Phantom FGR.2 XV432:L of No. 54 Squadron based at RAF Coningsby in 1972.Original gloss finish and having Type 'D' roundels in six positions.

No. 56 Squadron badge on fin

McDonnell Douglas F-4M Phantom FGR.2 XV470:C of No. 56 Squadron, RAF Wattisham in April 1976. Matt finish with Tactical Type 'D' roundels.

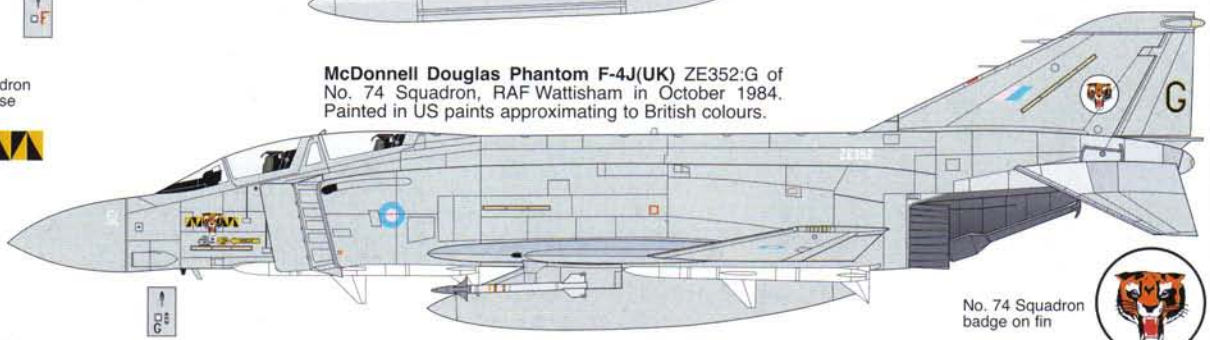


Revised No. 56 Squadron badge on nose

McDonnell Douglas F-4M Phantom FGR.2 XV474:F of No. 56 Squadrron based at RAF Wattisham in 1979. Radar Warning Receiver on fin tip has squadron red and white checks. Small Type 'D' roundels in six positions. Revised Phoenix badge and bars on nose.

No. 74 Squadron badge on nose

McDonnell Douglas Phantom F-4J(UK) ZE352:G of No. 74 Squadron, RAF Wattisham in October 1984. Painted in US paints approximating to British colours.



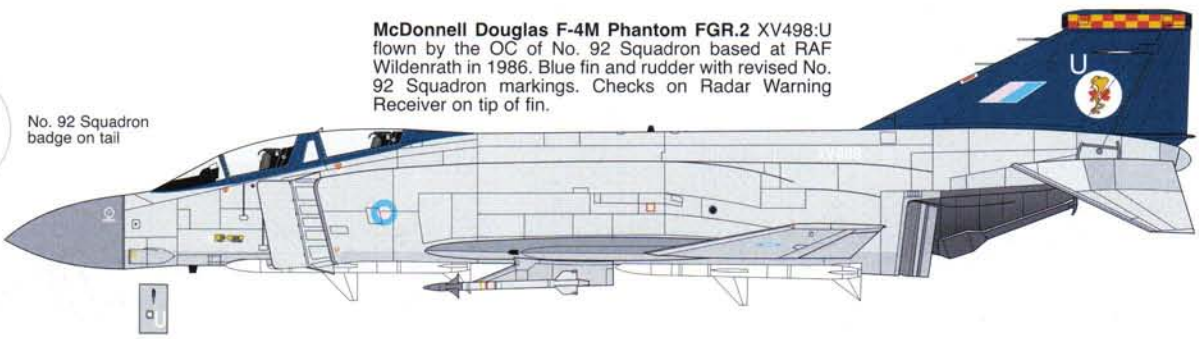
No. 74 Squadron badge on fin

McDonnell Douglas F-4M Phantom FGR.2 XV393:Q of No.74 Squadron, based at RAF Wattisham in 1991-92. Grey finish with small pale roundels. No. 56 Squadron insignia on nose No. 74 markings on tail. This was the 1992 display aircraft flown by Sqdn Ldr Liggat and Flt Lt Manwaring.

No. 56 Squadron badge on nose of XV393

No. 74 Squadron badge on fin of XV393

McDonnell Douglas F-4M Phantom FGR.2 XV498:U flown by the OC of No. 92 Squadron based at RAF Wildenrath in 1986. Blue fin and rudder with revised No. 92 Squadron markings. Checks on Radar Warning Receiver on tip of fin.



No. 92 Squadron badge on tail

No. 6 Squadron was the first to form at Coningsby with the Phantom FGR.2 in January 1969 and took over much of the service trials that had hitherto been carried out by the OCU. They were tasked with ground attack and tactical support with a secondary tactical reconnaissance role if required. The picture above shows the first markings adopted whilst, below, taken in 1974, toned down roundels and the 'tin opener' badge have been moved to the nose. (G.Mangion)

One of six Phantom FG.1s which went to RAF Leuchars from Yeovilton on 1 September 1972 to form the joint users Phantom Training Flight. This is XV569 sporting the 'LU' tail code which was thereafter changed to 'X'. (MAP)

and it was the final crew consisting of Lt Cdr Brian Davies with Lt Cdr Peter Goddard the observer, which set the fastest time for the crossing and won the £6,000 prize. Their overall time was 5 hours 11 minutes and 22 seconds from start to finish, and they also set a new record for the fastest flight from New York to London with a crossing time of 4 hours 46 minutes and 57 seconds, averaging over 1,000 mph (1600 km/h).

Once *HMS Ark Royal* came out of refit the squadron divided its time between the ship and Yeovilton, embarking for the first time on 30 April 1969 for a full work-up. Thereafter it carried out numerous exercises in the Atlantic and Caribbean, occasionally disembarking to US Naval Air Stations on the east coast of the USA, as well as regular operations in the Mediterranean. Whilst on these deployments use was often made of the US East Coast weapons ranges for live air-to-air missile firings against target drones.

This pattern continued until all RN Phantom operations moved from RNAS Yeovilton to RAF Leuchars in 1972 as part of the run-down of fixed-wing naval operations. The RN Detachment Leuchars was established to provide stores and engineering support for 892 Squadron with the squadron itself moving to Leuchars on 17 July 1972, but other than the change of home airfield squadron operations continued very much as before.

The most significant difference however, was that now being based at an 11 Group station and carrying out its daily operations largely under the control of the Master Radar Station at Buchan meant that 892 Squadron on occasions got involved with air defence activity over the Norwegian Sea. Crews did intercept some of the Soviet reconnaissance aircraft which regularly probed Britain's northern air defences, and if needed were also able to provide the Quick Reaction Alert Force (later Interceptor Alert Force) permanently maintained at Leuchars.

During the latter half of the 1970s naval Phantom operations at Leuchars began to run down. Surplus aircraft and equipment began to be transferred to the RAF so that by the time of *HMS Ark Royal's* final cruise in 1978 the RN presence was just sufficient to support 892 Squadron's expected needs. Once the ship returned and paid off the squadron disbanded at Leuchars on 15 December 1978 and its aircraft were passed over to the RAF which now operated most of the surviving Phantom FG.1s.

Of the remaining aircraft, those early examples which had never been brought up to full production standard, most had been on MoD(PE) charge engaged in trials or research flying and moving between various establishments and British Aerospace. The first prototype, XT595, had eventually been allocated to RAF Coningsby by 1978 for use

Left: Phantom FG.2 XV442 in No. 6 Squadron markings at RAF Coningsby. The picture dates to 1974 but previously the aircraft had been coded 'F'.

No 54 Squadron, the next to form with the FGR.2 after No. 6 Squadron, were not frequent overseas visitors. This picture was taken in September 1973 when they visited RAF Luqa, Malta, on an exercise. (G.Mangion)

as a ground instruction airframe but was cut up for scrap when no longer required. The nose section was then moved to RAF Abingdon for use by the RAF Exhibition Flight before going to St Athan in 1982 as a battle damage repair trainer. The remainder of the airframe was used for battle damage repair training at RAF Wattisham until it was scrapped there around 1993. The second prototype, XT596, ended its days at BAe Holme-on-Spalding-Moor from where it was passed to the BAe facility at Scampton as a training aid. Eventually by 1989 the airframe had passed to the Fleet Air Arm Museum at Yeovilton for display.

The first development F-4K, XT597, spent most of its working life at the A&AEE where it undertook all manner of test flying. For example, it was at one time fitted out to act as an airspeed and altitude instrument calibration aircraft for other aircraft types, including Concorde. When it was finally retired on 28 January 1994 it became an exhibit at the Boscombe Down museum. The other development F-4K, XT598, had been sufficiently representative of the Phantom FG.1 to be modified up to operational standard and issued to the RAF once it had completed development flying.

The only production naval Phantom that never saw front-line service was XT858 which, apart from a brief spell with 700P Squadron, spent all its life on development flying. It ended its career at BAe Brough as a fatigue test rig and from there went to Aston Down for storage in November 1991, before being scrapped around 1994.

In-flight refuelling was used on many sorties carried out by Phantom squadrons in the air defence role over the North Sea and on overseas sorties. This picture shows a No. 6 and a No. 54 Squadron aircraft hooked up to a Victor tanker. (MoD)

THE PHANTOM FG.1 WEAPONS SYSTEMS

What made the F-4J so attractive to the Admiralty, apart from the performance promised by the Spey-powered version, was its potent weapons system. The RN was looking primarily for a fleet air defence fighter with a secondary ground attack capability, hence the Fighter Ground attack designation. The existing 'FGA' mark number mission prefix was not used because in NATO terminology 'attack' indicated a non-nuclear capability whereas the Phantom was cleared for carriage of the Mk 57 Special Weapon in the nuclear 'strike' role. Rather than advertise this fact the Admiralty chose to omit the reference completely and see if anyone appreciated the significance of the omission!

Because long range ground attack missions were not a part of the naval Phantom's role it did not need the specialist navigation and bombing computers that went into the RAF FGR.2 version, but it was fitted with the state-of-the-art AN/AWG-11 weapons system optimised for air defence. This consisted of the AN/APG-59 air intercept radar and AN/ASW-25 weapons control computer coupled with the AIM-7 Sparrow semi-active radar-homing missile, four of which could be carried semi-recessed in the fuselage underside.

The advantage the Phantom had over the Sea Vixen, the RN's standard all-weather fighter of the 1960s, was the range at which it could detect and engage targets. The Sea Vixen's AI.18R radar was only really effec-

Bear baiting. Frequent Soviet reconnaissance flights over the North Sea were intercepted by air defence Phantoms sometimes up to 200 miles away from the coast. Here a No. 43 Squadron FG.1, under the control of the radar station at RAF Buchan, flies alongside a Soviet Bear turboprop reconnaissance aircraft. (MoD)

tive out to a range of about 20 nm against aircraft targets whilst its Red Top infrared homing missiles had a maximum range of about eight nm and could only engage targets from ahead if the latter were travelling at high speed. As a combat air patrol (CAP) the Sea Vixen generally flew a figure of eight pattern orientated up-threat, under close control from either a ship's fighter controller or an AEW Gannet aircraft. Ideally two CAP aircraft would be used, synchronised such that one was always outbound pointing up the threat sector searching with its radar and ready to engage targets.

The Phantom on the other hand had a radar capable of detecting targets at ranges in excess of 50 nm whilst the Sparrow missile could engage a target at ranges in excess of 30 nm at medium altitudes. This therefore allowed the Phantom CAP to fly long racetrack patterns up the threat sector using its own radar to search for targets on the outbound leg and to keep station on its parent ship whilst running inbound. Again two aircraft were generally employed flying synchronised CAP patterns, but now they were not as dependent on control from other ships or aircraft as had been the Sea Vixen. By operating at greater distances from the force and being able to engage targets even farther away, the Phantom CAP greatly increased the depth of the fleet's air defences.

The AN/APG-59 multi-mode pulse doppler radar operated in I-Band and, when it first appeared, was revolutionary. It was mounted in the aircraft nose with a 32 inch (81.5 cm) diameter scanner at the front which, together with the radome, was hinged to starboard to reduce the aircraft's overall length to permit stowage below decks on British carriers.

On the RAF's Phantom FGR.2 where length was not so critical, only the radome hinged for ease of maintenance. Besides the radar's conventional pulse radar mode which gave a target's bearing, range and relative height, there was also a Doppler mode which in essence identified moving targets against a stationary or slow-moving background. This permitted aircraft targets to be tracked through sea returns or over land, both situations where a conventional pulse radar would have lost the target. The radar system was also able to track designated targets automatically whilst still searching for new ones, as well as having various navigation, mapping and ground attack modes.

It was also crucial to the Sparrow missile which, being a semi-active radar-homing type, required its target to remain illuminated by the APG-59 radar for the duration of flight as it homed in on the radar energy

In addition to their air defence duties in the UK No. 43 Squadron made a number of overseas visits, particularly to the Mediterranean for exercise purposes with other NATO countries. Here most of their aircraft on the deployment are ranged next to Luqa's air traffic control building. (G.Mangion)

Live firing against banner towed targets was part of the routine exercises carried out by fighter squadrons, generally when on an overseas detachment. These pilots can be well pleaaed with themselves judging by the number of hits on the target, each pilot's score being recorded in different colours by painting the ammunition before firing. (MoD)

reflected back from the target. For this purpose there was a continuous wave (CW) element to the radar which continuously illuminated the target once it had locked on.

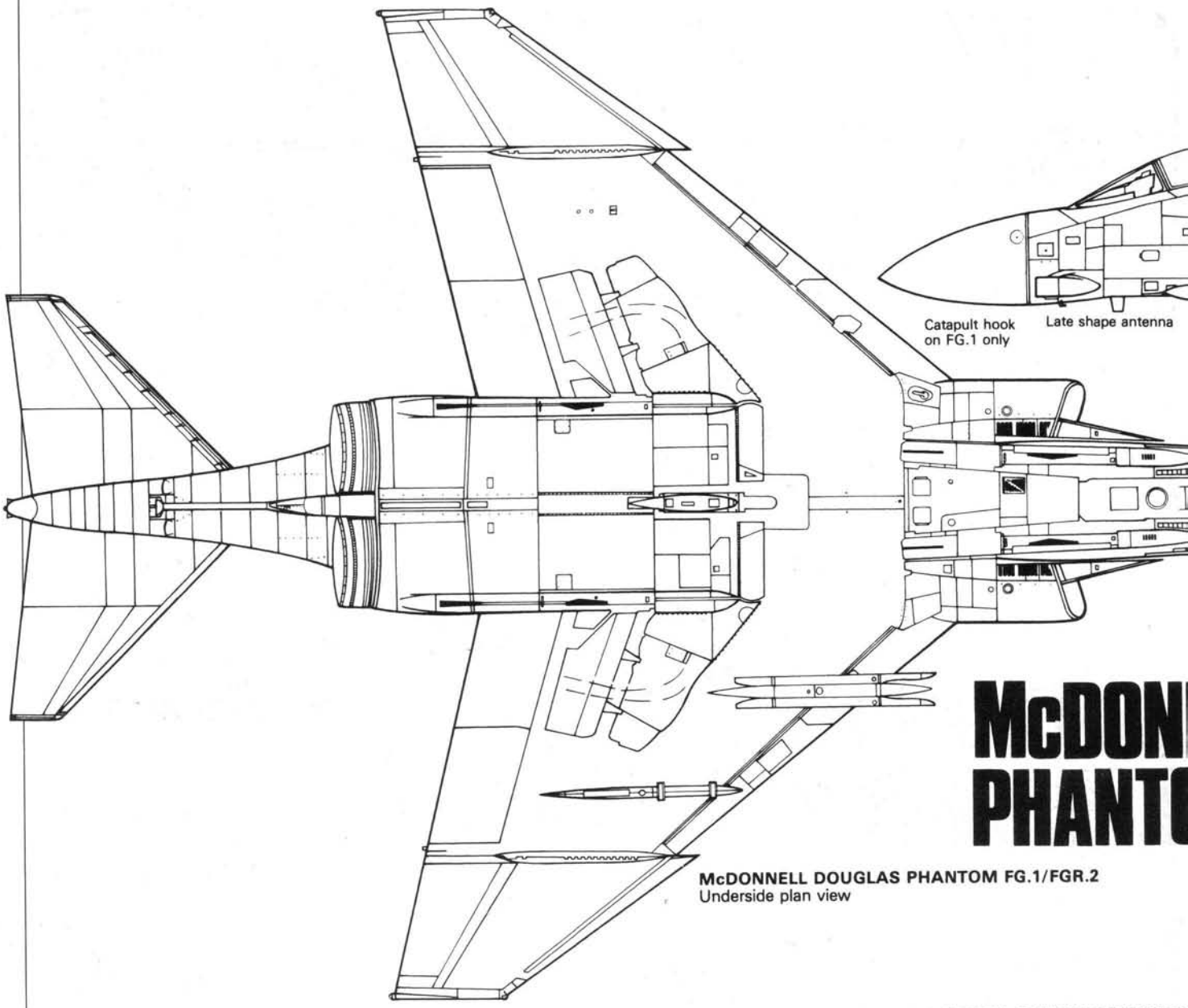
The radar was operated by the observer in the rear cockpit who had full radar controls and displays, whilst the pilot had just a radar display available for reference. For attacks with the infrared homing AIM-9 Sidewinder missile the observer and pilot worked together to achieve contact on the target. From that point an audio tone on the intercom indicated when the missile head had locked onto the target, followed by a further tone when the aircraft was within firing range. The early versions of the Sidewinder primarily homed onto the gasses from jet exhausts, which in effect meant the jet pipe in a stern shot, but on later versions the seeker head was sufficiently sensitive to engage a fast-moving target from most aspects.

RAF Phantoms

PHANTOM INTERCEPTORS

Because of the Phantom FG.1's excellent air intercept (AI) radar and long range missiles it was a logical decision on the part of the

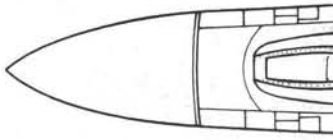
Firebird markings. Right, The red and white nose checks and the Firebird insignia on the tail indicate No. 56 Squadron's markings from the period when they were based at RAF Wattisham. Below: Two Phantoms from the same squadron retracting their undercarriages after a twin-ship take-off from Luqa, Malta in November 1977. (G.Mangion)



McDONN
PHANTO

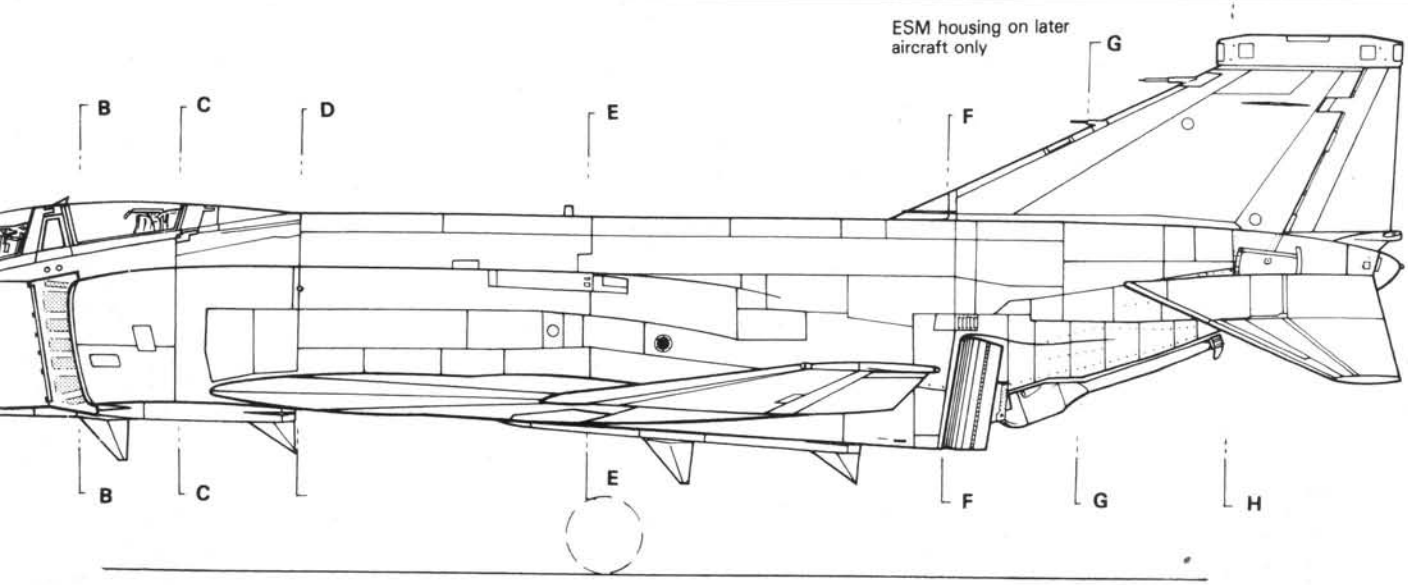
McDONNELL DOUGLAS PHANTOM FG.1/FGR.2
Underside plan view

McDONNELL DOUGLAS PHANTO
Upper surface plan view

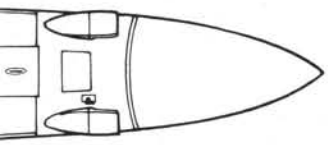


Drawings by Grant Race

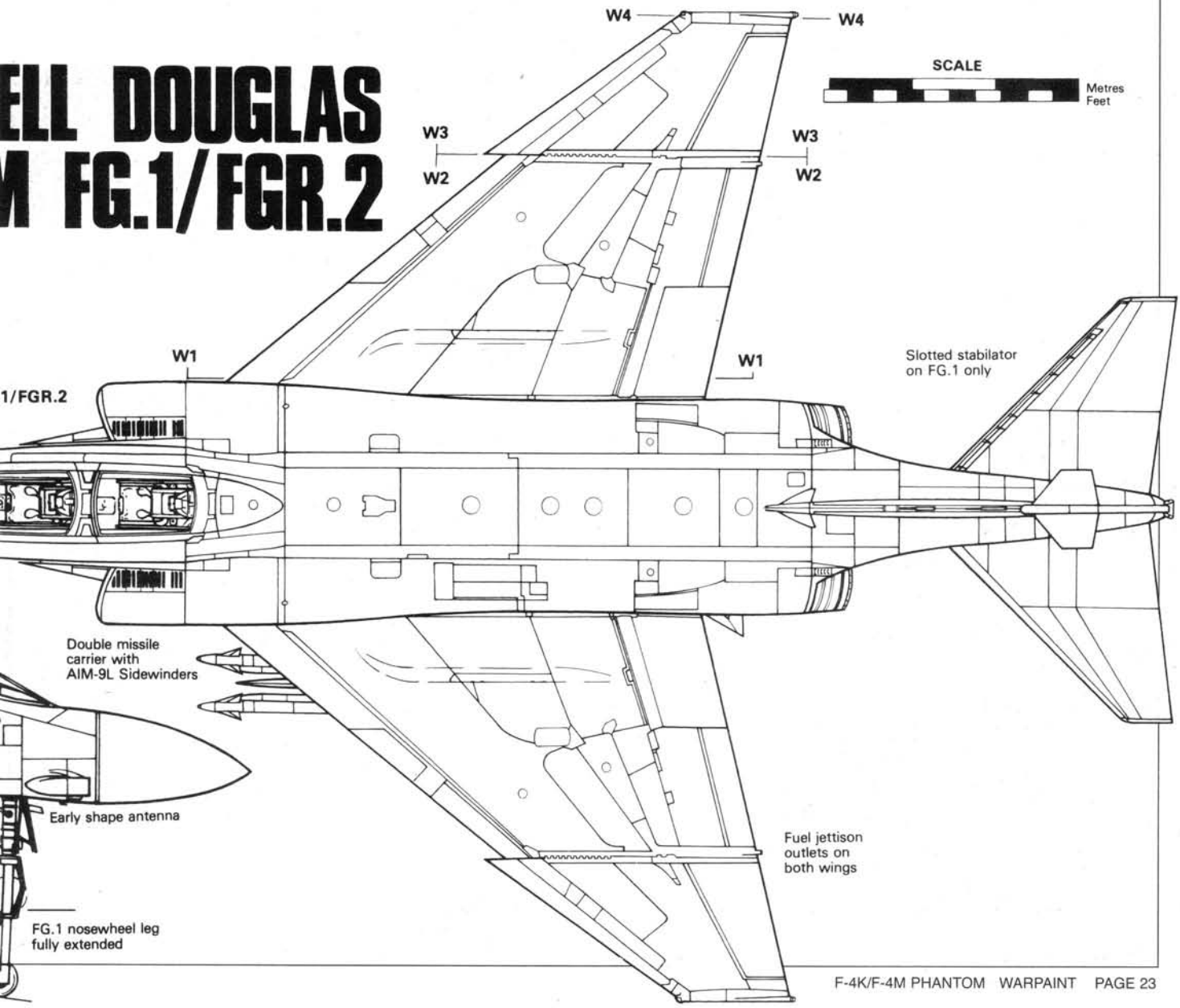
McDONNELL DOUGLAS PHANTOM FG.1
Starboard side view

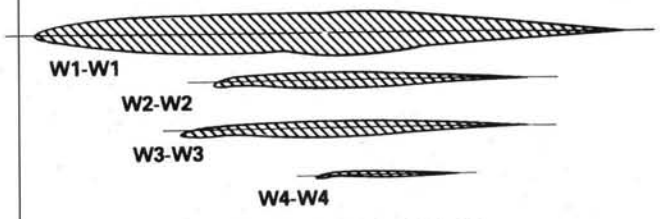


McDONNELL DOUGLAS PHANTOM FGR.2
Port side view

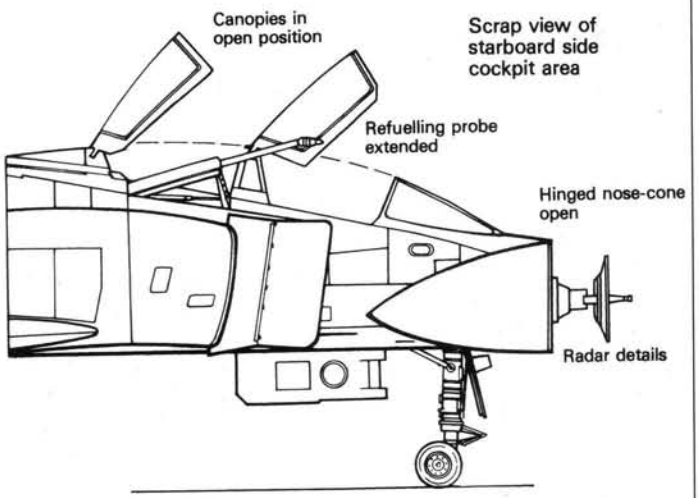


ELL DOUGLAS
M FG.1/FGR.2





WING CROSS SECTIONS

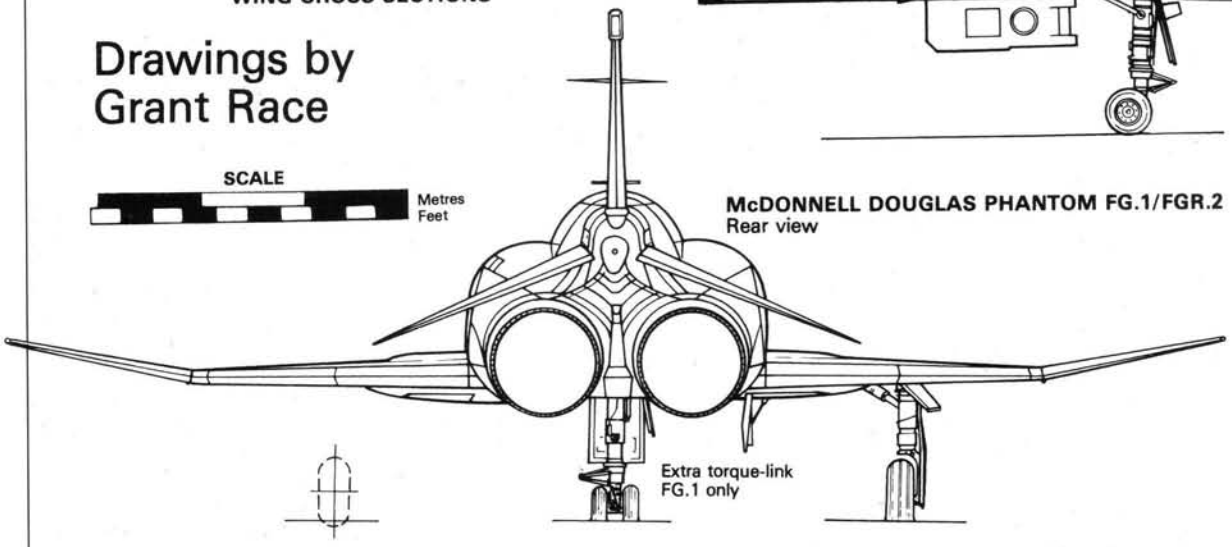


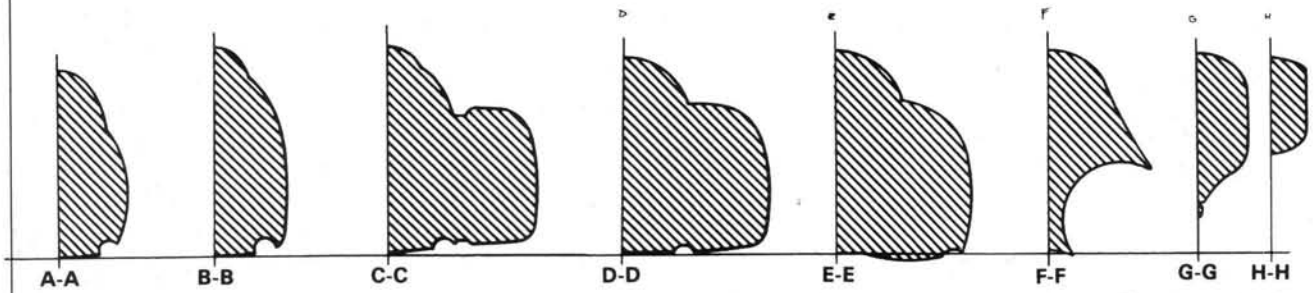
Drawings by Grant Race

SCALE

Metres
Feet

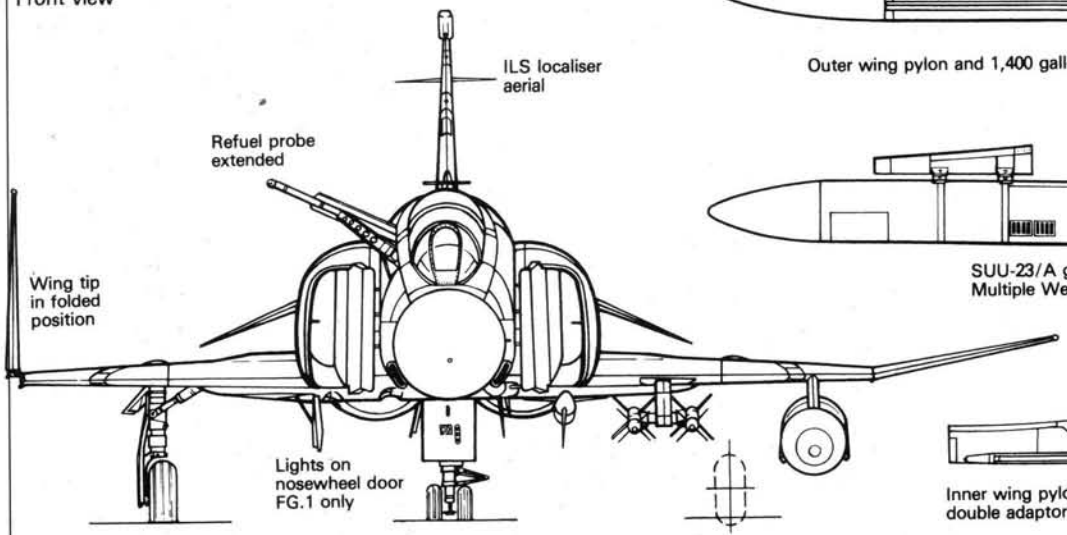
McDONNELL DOUGLAS PHANTOM FG.1/FGR.2
Rear view

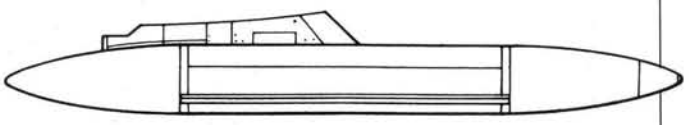




FUSELAGE CROSS SECTIONS

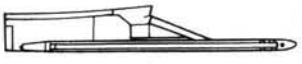
McDONNELL DOUGLAS PHANTOM FG.1/FGR.2
Front view





Outer wing pylon and 1,400 gallon Sergeant-Fletcher fuel tank

SUU-23/A gun pod mounted on Multiple Weapons Adaptor pylon



Inner wing pylon with double adaptor

Phantom XV469:W of No. 56 Squadron on the Wattisham ramp, presumably during an exercise otherwise the ground crewman in the centre would not be wearing his tin hat. Toned down markings and radar warning receiver on top of the fin indicate the photo date about 1980. (MoD)

government that when the RN order was cut back the remaining aircraft ordered were not cancelled but instead were diverted to the RAF. It was also acknowledged at the time that once the Fleet Air Arm had given up its fixed-wing aircraft its remaining Phantom FG.1s would be transferred to the RAF. These diverted RAF aircraft were delivered to No 23 Maintenance Unit (MU) at RAF Aldergrove for modifications as they came off the production line, whereas the RN aircraft had gone straight to NASU Yeovilton.

One of the modifications undertaken by 23 MU was to wire the aircraft to take the SUU-23A 20 mm rotary cannon pod below the centre fuselage, this not being carried by naval Phantoms. Some of the first RAF aircraft were in fact delivered to RNAS Yeovilton where they were used by 767 Squadron for training.

The remaining aircraft were prepared for RAF service and delivered to RAF Leuchars where No. 43 Squadron formed on 1 September 1969 to become the only Phantom air defence squadron in an otherwise Lightning-equipped No 11 Group.

Leuchars was chosen because it was the most active air defence airfield and because its QRA aircraft frequently had to operate well out over the Norwegian Sea, an area for which the Phantom with its better radar and longer endurance was better suited than the Lightning. Following a vigorous work-up period No. 43 Squadron was finally declared operational on 1 July 1970 with the dual role of UK air defence and the air defence of RN units operating around the UK. In both of these roles the squadron's Phantoms came to spend much time working with the Gannet AEW.3s of 849 Squadron and later the Shackleton AEW.2s of No. 8 Squadron once they became established on the other side of the Grampians at RAF Lossiemouth.

Just as No. 43 Squadron was playing an important part in UK air defence it was also undertaking a long term evaluation of the Phantom in the air defence role ready for the time when the Phantom FGR.2s would take over from the Lightnings. Interception and

Taken during one of the frequent NATO exercises over the Otterburn ranges in Northumberland, this Phantom shows its capabilities in a very low-level attack against a simulated convoy of vehicles, one of a number of targets available. The smoke came from practice bombs dropped by another Phantom seconds ahead of this one. (A.W.Hall)

RAF Phantom squadrons

Squadron	Type	Representative serials and dates
228 Operational Conversion Unit Formed 1 August 1968 at RAF Coningsby with Phantom FGR.2s and adopted Shadow identity of **No. 64 Squadron** in July 1970. Moved to RAF Leuchars 22 April 1987 and disbanded 31 January 1991.	Phantom FGR.2	1968 XT892, XT893, XT894. 1969 XT895, XT896, XV395. 1970 XT899, XT900, XT901. 1971 XT903, XT904, XT905. 1972 XT907, XT908, XT913. 1973 XT906, XT910, XT911. 1974 XT897, XV394, XV396. 1975 XV405, XV408, XV472. 1976 XT900, XT907, XV398. 1977 XT897:C, XT903:G, XV415:V. 1978 XT894:B, XT907:T, XV485:X. 1979 XT914:N, XV430:S, XV394:O. 1980 XT892:V, XV424:M, XV492:J. 1981 XV396:N, XV402:G, XV421:P. 1982 XT897:M, XT900:O, XV486:X. 1983 XV393:A, XV401:B, XV488:R. 1984 XT902:I, XV394:C, XV396:D. 1985 XT907:T, XV406:K, XV460:G. 1986 XT903:R, XV470:X, XV499:F. 1987 XV398:I, XV407:CL, XV470:CX. 1988 XT898:CE, XT903:CM, XV428:CC. 1989 XT897:CC, XV406:CK, XV425:CD. 1990 XT896:CY, XT906:CH, XV415:CB. 1991 XT895:CJ, XT907:CP, XV393:CA.
	Phantom FG.1	1990 XV582:M (used for 1990 display season).
Phantom Training Flight Formed 1 September 1972 at RAF Leuchars with Phantom FG.1s and disbanded 31 May 1978. Initially known as the Post OCU Phantom Training Flight. Re-formed 1 February 1991 at RAF Wattisham using Phantom FGR.2s borrowed from 56 and 74 Squadrons as required, and disbanded December 1991.	Phantom FG.1	XT857:U, XT861:V, XT866:W, XT868:LU,
	Phantom FGR.2	XV569:X, XV570:Y.
No. 2 Squadron Formed as 2 (Phantom) Sqdn 1 December 1970 at RAF Bruggen with Phantom FGR.2s and officially formed there 1 April 1971. Moved to RAF Laarbruch 3 May 1971 and disbanded 30 September 1976.	Phantom FGR.2	1970 XV485. 1971 XT906:T, XV417:E, XV430:S. 1972 XV467:R, XV485:W, XV489:O. 1973 XT910:T, XV470:W, XV494:N. 1974 XV475:Y, XV485:H, XV486:I. 1975 XV464:R, XV498:E, XV417:E. 1976 XV468:N, XV469:H, XV474:Y.
No. 6 Squadron Established as a cadre 13 January 1969 at RAF Coningsby and officially formed there 7 May 1969 with Phantom FGR.2s. Disbanded 30 September 1974.	Phantom FGR.2	1969 XT912, XV400, XV403. 1970 XV408:L, XV413:B, XV422:E. 1971 XV432:N, XV438:A, XV461:K. 1972 XV442:F, XV481:H, XV394:P. 1973 XT895:P, XV420:H, XV424:B. 1974 XV423:R, XV442:F, XV482:L.
No. 14 Squadron Formed 1 July 1970 at RAF Bruggen with Phantom FGR.2s and disbanded 30 November 1975.	Phantom FGR.2	1970 XT914, XV439, XV463. 1971 XV421, XV435, XV439. 1972 XV399, XV473, XV501. 1973 XT912, XV413, XV425. 1974 XV411, XV439, XV464. 1975 XV432, XV466, XV486.
No. 17 Squadron Established as 17 (Designate) Sqdn at RAF Wildenrath on 1 July 1970 and formed on 1 September 1970 at RAF Bruggen with Phantom FGR.2s. Disbanded 31 January 1976.	Phantom FGR.2	1970 XT901, XV468, XV475. 1971 XV474:G, XV483:E, XV488:F. 1972 XV392, XV393, XV471. 1973 XT905, XV498, XV475. 1974 XV469, XV474, XV489. 1975 XV466, XV470, XV497. 1976 XV462, XV494.
No. 19 Squadron Established as 19 (Designate) Sqdn during the summer of 1976 at RAF Coningsby with Phantom FGR.2s. Moved to RAF Wildenrath 27 September 1976 where it officially formed on 1 October 1976. Disbanded 9 January 1992.	Phantom FGR.2	1976 XV407:H, XV484, XV498:J. 1977 XT896:K, XV439:A, XV467:C. 1978 XT901:B, XV418, XV468:D. 1979 XV497:A, XV475:C, XV439:D. 1980 XV411:M, XV428:E, XV471:F. 1981 XV430:C, XV481:G, XV491:I. 1982 XV400:F, XV472:E, XV480:B. 1983 XT911:K, XV470:G, XV496:J. 1984 XV411:M, XV437:B, XV481:H. 1985 XV439:D, XV478:C, XV496:L. 1986 XT899:K, XV422:J, XV485:M. 1987 XT908:AK, XV472:E, XV476:G. 1988 XT902:K, XV411:G, XV468:E. 1989 XV401:AA, XV442:B, XV478:C. 1990 XV408:C, XV411:L, XV460:J. 1991 XT899:B, XV494:D, XV404:I. 1992 XV407:E, XV419:AA.
No. 23 Squadron Established as 23 (Designate) Sqdn 6 October 1975 at RAF Coningsby with Phantom FGR.2s and officially formed there 1 November 1975. Moved to RAF Wattisham 25 February 1976, and disbanded 30 March 1983. Re-formed 30 March 1983 at RAF Stanley, East Falkland with Phantom FGR.2s from 29 Sqdn Phantom Detachment. Moved to Mount Pleasant Airport, East Falkland, 21 April 1986, and renumbered 1435 Flt 1 November 1988.	Phantom FGR.2	1975 XV396:A, XV421:B, XV422:C. 1976 XV432:D, XV465:E, XV484:F. 1977 XV408:N, XV434:J, XV483:O. 1978 XT908:P, XV476:S, XV497:Q. 1979 XV423:E, XV472:L, XV474:F. 1980 XT909:T, XV414:B, XV489:L. 1981 XT903:X, XV490:H, XV500:S. 1982 XT899:X, XV485:P, XV492:U. 1983 XV402:A, XV464:U, XV501:B. 1984 XV426:Q, XV466:E, XV474:P. 1985 XV420:B, XV464:J, XV495:C. 1986 XV419:G, XV423:D, XV426:F. 1987 XV401:A, XV415:B, XV489:G. 1988 XV419:A, XV438:C, XV497:D.

On the way up. A fully armed No. 6 Squadron Phantom FGR.2 in a vertical climb. Its rate of climb was 32,000 feet per minute.

control techniques were tried and modified if necessary, together with methods for approaching, photographing and shadowing the Soviet intruder aircraft which almost daily probed the UK Air Defence Region.

In-flight refuelling from Victor tankers was also practised regularly and over the years standing tanker tow-line positions were established all around northern UK so that combined forces of fighters and tankers, and later AEW aircraft as well, could be deployed at short notice if a threat developed.

RAF Leuchars was designated as the eventual base for all Phantom FG.1s, including those of 892 Squadron when they left Yeovilton, and when 767 Squadron disbanded the training task was moved to Leuchars as well. On 1 September 1972 the Post Operational Conversion Unit Phantom Training Flight was established there as a joint RAF/RN unit under RAF control, using former RN aircraft now transferred to RAF ownership. Not surprisingly its title soon contracted to the Phantom Training Flight, and it continued to convert both RAF and RN aircrew to the Phantom FG.1 until 31 May 1978 when it was disbanded.

Thereafter there was no requirement to train naval crews, and RAF aircrew undertook conversion training on their front-line squadrons once they had passed out of 228 OCU.

Well before the disbandment of 892 Squadron the Phantom FGR.2-equipped No. 111 Squadron had moved to Leuchars from RAF Coningsby on 3 November 1975 ready to convert to the Phantom FG.1 once the former RN aeroplanes became available. These aircraft began to arrive from January 1978 and by late 1979 the conversion was complete.

Thereafter the Leuchars Wing flew Phantom FG.1s until the type gave way to the Tornado F.3, however by 1988 these Phantoms were beginning to be in short supply so from May that year No. 43 Squadron received three FGR.2s to maintain its operational establishment. During July 1989 the squadron was withdrawn from operations and began disposing of its Phantoms, rotating crews through 229 Operational Conversion Unit at Coningsby to convert to the Tornado F.3. The first of No. 43 Squadron's new aircraft was delivered to Leuchars on 23 September 1989 and before too long its last Phantom had gone. It was then the turn of No. 111 Squadron to go through a similar routine with its first aircraft leaving on 22 January 1990 and the squadron ceasing to be operational at the end of the month. As a swan song No. 111 Squadron displayed the specially painted all black XV582 'M' ('Black Mike') around the air show circuit during 1989. By June 1990 the Leuchars Wing was fully equipped with the Tornado.

Throughout the time that the RAF operated the Phantom FG.1 the aircraft underwent a gradual modification programme but this mainly involved the internal equipment such as improvements to the radar. However, one obvious external modification was the addition from 1973 onwards of a passive radar warning receiver (RWR) of the same type as was being fitted to the RAF Phantom FGR.2s. This consisted of a rectangular fairing mounted at the fintip containing the receiving aerials for equipment that would

Phantom FGR.2 XV464:B of No. 56 Squadron in a full reheat take-off. No armament or drop tanks are carried which was somewhat unusual (G. Mangion)

RAF Phantom Squadrons ... 2

Squadron	Type	Representative serials and dates
No. 29 Squadron Established as 29 (Designate) Sqdn 1 October 1974 at RAF Coningsby with Phantom FGR.2s and officially formed there 1 January 1975. Operated a detachment at Wideawake Airfield, Ascension Island, until July from 24 May 1982. Operated the Phantom Detachment at RAF Stanley, Falkland Islands, from 17 October 1982 until 30 March 1983 when it became 23 Sqdn. Disbanded 30 March 1987.	Phantom FGR.2	1974 XV423:R, XV424:B, XV490:M. 1975 XV418:C, XV438:A, XV485:K. 1976 XV417:I, XV420:H, XV481:E. 1977 XV400:I, XV425:R, XV465:B. 1978 XV399:P, XV487:L, XV495:X. 1979 XV442:F, XV433:X, XV501:O. 1980 XV436:E, XV468:W, XV484:C. 1981 XT898:T, XV424:I, XV489:A. 1982 XV419:G, XV421:B, XV466:E. 1983 XV406:D, XV423:D, XV473:L. 1984 XT909:M, XV401:L, XV404:E. 1985 XV412:H, XV438:Y, XV474:F. 1986 XV432:T, XV487:Q, XV494:T. 1987 XT902:M, XV428:I, XV486:N.
No. 31 Squadron Established as 31 (Designate) Sqdn in April 1971 at RAF Bruggen and officially formed there 20 July 1971 with Phantom FGR.2s. Disbanded 30 June 1976.	Phantom FGR.2	1971 XV402, XV426, XV434. 1972 XV427, XV431, XV487. 1973 XV393, XV440, XV460. 1974 XV433, XV480, XV484. 1975 XT909, XV404, XV426. 1976 XT905, XV494, XV501.
No. 41 Squadron Formed 1 April 1972 at RAF Coningsby with Phantom FGR.2s and disbanded 31 March 1977.	Phantom FGR.2	1972 XV401:A, XV418:C, XV466:K. 1973 XV415:D, XV432:L, XV434:E. 1974 XV465, XV493, XV495. 1975 XV401:1, XV463:R, XV499. 1976 XV412:I, XV492:Y, XV499:O. 1977 XV495.
No. 43 Squadron Formed 1 September 1969 at RAF Leuchars with Phantom FG.1s. Received some Phantom FGR.2s from 23 May 1988, and re-equipped with Tornado F.3s 31 July 1989.	Phantom FG.1	1969 XV571, XV574, XV575. 1970 XT875:K, XV581:E, XV582:F. 1971 XV573:L, XV576:D, XV585:P. 1972 XV578:O, XV580:Q, XV584:I. 1973 XT874:J, XV571:A, XV583:G. 1974 XV575:C, XV577:M, XV572:N. 1975 XV574:B, XV579:R, XV581:E. 1976 XT875:K, XV576:D, XV585:P. 1977 XV571:A, XV577:M, XV582:F. 1978 XV573:L, XV584:I, XV578:O. 1979 XT866:O, XV569:S, XV586:J. 1980 XT861:C, XV568:T, XV579:R. 1981 XV575:S, XV576:D, XV587:G. 1982 XT875:K, XV567:I, XV590:X. 1983 XT860:L, XV572:N, XV579:R. 1984 XV577:M, XV581:E, XV585:P. 1985 XT861:C, XV568:T, XV575:S. 1986 XT861:AC, XV587:G, XV590:AX. 1987 XV572:AN, XV582:AF, XV585:AP. 1988 XV567:AI, XV577:AM, XV579:AR. 1989 XV567:AT, XV581:AE, XV586:AJ.
	Phantom FGR.2	XV406:AV, XV470:AW, XV489:AU.
No. 54 Squadron Formed 1 September 1969 at RAF Coningsby with Phantom FGR.2s and disbanded 22 April 1974.	Phantom FGR.2	1969 XV404, XV416, XV420. 1970 XT906, XT911, XV403. 1971 XT902:P, XV412:A, XV420:D. 1972 XV403:A, XV415:O, XV419:G. 1973 XV404:J, XV429:E, XV432:L. 1974 XT902:K, XV406:D, XV437:F.
No. 56 Squadron Established as 56 (Designate) Sqdn 31 March 1976 at RAF Coningsby with Phantom FGR.2s, officially forming there 29 June 1976. Moved to RAF Wattisham on 9 July 1976, and disbanded 30 June 1992.	Phantom FGR.2	1976 XV470:C, XV489:F, XV497:G. 1977 XV415:A, XV464:B, XV475:H. 1978 XV409:D, XV420:J, XV482:C. 1979 XV401:N, XV474:F, XV494:G. 1980 XT908:Y, XV469:A, XV495:L. 1981 XV434:G, XV466:K, XV469:I. 1982 XV404:B, XV423:Q, XV428:I. 1983 XT901:Y, XV437:J, XV482:C. 1984 XV488:J, XV490:H, XV492:U. 1985 XT906:X, XV489:A, XV501:B. 1986 XV469:T, XV474:M, XV500:J. 1987 XT892:X, XT897:Y, XV473:K. 1988 XV399:L, XV424:Q, XV426:P. 1989 XV402:C, XV420:T, XV423:F. 1990 XT894:X, XV400:D, XV480:I. 1991 XV472:A, XV473:N, XV481:H. 1992 XV468:H, XV470:BD, XV494:O.
No. 74 Squadron Established as a cadre 1 July 1984 at RAF Wattisham, receiving Phantom F-4J(UK)s from 30 August 1984 and officially forming there 19 October 1984. Officially converted to Phantom FGR.2s 1 February 1991, and disbanded 1 October 1992.	Phantom F-4J(UK)	1984 ZE350:T, ZE352:G, ZE354. 1985 ZE355:S, ZE364:Z, ZE362:V. 1986 ZE357:N, ZE359:J, ZE363:W. 1987 ZE356:Q, ZE358:H, ZE361:P. 1988 ZE351:I, ZE353:E, ZE360:O. 1989 ZE350:T, ZE354:R, ZE364:Z. 1990 ZE355:S, ZE357:N, ZE362:V. 1991 ZE354:R, ZE360:O, ZE363:W.
	Phantom FGR.2	1991 XT895:Q, XT901:O, XV433:T. 1992 XT914:Z, XV469:N, XV497:W.
No.92 Squadron Established as 92 (Designate) Sqdn in the autumn 1976 at RAF Coningsby with Phantom FGR.2s. Moved to RAF Wildenrath 1 January 1977 where it officially formed 1 April 1977. Maintained a detachment at RAF Akrotiri, Cyprus, as 92	Phantom FGR.2	1976 XT899:T, XV413:Z. 1977 XV402:Q, XV499:R, XV411:S. 1978 XT899:T, XV462:Y, XV498:R. 1979 XV418, XV487:Y, XV496:W. 1980 XT914:T, XV460:T, XV418:Y. 1981 XV435:X, XV462:U, XV471:V. 1982 XT895:T, XV415:P, XV498:R. 1983 XV422:O, XV467:Q, XV475:S. 1984 XT908:T, XV480:X, XV490:S. 1985 XV415:O, XV468:P, XV435:R. 1986 XV424:W, XV467:Q, XV494:U. 1987 XV408:S, XV497:X, XV498:U. 1988 XT914:AT, XV437:Y, XV481:X. 1989 XV469:AO, XV488:O, XV492:W. 1990 XV430:S, XV464:AN, XV467:Q. 1991 XV408:Z, XV498:U.

RAF squadrons and miscellaneous units ... 3

Continued from pevious page

Squadron or unit	Type	Representative serials and ate
No.92 Squadron continued (Composite) Sqdn from 17 August 1990 until approx. April 1991. Disbanded 5 July 1991.		
No. 111 Squadron Established as 111 (Designate) Sqdn 1 July 1974 at RAF Coningsby with Phantom FGR.2s, and officially formed there 1 October 1974. Moved to RAF Leuchars 3 November 1975. Received Phantom FG.1s from Jan 1978 and fully re-equipped by July 1979. Re-equipped with Tornado F.3s June 1990.	Phantom FGR.2	1974 XT893:K, XV404:J, XV478:O. 1975 XT912:K, XV416:H, XV500:M. 1976 XV403:A, XV428:H, XV491:O. 1977 XV401:U, XV410:E, XV494:T. 1978 XT895:D, XV419:J, XV424:B. 1979: XT892:K, XV409:Q, XV478:X.
	Phantom FG.1	1978 XT598:E, XT857:C, XT874:J. 1979 XT873:A, XV578:F, XV583:B. 1980 XV570:N, XV589:P, XV592:L. 1981 XT859:K, XT865:U, XT872:T. 1982 XT863:G, XT867:H, XV573:D. 1983 XT857:C, XV591:M, XV574:Z. 1984 XT870:S, XT873:A, XV584:F. 1985 XT864:J, XT874:E, XV569:Q. 1986 XT867:H, XT874:BE, XV583:BB. 1987 XV573:BD, XV583:BB, XV591:BM. 1988 XV569:BQ, XV570:BN, XV584:BF. 1989 XT864:BJ, XV572:BG, XV592:BL. 1990 XV575:BO, XV582:M, XV587:BR.
1435 Flight Formed 1 November 1988 at Mount Pleasant Airport, East Falkland, from 23 Sqdn, with Phantom FGR.2s. Re-equipped with Tornado F.3s July 1992.	Phantom FGR.2	1988 XV419:A, XV433:B. 1989 XV438:C, XV497:D 1990 XV461:C, XV466:D. 1991 XV421:F, XV442:H. 1992 XV409:H, XV472:F.
BRITISH MISCELLANEOUS UNITS AND INDUSTRY USE		
Aeroplane and Armament Experimental Establishment, Boscombe Down	Phantom FG.1	XT597, XT598, XT857, XT858:724-VL, XT865, XT868:153-VL, XT872, XV567.
	Phantom YF-4M	XT852, XT853.
	Phantom FGR.2	XT898, XT900, XV401:I, XV406, XV410, XV415
	Phantom F-4J(UK)	ZE360.
Royal Aircraft Establishment, Bedford	Phantom FG.1	XT857, XT858, XT865, XT870, XT872.
Trials and Experimental Establishment, Llanbedr	Phantom FGR.2	XV435.
British Aerospace (formerly Hawker-Siddeley), **Brough** and **Holme-on-Spalding-Moor**	Phantom YF-4K	XT595, XT596.
	Phantom FG.1	XT597, XT598, XT858, XT865, XT873, XV574, XV587.
	Phantom YF-4M	XT852, XT853.
	Phantom FGR.2	XT898, XV406, XV411, XV415, XV501.
McDonnell, St Louis, Mo, USA	YF-4K	XT595, XT596.
	Phantom FG.1	XT597, XT598, XT857, XT858.
	YF-4M	XT852, XT853
Rolls-Royce, Hucknall	Phantom FG.1	XT858:724-VL.

receive E - J band radar signals, the bands used by search and fire control radars. The signal would show on a display giving the relative bearing of the transmitter to the aircraft, and the crew would also receive an audio signal to help identify the radar in question.

Another modification usually undertaken at the same time was the fitting of an instrument landing system, the plate aerials of which appeared on either side of the fin just below the RWR fairing. The RWR was also fitted to 892 Squadron's Phantom FG.1s but the ILS was not whilst the aircraft remained on naval charge.

GROUND ATTACK PHANTOMS FOR THE RAF

Whereas the RN wanted the Phantom for air defence the RAF primarily needed a long-range tactical ground attack and reconnaissance aircraft. Accordingly, although the RAF's F-4M was still based upon the Anglicised F-4J design it incorporated many of the features of the F-4E then being designed for the USAF. Externally there was little to distinguish the F-4M from the F-4K except that it had a standard F-4C nose oleo replacing the extending nosewheel oleo, and it lacked the ventral catapult fittings and slotted stabilator leading edge. Additionally the hinged nose was the standard Phantom nose where only the radome hinged to starboard for access. Whilst the outer wing panels still folded, on the F-4M they were folded manually rather than hydraulically as on the F-4K.

The main difference with the F-4M was with its internal equipment fit which was optimised for low-level, ground attack missions. The most significant change was the AN/AWG-12 weapons system which incorporated the Marconi inertial navigation and attack system (INAS), interfaced with other onboard navigation equipment, to give the standard of navigation necessary for long range, low-level tactical flying. It fed navigational information to the pilot's head-up

Above: Two of No. 43 Squadron's Phantom FG.1s make a formation take off from Luqa's busy runway in March 1978. The nearest aircraft is XV583:G and its companion XV585:P. (G.Mangion)

display (HUD) as well as to the navigator's cockpit displays, and could be operated in several modes, such as navigation, attack and terrain avoidance.

Other specialised equipment fitted included a lead computing optical sight that generated aiming marks for the Head Up Display, a radar altimeter and high frequency (HF) radio for long-range communications. There was also a ventral fuselage fitting to carry either a 20 mm gun pod or an electro-optical reconnaissance pod, as well as provision for a strike camera below the fuselage on the port forward Sparrow missile station.

The F-4M was fitted with Spey 202 engines which had a slightly slower afterburner response time than the Mark 203 and lacked the anti-corrosion features desirable on a seagoing engine. It did, however, have a gas turbine starter unit which meant that the RAF Phantom was the only variant capable of starting up using internal power alone, all other versions requiring an external ground starter unit. From 1971 the F-4Ms were fitted with improved Spey 204 engines which added the rapid afterburner response to the existing Mark 202 engine, but the aircraft's designation remained unchanged.

All weapons were to be carried externally on pylons, except for the Sparrow missiles on their usual semi-recessed ventral mountings. There were in all five pylons, two below each wing and one below the centre fuselage, but in each case these were generally fitted with multiple stores adapters.

Seen from the rear cockpit of a No. 111 Squadron Phantom which had just hooked up to a Victor tanker over the North Sea. Combat Air Patrols were maintained against Soviet intruders during the Cold War and in-flight refuelling to extend on-station endurance was common place. (MoD)

No. 43 Squadron retained individual aircraft letters on their aircraft when based at Leuchars. They also used Phantom FG.1s from 1969 to 1988 - the one on the left being XV577:M. (G.Mangion)

Sidewinder missiles carried for self-defence were invariably fitted in pairs to each inboard wing pylon which could instead be fitted with a triple bomb-carrier if required, and similar bomb-carriers could be fitted to the other pylons as well. These could handle 1,000 lb and 500 lb general purpose bombs in varying combinations together with pods of 24 x 2 in unguided rockets, Matra 155M 68 mm rocket pods, Hunting BL755 600 lb Cluster Bomb Units and 8 inch Lepus illumination rockets. In the nuclear strike role Phantoms could carry a single Mk 57 nuclear bomb on the fuselage centreline pylon. The Phantom was also cleared to use the Martel anti-radiation or TV-guided missiles but in practice never did

Two distinctive squadron markings, those of No. 111 Squadron in the foreground and No. 29 Squadron, are shown on Phantom FGR.2s of Strike Command's home defence element at RAF Coningsby. (A.W.Hall)

so. Apart from weapons the Phantom could also carry external fuel drop-tanks, a single 600 US gallon (500 imperial gallon) tank below the fuselage and a 370 US gallon (308 imp. gal.) tank below each wing on the outboard pylon.

SQUADRON DELIVERIES BEGIN

The design for the F-4M was frozen in November 1966 and the two YF-4M prototypes, ordered in June 1965 together with 24 production Phantom FGR.2s, followed the first four RN Phantoms down the St Louis production line at intervals.

The first prototype was XT852 which made its maiden flight on 17 February 1967 powered by Spey 201 engines and with test instrumentation fitted but minus the INAS. The INAS was based upon equipment originally designed for the TSR-2 and should have been due for delivery from December 1966, but serious delays meant that the first complete unit was not delivered to St Louis until October 1968. Even once fitted additional problems arose which had to be rectified, further delaying a test programme which was already seriously behind sched-

These two pictures (left and below) show the two roles of No. 2 Squadron when equipped with the Phantom. Showing a shark's mouth painting on the nose of the underslung camera pod typifies the squadron's main task of photo reconnaissance but that below, taken at Wildenrath in 1977, shows XV468 fitted with an SUU-23A gun pod for the ground attack role. Both aircraft display the early markings of the squadron which should be compared with that on page 32 where squadron markings have been toned down. (MoD)

McDonnell Douglas F-4M Phantom FGR.2 XV469:AO of No. 92 Squadron, RAF Wildenrath in 1989. Grey paint scheme with red fin and rudder. Checks on Radar Warning Receiver and revised cobra badge.

McDonnell Douglas F-4M Phantom FGR.2 XV408:Z of No. 92 Squadron, RAF Wildenrath in 1991. Special overall finish in Satin Blue (BS681C-110).

McDonnell Douglas F-4M Phantom FGR.2 XV485:O of Nos. 64 and 111 Squadrons at RAF Leuchars in June 1978. Aircraft was borrowed from 228 OCU (No. 64 Shadow Squadron). Matt finish, Tactical Type 'D'; roundels, small yellow code on fin.

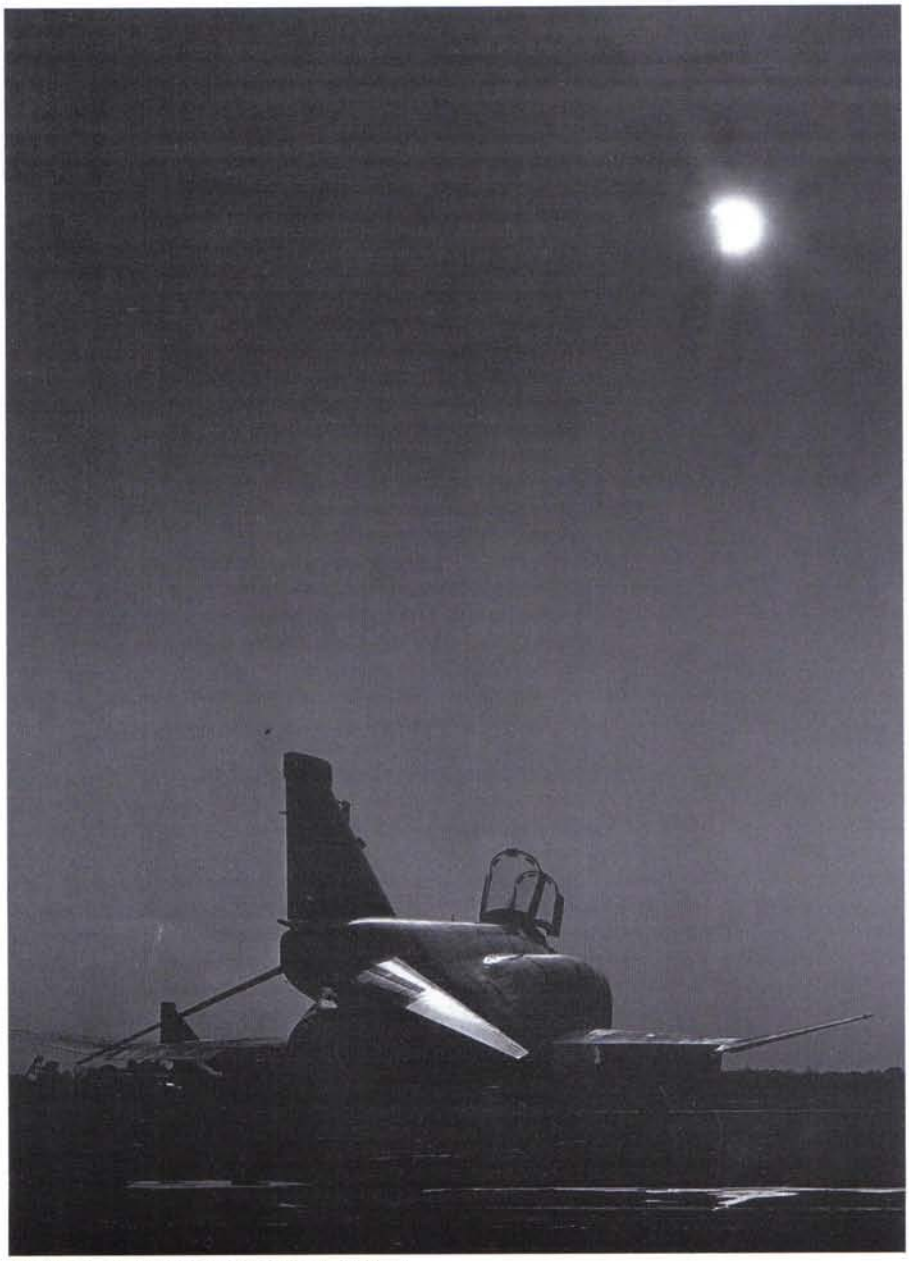
McDonnell Douglas F-4K Phantom FG.1 XV574:Z of No. 111 Squadron, RAF Leuchars in 1986. Overall grey scheme but with black spine, fin and rudder, with squadron badge on central yellow section.

ule because of the early difficulties with the Spey engine.

During the course of 1967 XT853, the second RAF prototype, joined the first on company trials at St Louis, then from 20 July 1968 the first production Phantom FGR.2s started arriving at 23 MU. These early aircraft arrived without the INAS which had to be fitted later, but in view of the delays already experienced it was now considered a matter of some urgency for aircrew training to begin as soon as possible. The Phantom FG.1 service trials were making good progress by that time so the RAF chose to employ what aircraft were available for training even though they were not up to operational standard, then to withdraw them later so that they could be fully modified.

Since the Phantom FG.1s undertook most of the service trials at Boscombe Down and with the manufacturers, when the first Phantom FGR.2s were ready for delivery they went straight to RAF Coningsby where 228 Operational Conversion Unit (OCU) was established as the main RAF Phantom training unit.

At the time it was formed the OCU came within 38 Group, RAF Air Support Command, the RAF's home-based tactical group. The first aircraft arrived on 23 August 1968 from 23 MU and immediately the training of ground crew and instructors



Above: Compare the toned down markings of this No. 2 Squadron Phantom with those on page 30. The nose markings are now hardly visible. (G.Mangion) Left: Wattisham by moonlight. 24-hour vigilance was necessary during the Cold War period when Phantoms on home defence duties could be called on at any time to make an interception out over the North Sea. (MoD)

began, followed by a period of service trials to establish the standard operating procedures for the new aircraft and to permit the writing of the type's training syllabus.

Because there was no dual-control version of the Phantom some 24 aircraft from the first batch (XT891-XT914) were modified to act as training aircraft when required. This consisted of fitting removable flying controls and the necessary instrumentation in the rear cockpit for use by the instructor, with a periscope also being added later to improve forward visibility.

Because these extra flight controls inhibited the use of the radar the twin-stick aircraft could not be used operationally, so when not required the extra equipment was usually removed. However, once all the RAF Phantoms had been delivered and squadrons were up to strength, it became common for each unit to maintain at least one 'trainer' Phantom fitted out for instrument rating checks and pilot continuation training since it could easily be converted back to operational status if needed.

The first OCU course started in January 1969 and thereafter the training programme gathered momentum, although a lack of spares and Spey engines meant that training had to be slowed or even suspended on a number of occasions over the coming years.

RAF Coningsby had been chosen as the RAF's main Phantom base which meant that all training and service engineering support was to be concentrated there, and a good number of the RAF's Phantom squadrons formed there as well before deploying to their operational airfields.

The RAF's first Phantom FGR.2 squadron

Above: Seen during No. 41 Squadron's partial detachment to RAF Akrotiri, Cyprus, this Phantom FGR.2 is being prepared for take-off. (MoD) Below: Well zapped! With evidence of a number of deployments both in France and the UK this Phantom of No. 41 Squadron also wears a shark's mouth on the nose. RAF Germany Phantom squadrons were frequent visitors to other NATO countries for exercises and familiarisation. This aircraft depicts the main role of No. 41, that of tactical reconnaissance, with a camera pod slung under the centre line. (MoD)

was No. 6 (Designate) Squadron which formed as a cadre at Coningsby on 13 January 1969 whilst its aircrew underwent training as the first OCU course. Once the course finished the crews joined No. 6 Squadron on 2 May, taking their aircraft with them, and on 7 May 1969 the unit was officially established with the 'designate' caveat being dropped from the squadron title. Thereafter it carried out a brisk work-up to operational standard and took over much of the service trials responsibility from 228 OCU. The squadron was tasked primarily with ground attack and tactical support, but also had a secondary tactical reconnaissance role if required.

The next Phantom unit was No. 54 Squadron which formed at Coningsby on 1 September 1969 and which took most of the students from the second OCU course together with another batch of 228 OCU's Phantoms. Thereafter it continued in the ground attack role until disbanding on 22 April 1974.

Both Nos. 6 and 54 Squadrons were to support British forces wherever they were required and were also declared to NATO, so they flew frequent detachments to the Far and Middle East, as well as to the Mediterranean and Europe.

During the Turkish invasion of northern Cyprus in August 1974 No. 6 Squadron made a rapid deployment to RAF Akrotiri, Cyprus, in order to protect the British Sovereign Base Areas on the island. It also went to give air support to British and UN forces should the Turks and Turkish Cypriots try to over-run the whole island. Fortunately the situation stabilised and the squadron was eventually able to return home, leaving the UN to preserve the peace as best it could. Soon after its return the squadron disbanded on 30 September 1974.

Besides these two front-line Phantom squadrons, 228 OCU was given the 'shadow' identity of No. 64 Squadron from July 1970 once it had become established as a training unit with a core of experienced instructors. This meant that in time of tension or when required for specific exercises, the OCU would form up a contingent of instructor crews and fully modified operational aircraft and act as a front-line squadron under the operational control of Group Headquarters.

RECONNAISSANCE PHANTOMS

With sufficient Phantoms available by 1970 it was possible to release some aircraft for specialist trials around various establishments in the UK. Apart from individual aircraft going for periods of short-term loan to the A&AEE, aircraft used there for longer trials included XV410 which was used for radio work during 1969-70 and XT898 which was used for navigation equipment trials from 1971-72.

Of major importance was XV406 which was assigned to Brough/Holme-on-Spalding-Moor from 1969, and then to Boscombe Down, for trials with the EMI

No. 41 Squadron's pre-toned down markings appear well on these two Phantom FGR.2s on detachment to RAF Luqa, Malta, probably their first visit in 1977-78 (G.Mangion)

GROUND INSTRUCTION AIRFRAMES

XT595 (8550M/8851M), XT596, XT852,
Each serial is followed by its Maintenance number where known

XT853 (9071M), XT857 (8913M), XT858, XT859 (8999M), XT864 (8998M), XT867 (9064M), XT869, XT871, XT874 (9068M), XT891 (9136M), XT895 (9171M), XT900 (9099M), XT905 (9286M) XT907 (9151M), XT914, XV401, XV406 (9098M), XV408 (9165M), XV409 (9160M), XV411 (9103M), XV412 (9104M), XV415 (9163M), XV420 (9247M), XV422 (9157M), XV423, XV424 (9152M), XV425 (9094M), XV426, XV435, XV436 (8850M), XV467 (9158M), XV468 (9159M), XV475 (9105M), XV481 (9135M), XV482 (9107M), XV485 (9106M), XV500 (9113M), XV569 (9063M), XV570 (9069M), XV577 (9065M), XV581 (9070M), XV582 (9066M), XV586 (9067M), XV587 (9088M), ZE350 (9080M), ZE351 (9058M), ZE352 (9086M), ZE353 (9083M), ZE354 (9084M), ZE356 (9060M), ZE357 (9081M), ZE360 (9059M), ZE361 (9057M), ZE363 (9082M), ZE364 (9085M).

PHANTOM LOSSES

XT598	FG.1	23 November 1978
XV427	FGR.2	22 August 1973
XT857	FG.1	August 1985*
XV428	FGR.2	23 September 1988
XT860	FG.1	20 April 1988
XV431	FGR.2	11 October 1974
XT861	FG.1	7 September 1987
XV434	FGR.2	7 January 1986
XT862	FG.1	19 May 1971
XV436	FGR.2	5 March 1980
XT866	FG.1	9 July 1981
XV437	FGR.2	18 October 1988
XT868	FG.1	12 May 1978
XV440	FGR.2	25 June 1973
XT869	FG.1	15 October 1973
XV441	FGR.2	21 November 1974
XT871	FG.1	25 July 1973
XV462	FGR.2	8 January 1991
XT876	FG.1	10 January 1972
XV463	FGR.2	17 December 1975
XT893	FGR.2	24 April 1989
XV471	FGR.2	3 July 1986
XT904	FGR.2	15 October 1971
XV477	FGR.2	21 November 1972
XT908	FGR.2	9 January 1989
XV478	FGR.2	19 September 1990
XT912	FGR.2	14 April 1982
XV479	FGR.2	12 October 1971
XT913	FGR.2	14 February 1972
XV483	FGR.2	24 July 1978
XV395	FGR.2	9 July 1969
XV484	FGR.2	17 October 1983
XV397	FGR.2	1 June 1973
XV491	FGR.2	7 July 1982
XV402	FGR.2	30 April 1990
XV493	FGR.2	9 August 1974
XV403	FGR.2	4 August 1978
XV501	FGR.2	2 August 1988
XV405	FGR.2	24 November 1975
XV565	FG.1	29 June 1971
XV413	FGR.2	12 November 1980
XV566	FG.1	3 May 1970
XV414	FGR.2	9 December 1980
XV578	FG.1	28 February 1979
XV416	FGR.2	3 March 1975
XV580	FG.1	18 September 1975
XV417	FGR.2	23 July 1976
XV588	FG.1	17 May 1977
XV418	FGR.2	11 July 1980
XV589	FG.1	3 June 1980
XV421	FGR.2	30 October 1991
ZE358	F-4J(UK)	26 August 1987

** Damaged in landing accident and not repaired.*

Climbing into the cockpit of a No. 19 Squadron Battleflight Phantom FGR.2 are the crew using the Squadron Commander's aircraft. Stationed at RAF Wildenrath, Germany this squadron was on 24-hour standby to intercept any Soviet or Warsaw Pact aircraft that strayed towards the NATO boundary of West Germany. (MoD)

Phantom Reconnaissance Pod. This was an electro-optical pod weighing 2,300 lb based upon the 24 feet long, 500 gallon Phantom centreline fuel tank, which contained an RS-700 infra-red linescan unit, a high definition EMI P391 sideways looking airborne radar (SLAR) and up to five optical film cameras. The cameras were arranged with one facing forward, one vertical, two oblique sideways facing and a vertical F135 twin-lensed, stereo unit. If required the cameras could operate simultaneously to give panoramic, horizon-to-horizon coverage.

For night operations four F135 cameras were fitted, synchronised to an electronic strobe flash unit built into the front of a specially adapted 308 gallon drop tank carried on the outboard wing pylon, and for special missions combinations of other cameras could be fitted. In all cases the time and geographical co-ordinates were marked on each frame, and the films could be processed in flight and the developed film cassettes ejected for (theoretically) recovery and speedy analysis by ground forces. A big advantage with this pod was that it could be carried under the fuselage on the centreline station (of suitably modified aircraft only) and was easily removed, allowing the aircraft to retain their ground attack capability.

In an unusual anomaly the Phantom FGR.2 did not actually have a practical reconnaissance capability except for the 30 or so aircraft specially modified to carry the reconnaissance pod.

The first Phantom reconnaissance unit was No. 2 (Phantom) Squadron, which formed at RAF Bruggen on 1 December 1970 the same day as the existing Hunter FR.10-equipped No. 2 Squadron at RAF Gutersloh was retitled No. 2 (Hunter) Squadron. Both units operated simultaneously as part of RAF Germany (RAFG) with the Hunters continuing to provide the command's tactical reconnaissance capability until the Phantom squadron had completed its work-up. Once this was accomplished No. 2 (Hunter) Squadron disbanded on 31 March 1971 and the following day the Phantom unit assumed both the squadron nameplate and the tactical reconnaissance tasking for RAFG.

On 3 May 1971 the squadron moved to its

Right: An historic picture to conjure up many wartime memories. This No. 17 Squadron Phantom FGR.2 from RAF Bruggen, Germany, flies over the Mohne dam which was breached by No. 617 Squadron during World War 2. The object of the aircraft's low approach was more likely to be on a reconnaissance mission in which pinpoint targets were specified and from which detailed analysis could be made. Note the additonal squadron badge on the nose. (MoD)

operational base at RAF Laarbruch where it remained until its disbandment on 30 September 1976. By then RAFG's ground attack Phantom squadrons had all re-equipped with the SEPECAT Jaguar GR.1 and sufficient aircraft were available to take over the tactical reconnaissance role as well, releasing the Phantoms for air defence duties back in the UK.

The other Phantom reconnaissance unit was No. 41 Squadron which formed at RAF Coningsby on 1 April 1972, once No. 2 Squadron was fully equipped and had successfully completed operational testing of the EMI pod. This became the third squadron of the Coningsby Wing and provided tactical reconnaissance for 38 Group, a part of RAF Strike Command from July 1972, and a role it continued to fulfil until here too Jaguars replaced the Phantoms. On 1 October 1976 No. 41 (Designate) Squadron formed at RAF Coltishall equipped with Jaguar GR.1s and once it was declared operational No. 41 Squadron at Coningsby disbanded on 31 March 1977.

PHANTOM PRODUCTION

McDonnell St Louis line numbers appear after the serial

Phantom YF-4K Prototypes
XT595 (c/n 1449) and XT596 (1527). 2 aircraft

Phantom F-4K/FG.1
XT597 (c/n 1611), XT598 (c/n 1669), XT857-876 (c/n 2097, 2225, 2279,2336, 2383, 2426, 2463, 2475, 2502, 2526, 2546, 2602, 2623, 2646, 2666, 2706, 2738, 2775, 2813, 2856), XV565-592 (c/n 2872, 2896, 2922, 2943,2970, 2995, 3020, 3042, 3065, 3087, 3112, 3134, 3155, 3180, 3204, 3218, 3235, 3253, 3268, 3286, 3302, 3317, 3331, 3346, 3363, 3394, 3409, 3424).
XV604-610 cancelled. 50 aircraft

Phantom YF-4M Prototypes
XT852 (c/n 1950) and XT853 (c/n 2020). 2 aircraft

Phantom F-4M/FGR.2
XT891-914 (c/n 2250, 2285, 2333, 2370,2417, 2456, 2471, 2485, 2507, 2516, 2536, 2567, 2592, 2616, 2636, 2657, 2665, 2684, 2696, 2709, 2727, 2742, 2754, 2771), XV393-442 (c/n 2791, 2803, 2822, 2834, 2850, 2864, 2869, 2877, 2885, 2893, 2901, 2910, 2919, 2928, 2937, 2946, 2955, 2964, 2973, 2981, 2990, 2999, 3007, 3017, 3026, 3036, 3045, 3053, 3061, 3068, 3075, 3084, 3093, 3100, 3106, 3115, 3124, 3131, 3140, 3149, 3158, 3167, 3174, 3183, 3195, 3201, 3208, 3214, 3220, 3226), XV460-501 (c/n 3231, 3237, 3243, 3249, 3255, 3261, 3266, 3270, 3276, 3282, 3288, 3293, 3298, 3304, 3309, 3314, 3321, 3329, 3336, 3344, 3350, 3355, 3361, 3367, 3373, 3377, 3382, 3386, 3392, 3396, 3401, 3407, 3413, 3420, 3428, 3434, 3442, 3454, 3466, 3477, 3491, 3507).
XT915-928 and XV520-551 cancelled. 111 aircraft

Phantom F-4J(UK) (originally F.3)
ZE350-364 (c/n 1692, 1759, 1870, 1888, 1978, 2038, 2293, 2592, 2689, 2746, 2879, 2906, 2958, 3338, 3542). Originally USN F-4J 153768, 773, 783, 785, 795, 803, 850, 892, 155510, 529, 574, 734, 755, 868, 894 respectively. 15 aircraft

THE RAF GERMANY GROUND ATTACK FORCE

The 38 Group Phantom squadrons essentially formed a compact, self-contained force which introduced the aircraft into RAF service and gave it a thorough evaluation under operational conditions. The Phantom had originally been ordered as a replacement for the ground attack Hunters but it seemed the government had failed to notice that the RAF Germany ground attack Hunter squadrons had already been re-equipped with Canberras! What actually happened was that the Phantoms replaced some of the

The Press were allowed to visit RAF Wattisham during one of the late 1970s summer exercises involving the UK's air defence squadrons. These pictures were taken at the time a Phantom arrived for an immediate turn round in which missiles had to be reloaded and fuel provided. The picture (right) shows a No. 29 Squadron Phantom minus its tail braking chute with a Sparrow missile in the foreground. Below: The same aircraft with ground crew in NBC clothing prepare to add Sidewinder missiles under the wings. (A.W.Hall)

With a background of No. 203 Squadron's Nimrods, permanently based at Luqa, Malta, this No. 17 Squadron Phantom is on detachment from RAF Germany for exercise purposes. (G. Mangion)

interdiction and tactical reconnaissance Canberras in RAFG, with RAF Bruggen in north-west Germany being chosen as the base for this ground attack Phantom force. At this stage the responsibility for air defence remained with the two Lightning squadrons at RAF Gutersloh.

Within RAFG the prime role of the Phantom would be that of ground support of allied forces in northern Germany, together with long-range ground attack and interdiction beyond the front line into East Germany and Poland. They would, like their RN counterparts, also have the capability for nuclear strike. Because in any conflict the aircraft would generally be operating at low level over central Europe, the squadrons had no requirement for in-flight refuelling so unlike the 38 Group squadrons the RAFG Phantom crews never practised this.

The first RAFG unit was No. 14 Squadron which formed at Bruggen on 1 July 1970, having previously flown Canberra B(I).8s from RAF Wildenrath. Its Phantoms had begun to arrive at Bruggen from 1 June so that the station's engineering staff could acquaint themselves with the aircraft, then as aircrew were posted in, training flights began even before the squadron officially came into being.

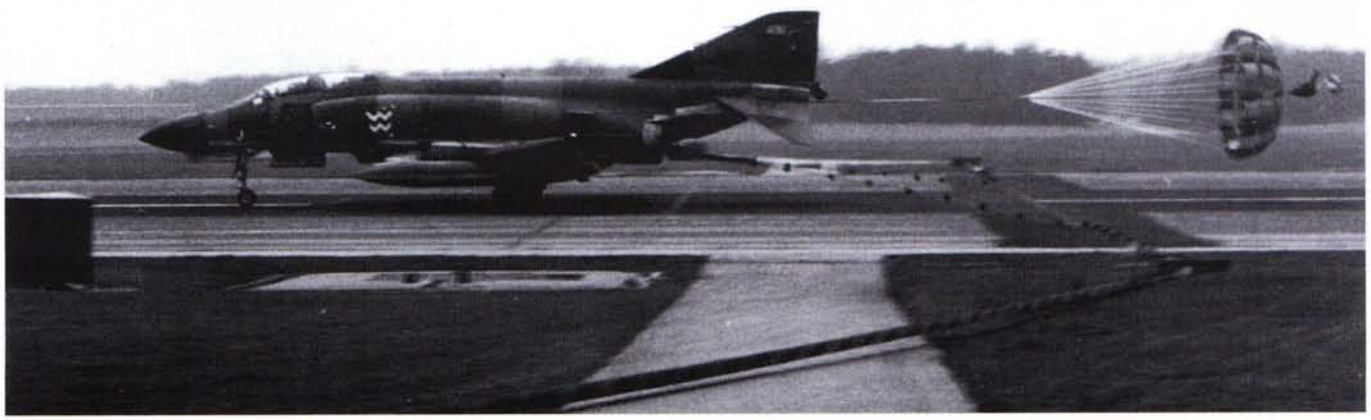
The next unit was No. 17 (Designate) Squadron which was established at Wildenrath from 1 July 1970 when its aircraft and crews began to arrive, and which officially formed at Bruggen on 1 September that year.

The last unit of the Bruggen Wing was No. 31 (Designate) Squadron whose crews began to arrive from April 1971, to be joined by some aircraft from June. The squadron reformed on 20 July but shortage of crews and Phantoms meant that it was some three months before it became fully operational, and it did not have its official formation ceremony until 7 October. Of the three units No. 31 Squadron was unusual in being the only one to have a secondary photo-reconnaissance role, for which it was eventually allotted several Phantom FGR.2s modified to carry the EMI reconnaissance pod.

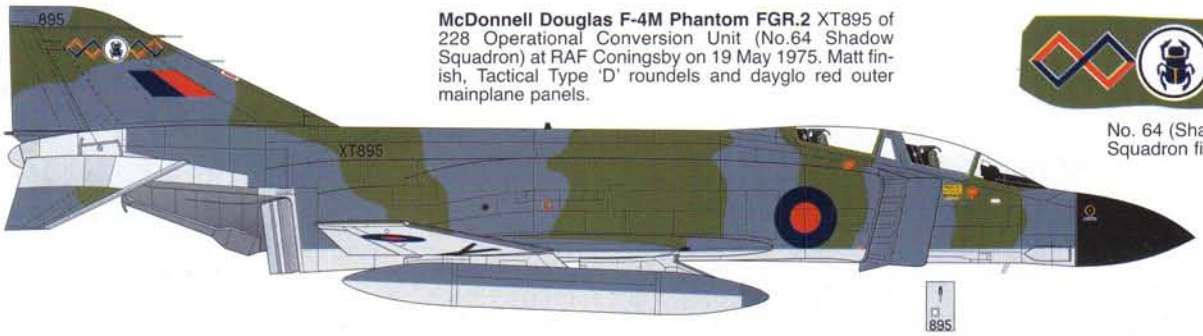
Before many years had passed however, the SEPECAT Jaguar GR.1 became available in sufficient numbers for RAFG to begin re-equipping with the type. As with the Phantom, the RAF initially re-equipped Nos. 6 and 54 Squadrons in the UK with the Jaguar and then set about re-equipping the units based in Federal Germany.

So as not to diminish the front-line strength of RAFG whilst the Jaguar was introduced into service, the policy adopted was for each new Jaguar-equipped squadron to form and work up until it became opera-

Left: One of No. 17 Squadron's Phantom FGR.2s on a low-level mission over Germany. Based at Wildenrath the squadron settled there in July 1970 and moved to Bruggen on 1 September the same year. Below: Taking the wire. This No. 17 Squadron Phantom, XV498, is seen making the 100th arrested landing at Bruggen. With its brake chute open and the aircraft's hook actually at the moment of contact with the arrester wire this is something of a unique picture. (MoD)



McDonnell Douglas F-4M Phantom FGR.2 XT895 of 228 Operational Conversion Unit (No.64 Shadow Squadron) at RAF Coningsby on 19 May 1975. Matt finish, Tactical Type 'D' roundels and dayglo red outer mainplane panels.

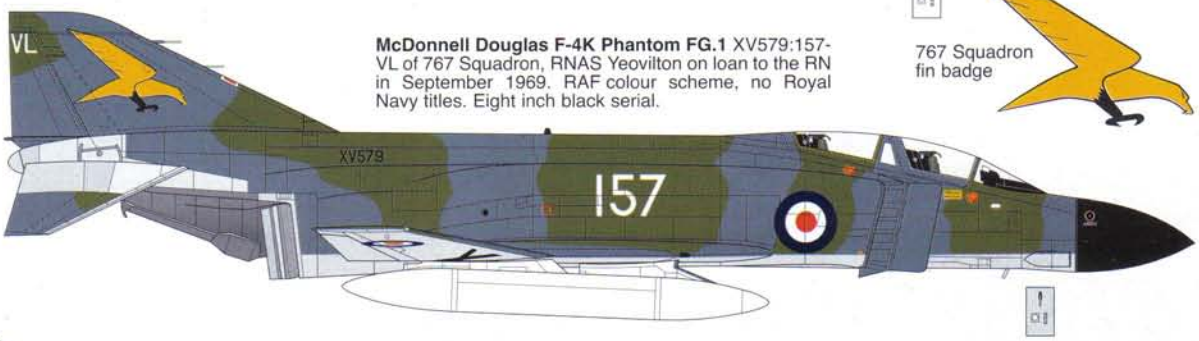


No. 64 (Shadow) Squadron fin badge

McDonnell Douglas F-4K Phantom FG.1 XT859:725-VL of 700P Squadron, RNAS Yeovilton in September 1968. Extra Dark Sea Grey and White undersides.

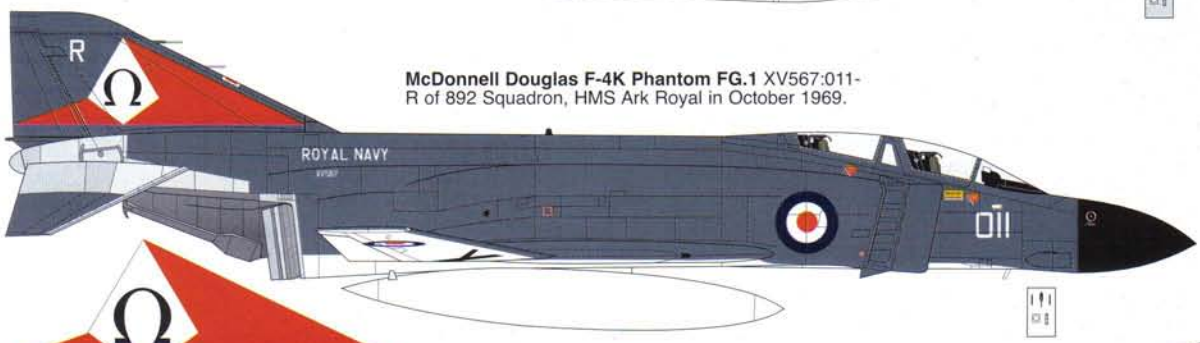
700P Squadron fin badge

McDonnell Douglas F-4K Phantom FG.1 XV579:157-VL of 767 Squadron, RNAS Yeovilton on loan to the RN in September 1969. RAF colour scheme, no Royal Navy titles. Eight inch black serial.



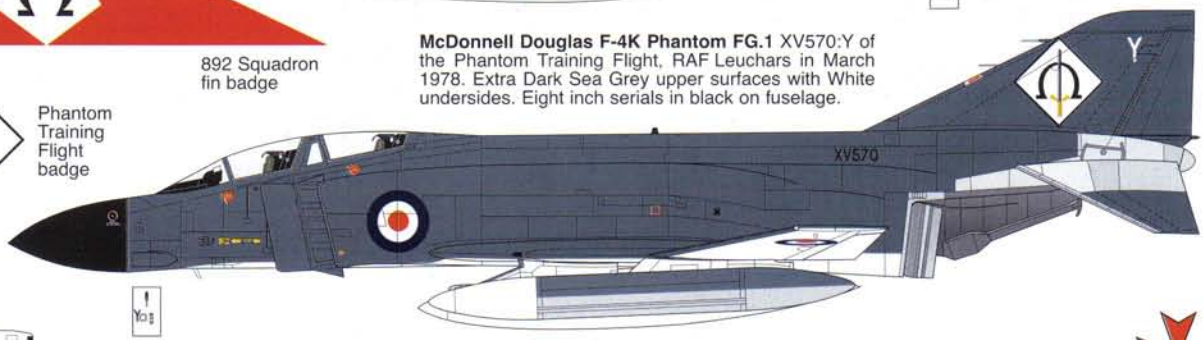
767 Squadron fin badge

McDonnell Douglas F-4K Phantom FG.1 XV567:011-R of 892 Squadron, HMS Ark Royal in October 1969.



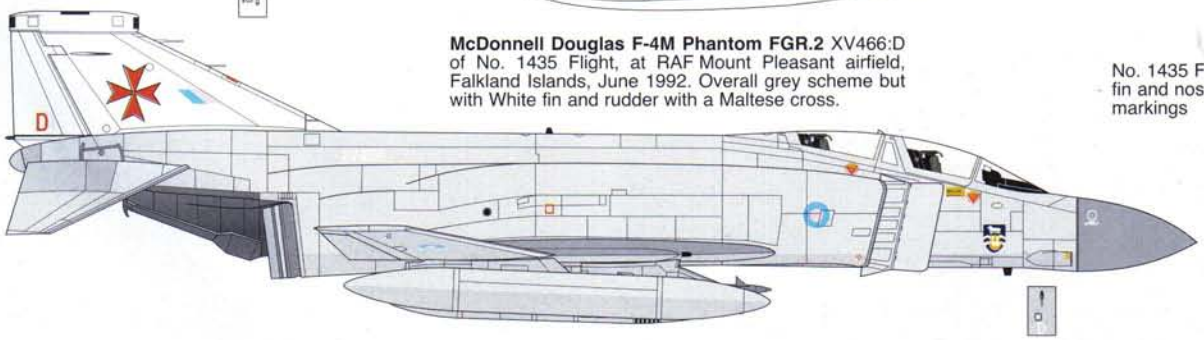
892 Squadron fin badge

McDonnell Douglas F-4K Phantom FG.1 XV570:Y of the Phantom Training Flight, RAF Leuchars in March 1978. Extra Dark Sea Grey upper surfaces with White undersides. Eight inch serials in black on fuselage.



Phantom Training Flight badge

McDonnell Douglas F-4M Phantom FGR.2 XV466:D of No. 1435 Flight, at RAF Mount Pleasant airfield, Falkland Islands, June 1992. Overall grey scheme but with White fin and rudder with a Maltese cross.



No. 1435 Flight fin and nose markings

Old and new markings for No. 31 Squadron in RAF Germany. Based at Bruggen from July 1971 XV402, (above) shows the Type D roundels which were first in service whilst that below depicts the toned down version that came into service shortly afterwards. Unlike some squadrons No. 31's squadron insignia was left largely unaltered. (Peter Doll)

tional, at which time the original Phantom-equipped unit would disband. Accordingly, the first Jaguar GR.1 was delivered to Bruggen on 7 April 1975 with No. 14 (Designate) Squadron forming there two days later. During November the squadron was declared operational and the Phantom-equipped No. 14 Squadron disbanded at the end of the month.

During the summer of 1975 the first Jaguars destined for No. 17 Squadron began to arrive and on 1 September No. 17 (Designate) Squadron formed and began its work-up. On 31 January 1976 the Phantom squadron disbanded to be replaced the following day by the Jaguars of the new No. 17 Squadron. By then aircraft for No. 31 Squadron, the final unit to re-equip, had already begun to arrive at Bruggen with No. 31 (Designate) Squadron forming there on 1 January 1976. The squadron was eventually declared operational on 30 June that year, the same day as the original No. 31 Squadron disbanded.

When the Phantom first entered RAF service its main engineering support facility was 23 MU at Aldergrove, to be joined later by 60 MU at RAF Leconfield, where all major servicing was undertaken together with modification and repair work. However, from 1977 this work was transferred to the maintenance complex at RAF St Athan. From 1970 RAF Germany had its own Phantom support organisation within 431 MU at Bruggen, which undertook much the same work together with the recovery of damaged or crashed aircraft from within RAFG's area of responsibility. With the withdrawal of the ground attack Phantoms

A No. 31 Squadron Phantom FGR.2 passing through RAF Bruggen's washing plant. Low-level operations over both land and sea plus the continuous use of the aircraft meant that corrosion was a problem, hence the frequent washing down of all operational aircraft. (MoD)

SURVIVING PHANTOMS

XT595	YF-4K	RAF St Athan	Forward fuselage.
XT596	YF-4K	FAA Museum, RNAS Yeovilton	
XT597	FG.1	DERA Boscombe Down	
XT852	YF-4M	West Freugh	
XT863	FG.1	Cowes	Forward fuselage.
XT864	FG.1	RAF Leuchars	Painted as XT684 .
XT867	FG.1	RAF Leuchars +	
XT891	FGR.2	RAF Coningsby	
XT899	FGR.2	Czech & Slovak Air Forces Museum, Kbely	
XT903	FGR.2	RAF Leuchars + Rear fuselage. Nose Hendon	
XT905	FGR.2	RAF North Luffenham	
XT907	FGR.2	Chattenden	
XT914	FGR.2	RAF Brampton	
XV399	FGR.2	Stock	Forward fuselage.
XV401	FGR.2	DERA Boscombe Down	
XV406	FGR.2	Carlisle	
XV408	FGR.2	RAF Halton	
XV409	FGR.2	Mount Pleasant Airfield	
XV411	FGR.2	Manston	Probably now scrapped.
XV415	FGR.2	RAF Boulmer	
XV420	FGR.2	RAF Neatishead	
XV423	FGR.2	RAF Leeming +	
XV424	FGR.2	RAF Museum, Hendon	
XV426	FGR.2	RAF Coltishall	Forward fuselage.
XV435	FGR.2	Llanbedr	
XV460	FGR.2	Usworth	Forward fuselage.
XV465	FGR.2	RAF Leeming +	
XV468	FGR.2	RAF Woodvale	
XV470	FGR.2	RAF Akrotiri	
XV474	FGR.2	Duxford	
XV489	FGR.2	Netherlands	Forward fuselage.
XV490	FGR.2	Nantwich	Forward fuselage.
XV497	FGR.2	RAF Coningsby	
XV499	FGR.2	RAF Leeming +	
XV500	FGR.2	RAF St Athan	Painted as XV498
XV577	FG.1	RAF Leuchars +	
XV581	FG.1	Bridge of Don	Forward fuselage.
XV582	FG.1	RAF Leuchars	
XV586	FG.1	RAF Leuchars	
XV591	FG.1	RAF Cosford	Forward fuselage.
ZE350	F-4J(UK)	Stock	
ZE352	F-4J(UK)	Stock	
ZE353	F-4J(UK)	Manston	
ZE354	F-4J(UK)	RAF Coningsby +	
ZE355	F-4J(UK)	Pendine	
ZE356	F-4J(UK)	RAF Waddington	
ZE359	F-4J(UK)	Duxford	Painted as USN 155529.
ZE360	F-4J(UK)	Manston	
ZE361	F-4J(UK)	RAF Honington +	
ZE362	F-4J(UK)	Pendine	
ZE363	F-4J(UK)	Pendine	

\+ *airframe offered for sale as scrap 2000.*

Publicity picture for No. 111 Squadron at Coningsby. Two crew members and the variety of weaponry carried by air defence Phantoms . (MoD)

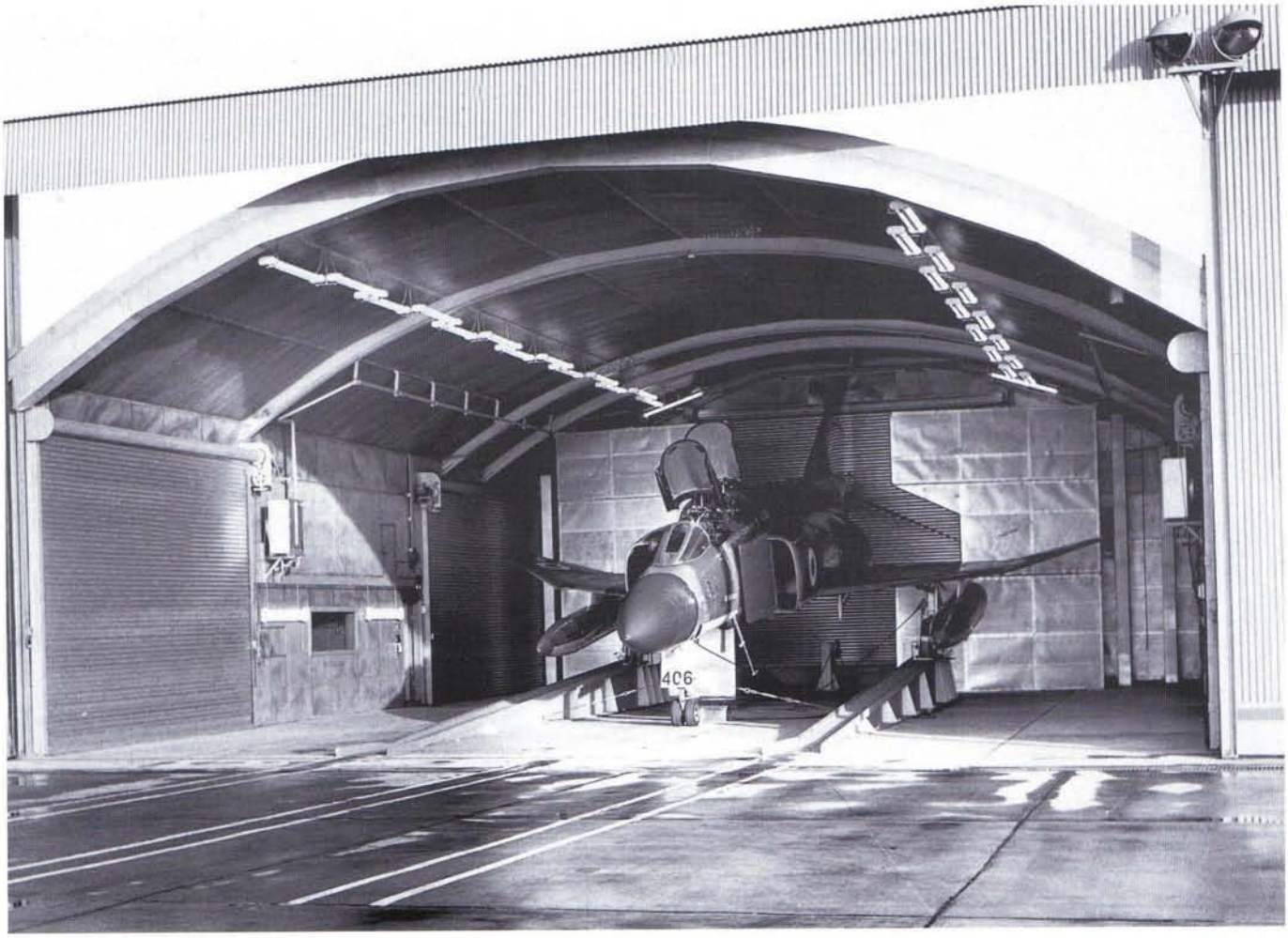
RAF Germany Phantoms. Top to bottom: No. 19 Squadron's XV407 landing at Wildenrath. Also at Wildenrath a No. 92 Squadron Phantom on full reheat take-off. No. 14 Squadron had the smallest squadron insignia on the nose. No. 19 Squadron in noddy land. Seen during an exercise the ground crew are all wearing NBC clothing and are armed. (RAF Germany)

from RAFG 431 MU's commitments were mostly transferred to St Athan, but some routine work was still undertaken there or by RAF Wildenrath's Engineering Wing until the last Phantoms left RAFG.

A NEW LEASE OF LIFE

Even though the Phantom was ordered for the RAF as a tactical ground attack and reconnaissance aircraft its career in these roles was brief, being quickly made redundant by the Jaguar, one of the results of the new entente with France. Fortunately however, the surplus Phantoms were available at the right time to get a new lease of life as air defence interceptors, largely replacing the Lightnings which had served in that role since 1960.

The Phantom FG.1s of 'Northern Q' at Leuchars had been operating with 11 Group since 1969 but it was not until 1974 that the FGR.2s began to arrive on the air defence squadrons. For conven-



Engine testing is an essential part of routine testing on the ground. But because of the noise and that the RAF liked to be neighbour friendly, large noise chambers were built at a number of RAF Stations like this one at Coningsby. Hoisted onto a ramp the noise and exhaust gases were funnelled into the atmosphere through a large chimney in the back of the building cutting the noise to over 50 per cent of that if the aircraft were run up outside. (MoD)

ience RAF Coningsby remained the Phantom training base and during 1974 the emphasis of 228 OCU's training syllabus changed from ground attack to air defence. Finally, on 1 October 1974 RAF Coningsby and 228 OCU transferred to 11 Group, reflecting their new air defence role.

The former ground attack Phantoms had first to be overhauled and brought up to the necessary modification state for their new air defence duties before they could be issued to the squadrons. The work chiefly involved the weapons system and missile pylons, together with the retractable in-flight refuelling probe above the starboard intake and the associated pipe-work, equipment that had been inhibited on the ex-RAFG aircraft. Gradually many were also fitted with TESS, a telescopic sighting system which

New colours, new squadron. No. 74 Squadron was formed on 30 August 1984 with Phantom F-4J(UK)s at Wattisham but later received FGR.2s. XT914:Z had a black fin to emphasise the Tiger's head but on the nose are No. 56 Squadron's Firebird insignia because it was a 1992 display Phantom. (A.W.Hall)

Grey sky, grey Phantom. Although not all that long from being disbanded 228 Operational Conversion Unit repainted its Phantoms in the grey scheme and applied pale blue and red roundels. No.64 (shadow squadron) badge on the cowling was also toned down. The aircraft is XV499:CF (Gary Madgwick)

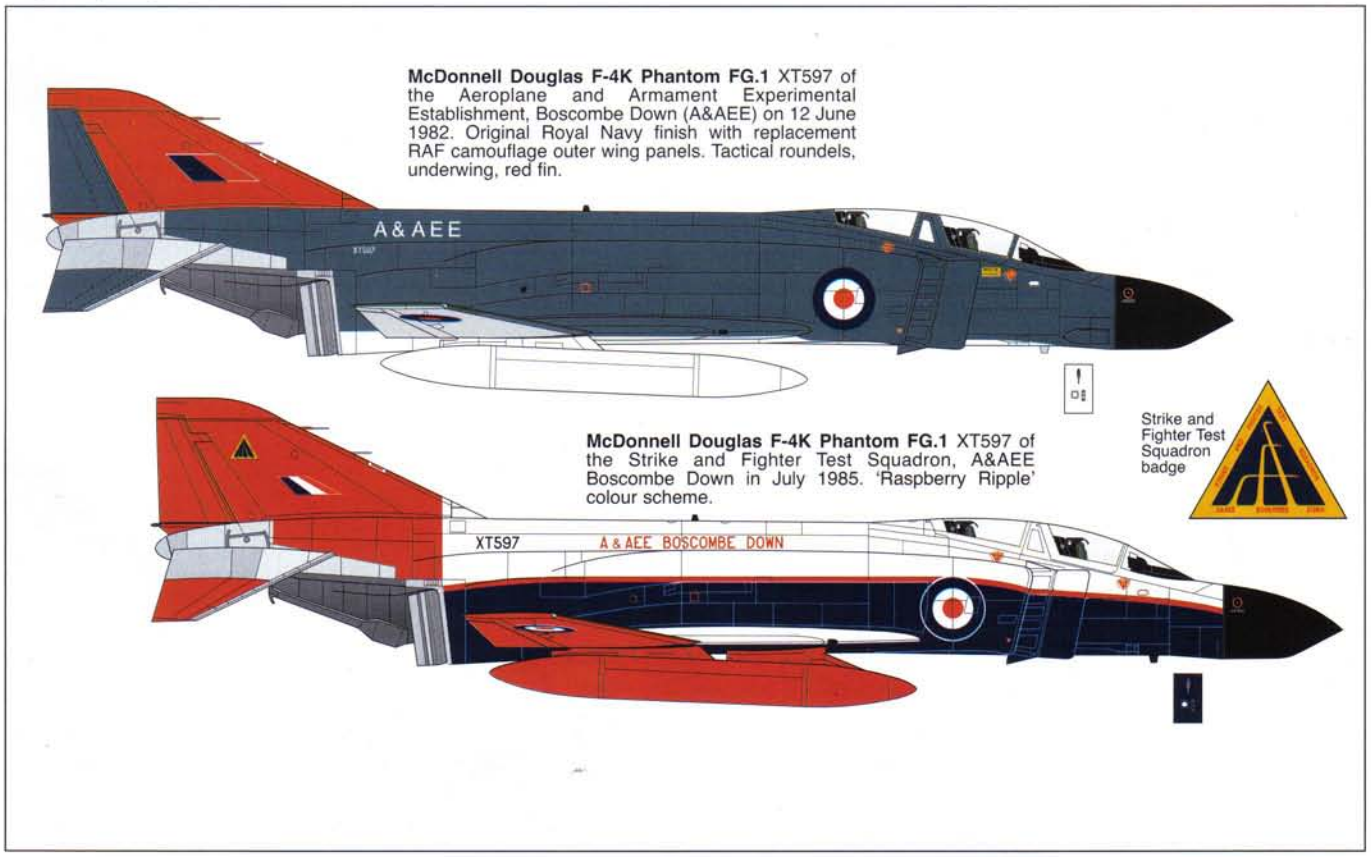
projected from the port side of the rear cockpit to allow the navigator to get a magnified view ahead of the aircraft to assist in the visual identification of potential targets.

However, it was acknowledged that there were insufficient Phantoms available to equip both the OCU and all of 11 Group's fighter squadrons, so Lightnings were to remain at RAF Binbrook to augment the Phantom force until the Panavia Tornado entered service and re-equipped all the fighter squadrons. Even this was over-optimistic as things turned out, because delays in the introduction of the Tornado into service meant that there were not enough Phantoms available to maintain front-line strength.

The first Phantom FGR.2s available for air defence were those from No. 54 Squadron which passed its aircraft on to No. 111 (Designate) Squadron which formed at Coningsby on 1 July 1974. Following the customary work-up period the squadron reformed on 1 October 1974, dropping its (Desig.) caveat, the day after the Lightning-equipped No. 111 Squadron had disbanded at RAF Wattisham. The squadron remained at Coningsby for little over a year during which time it carried out the operational evaluation of the Phantom FGR.2 in the interceptor role. It worked closely with the 11 Group radar stations down the east coast of the UK to update the air defence procedures to reflect the Phantom's greatly increased capabilities over the Lightning, around which the existing system had been built. Once this was done No. 111 Squadron moved north to RAF Leuchars on 3 November 1975 to become the second Phantom squadron of the Leuchars Wing, taking the place left vacant by the disbanded Lightning-equipped No. 23 Squadron. Thereafter it operated alongside the Phantom FG.1s of No. 43 Squadron until, in the interests of standardisation, it re-equipped with this mark of Phantom as well. It had to wait until January 1978 before its first Phantom FG.1 arrived, once surplus RN aircraft started to be transferred to the RAF, and it was not until July 1979 that No. 111 Squadron became fully equipped and was able to send its last FGR.2 south.

Following on from No. 111 Squadron successive units received their Phantom FGR.2s by a similar process, with the squadrons forming at intervals once sufficient former ground attack aircraft were overhauled and available. The first was No. 29 (Designate)

As one of the UK's main air defence fighter units No. 43 Squadron was amongst the first to re-camouflage its aircraft in the light grey scheme. Fully armed XV572:AN is shown on air show duty. (Gary Madgewick)



McDonnell Douglas F-4K Phantom FG.1 XT597 of the Aeroplane and Armament Experimental Establishment, Boscombe Down (A&AEE) on 12 June 1982. Original Royal Navy finish with replacement RAF camouflage outer wing panels. Tactical roundels, underwing, red fin.

McDonnell Douglas F-4K Phantom FG.1 XT597 of the Strike and Fighter Test Squadron, A&AEE Boscombe Down in July 1985. 'Raspberry Ripple' colour scheme.

Strike and Fighter Test Squadron badge

Above: The two crews on alert standby scramble for their No. 56 Squadron Phantom, XV410:E. The pale national and squadron markings make this aircraft difficult to identify on the ground. Hopefully it was even better in the air. (MoD)

Squadron which formed at Coningsby on 1 October 1974 and which was unusual in that it remained based there until it disbanded on 30 March 1987. On 1 January 1975 it formally took over the squadron number-plate from the Lightning Squadron which had disbanded at RAF Wattisham on New Year's Eve. From then on it continued its work-up until achieving operational status in May, then besides its operational tasking it also took over more of the Phantom evaluation flying which had previously been done by No. 111 Squadron. Besides UK air defence No. 29 Squadron was also tasked with maritime air defence of RN and NATO units primarily in the North Sea and Baltic Approaches.

When the Falklands crisis occurred in 1982 it fell to No. 29 Squadron to provide a detachment of aircraft at short notice to deploy to Wideawake Airfield on Ascension Island for air defence duties. Ascension would become the main staging post for naval units and aircraft heading for the South Atlantic and it was felt that there was a significant risk that Argentine carrier-based naval aircraft could attack British forces in the area. There was also the probability that long range Hercules and Electra aircraft would shadow British forces moving south. Accordingly, No. 29 Squadron maintained a detachment at Wideawake from 24 May 1982 until cessation of hostilities with the aircraft returning to Coningsby in July.

Above: Non-standard markings on No. 111 Squadron Phantom coded 'G' on air show duty. The large Type 'D' roundels on the fuselage were not used on other aircraft in the same unit. Below: No. 56 Squadron's Firebird badge appeared much smaller on the nose in their grey scheme markings. XV400:D is illustrated. (Both Gary Madgewick)

Two No. 19 Squadron Phantom FGR.2s that took part in the Tactical Air Meet in Germany in 1984. (MoD)

There then followed a hectic period of preparation for once Stanley Airfield in East Falkland had been restored to operational status No. 29 Squadron sent a permanent Phantom Detachment south to provide air defence for the Falkland Islands. The aircraft arrived on 17 October 1982 and remained a part of No. 29 Squadron although personnel from other units were rotated through the detachment to give them operational experience and to spread the burden. Finally, on 30 March 1983, responsibility for the detachment was transferred to No. 23 Squadron.

The remaining 11 Group Phantom squadrons all formed at Coningsby then moved to their operational bases following a work-up period, with each replacing one of the Lightning squadrons. On 6 October 1975 No. 23 (Designate) Squadron formed at Coningsby, dropping the (Desig.) caveat when the original No. 23 Squadron equipped with Lightnings disbanded at Leuchars on 31 October 1975. Once it had completed its work-up the squadron moved to RAF Wattisham, its operational base, on 25 February 1976. However, after the Falklands Conflict the squadron was chosen to become the resident Falkland Islands air defence squadron. It accordingly disbanded at Wattisham on 30 March 1983 and reformed the same day at RAF Stanley, taking over the aircraft and crews of the resident Phantom Detachment, hitherto a part of No. 29 Squadron. Thereafter it continued to patrol the islands' Air Exclusion Zone and to maintain a QRA flight ready to scramble and intercept unidentified air contacts approaching the islands, generally under the control of the radar station on Mount Kent.

On 21 April 1986 the squadron moved to the newly constructed airfield at Mount Pleasant from where it continued to operate, but at a steadily reducing strength as the

Continued on page 46

Compare this picture of a No. 56 Squadron Phantom FGR.2 with that on the left. The all-red tail was applied to all the squadron's aircraft from 1991. (Gary Madgewick)

Phantom armament

Above: A No 6 Squadron Phantom at Coningsby showing the full range of the Phantom's offensive load. Below: Servicing and loading the SUU-23A multi-barrel cannon. (MoD)

Seven cluster bombs, four Sparrows and a ventral camera pod make a heavy load for this No. 41 Squadron Phantom. 2. Sidewinder simulator. Used for mock attacks and recording scores. 3. The BL755 Cluster bomb contained 100 small munitions ideal for attacks on tanks or vehicle convoys. 4. Matra 68mm rocket packs and the SUU-23A cannon. 5. Blue-painted inert Sidewinder missiles on the inner weapons station. 6. Loading a Sparrow missile in its special recessed centre fuselage station whilst wearing NBC clothing was no easy job. 7. A No. 56 Squadron Phantom firing a Sparrow on the Aberporth range.

McDONNELL F-4 PHANTOM SPECIFICATION

PHANTOM F-4K/FG.1

Power plant:
2 x Rolls Royce Spey 203 turbofans with afterburners, each rated at 12,250 lb thrust and 20,515 lb with reheat.

Performance:
Max speed 1,386 mph at 40,000 ft. Initial climb rate 32,000 ft/min. Service ceiling 57,200 ft. Max. range un-refuelled 1,750 miles.

Weight:
Empty 31,000 lb. Max. loaded 58,000 lb.

Dimensions:
Span (spread) 38 ft 5 ins (11.71 m). Span (folded) 27 ft 6.5 ins (8.40 m). Length 57 ft 7 ins (17.55 m). Height 16 ft 1 in (4.90 m), with RWR fintip mod. 16 ft 9 ins. (5.10 m). Wing area 530 sq ft (49.24 sq m).

Armament:
4 x AIM-7 Sparrow or Sky Flash (RAF aircraft only) medium range, semi-active radar-homing missiles housed semi-recessed below the fuselage. Also 4 x AIM-9 Sidewinder short range, infrared homing missiles, 2 on each inboard under-wing pylon. Various combinations of 500 lb and 1,000 lb bombs, Hunting BL755 600 lb cluster bomb units, Matra 155M 68mm rocket pods, napalm tanks, Lepus rocket flares. 1 x Mk 57 500 lb nuclear bomb. Naval aircraft could not carry the ventral gun pod but RAF FG.1s could carry 1 x SUU-23A 20mm rotary cannon pod below the centre fuselage. External fuel tanks can also be carried, a single 500 gallon (600 US gal.) tank on the fuselage centre line and 2 x 308 gallon (370 US gal) under wing tanks, one on each outboard pylon.

PHANTOM F-4M/FGR.2

Power plant:
2 x Rolls Royce Spey 202, later 204 turbofans with afterburners, each rated at 12,250 lb thrust and 20,515 lb with reheat.

Performance:
As for FG.1.

Weight:
Empty 31,350 lb. Max. loaded 58,000 lb.

Dimensions:
As for FG.1.

Armament:
4 x AIM-7 Sparrow or Sky Flash medium range, semi-active radar-homing missiles housed semi-recessed below the fuselage. Also 4 x AIM-9 Sidewinder short range, infrared homing missiles, 2 on each inboard under-wing pylon. 1 x SUU-23A 20mm rotary cannon pod below the centre fuselage. Various combinations of 500 lb and 1,000 lb bombs, Hunting BL755 600 lb cluster bomb units, Matra 155M 68mm rocket pods, napalm tanks, Lepus rocket flares. 1 x Mk 57 500 lb nuclear bomb. 1 x KB-18 strike camera unit fitted in place of the port front Sparrow. 1 x EMI Phantom Reconnaissance Pod on the fuselage centreline station of suitably modified aircraft, carried in conjunction with modified night reconnaissance drop tanks on the outboard underwing pylons. External fuel tanks can also be carried, a single 500 gal lon (600 US gal.) tank on the fuselage centre line and 2 x 308 gallon (370 US gal) underwing tanks, one on each outboard pylon.

PHANTOM F-4J(UK)

Power plant:
2 x General Electric J79-GE-10B turbojets with afterburners, each rated at 11,810 lb thrust and 17,900 lb with reheat.

Performance:
Max speed 1,434 mph at 40,000 ft. Initial climb rate 41,750 ft/min. Service ceiling 61,900 ft.

Weight:
Empty 29,900 lb. Max. loaded 58,000 lb.

Dimensions:
Span (spread) 38 ft 5 ins (11.71 m). Span (folded) 27 ft 6.5 ins (8.40 m). Length 58 ft 3 ins (17.76m). Height 16 ft 3 ins (4.95m). Wing area 530 sq ft (49.24 sq m).

Armament:
4 x AIM-7 Sparrow or Sky Flash medium range, semi-active radar-homing missiles housed semi-recessed below the fuselage. Also 4 x AIM-9 Sidewinder short range, infrared homing missiles, 2 on each inboard underwing pylon. 1 x SUU-23A 20mm rotary cannon pod below the centre fuselage. Combinations of under-wing stores as for the FGR.2 to a maximum weight of 16,000 lb. External fuel tanks can also be carried, a single 500 gallon (600 US gal.) tank on the fuselage centre line and 2 x 308 gallon (370 US gal) underwing tanks, one on each outboard pylon.

Continued from page 43

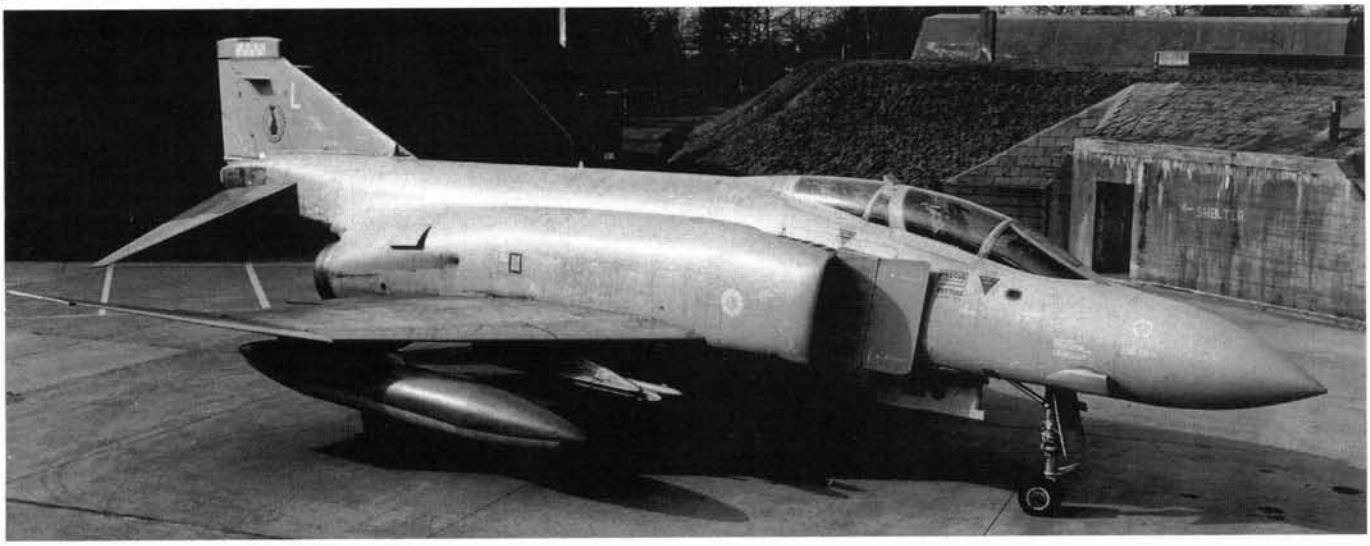
political situation in the region gradually improved and the threat to the islands diminished. Eventually what remained of No. 23 Squadron was renumbered 1435 Flight on 1 November 1988 and this continued to operate the four Phantom FGR.2s, named *'Faith'*, *'Hope'*, *'Charity'* and *'Desperation'*, until they were replaced by Tornado F.3s in July 1992. The redundant Phantoms were never returned to the UK but were scrapped at Mount Pleasant, except for XV409 which was put on display there.

Phantoms painted in the colours of No. 56 (Designate) Squadron, the last scheduled 11 Group unit, began to appear at Coningsby during March 1976 in readiness for the squadron's formation on 31 March, once No. 23 Squadron had moved out. On 29 June the squadron officially took over from the Lightnings of its predecessor at Wattisham, and moved south to join No. 23 Squadron there on 9 July completing the UK Phantom re-equipment programme.

In June 1979 XV424 and XV486 were painted in a special colour scheme by RAF St Athan to commemorated the 60th anniversary of Alcock and Brown's trans-Atlantic flight, as that season's display aircraft. This honour evidently went to No. 56 Squadron because one of its crews consisted of Sqdn Ldr A J Alcock and Flt Lt W N Browne, who became that year's Phantom display crew around the air show circuit.

Once the 11 Group squadrons had all re-equipped with the Phantom FGR.2 it was the turn of RAFG to receive Phantoms once again, but this time in the air defence role to replace the Gutersloh Lightnings. The fighters were now to be based at RAF Wildenrath but initially both squadrons formed at Coningsby before moving out to Germany. The first was No. 19 (Designate) Squadron which formed in the early summer of 1976 as a nucleus of crews with their aircraft, moving to Wildenrath from 27 September and officially taking up residence there on 1 October 1976. From then on further aircraft were delivered direct to Germany so that the squadron was fully

Phantom FGR.2 XV476:L of No. 19 Squadron in its revetment at Wildenrath, RAF Germany. Although the aircraft has been repainted in the standard grey scheme the drop tank is obviously a left-over from the grey-green camouflage period. (MoD)



Above: Sister squadron to No. 19 at RAF Wildenrath was No. 92 represented here by XV460:W leaving its revetment. Both squadrons were committed to the air defence role, together with other NATO squadrons, in Germany. (MoD)
Right: Towards the end of their operational lives a number of Phantoms were given special colour schemes to celebrate a certain anniversary or event. No. 111 Squadron had two aircraft painted in non-standard colours. This one was XV574:Z which had the normal basic grey scheme suplemented by a black spine and two thirds of the vertical stabiliser. The centre of the tail unit was yellow on which the squadron badge was displayed. This aircraft was also the unit's trainer in that the rear cockpit was also fitted with flying controls. The instructor in the rear seat had his forward vision supplemented by a periscope fitted to the top of the canopy.
Below: Commemorating the 60th anniversary of the first crossing of the Atlantic by an aircraft, the RAF painted two Phantoms in special colours in 1979. They also, by coincidence, found a Flt Lt Alcock and another named Browne in the Phantom force to fly them. (MoD)

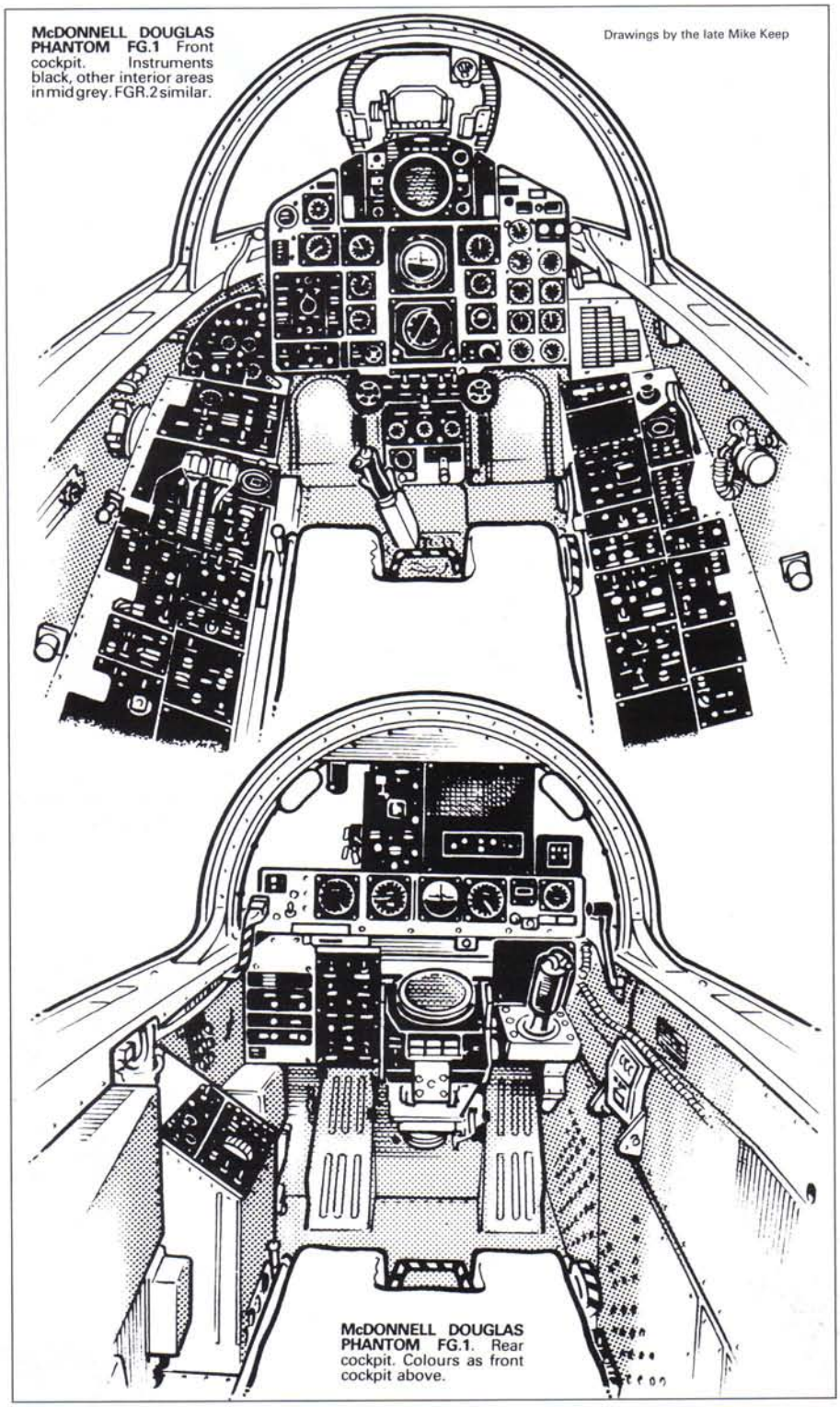
equipped by the end of the year. The Lightning-equipped No. 19 Squadron at Gutersloh disbanded on New Year's Eve and the following day officially re-formed at Wildenrath with Phantoms.

No. 92 (Designate) Squadron followed a similar pattern, forming at Coningsby during the autumn of 1976 and moving out to Wildenrath on 1 January 1977. Once Phantom deliveries were completed the Lightning squadron stood down at the end of March 1977 and No. 92 Squadron formally commissioned at Wildenrath the following day. Both units took turns to provide the Battle Flight, a pair of armed Phantoms ready to scramble at any time to investigate unidentified air contacts in the region of the Air Defence Identification Zone (ADIZ) which ran down the West and East German border. Thereafter they continued to contribute to the air defence of north-west Germany until the collapse of the Iron Curtain and the re-unification of Germany made their presence unnecessary and led to a reduction of British forces in Germany.

However, there was a significant change to the squadrons' routine during the summer of 1990 when Iraq invaded Kuwait. At the time of the invasion in August, an RAF armament practice camp was in progress for Tornadoes at RAF Akrotiri, Cyprus. Some of the aircraft involved were soon redeployed to Saudi Arabia whilst the others remained at Akrotiri to provide air defence for what was to become a major British staging post to the Gulf.

However, as the demand for Tornado fighters grew it was decided to release those at Akrotiri and to replace them with six Phantoms drawn from Nos. 19 and 92 Squadrons. Each unit provided three aircraft which flew out to Cyprus on 17 August, constituting No. 92 (Composite) Squadron, and these remained in theatre probably until the fighting ended in April 1991 when they returned to the UK. This was very much the squadrons' swan song because very soon afterwards both began to prepare for disbandment. The first to go was No. 92 Squadron on 5 July 1991, followed by No. 19 Squadron on 9 January 1992.

Commemorative Phantoms. Above: No. 19 Squadron celebrated their 75th anniversary by painting XT899:B in this all-blue scheme. It was on show at the Brize Norton photo day in September 1991. Below: No.111 Squadron painted XV582 in an all-black scheme outlining the roundels in white and adding their own distinctive squadron badges on the nose and tail. It was on show at Mildenhall in May 1990. (Richard L. Ward)



McDONNELL DOUGLAS PHANTOM FG.1 Front cockpit. Instruments black, other interior areas in mid grey. FGR.2 similar.

Drawings by the late Mike Keep

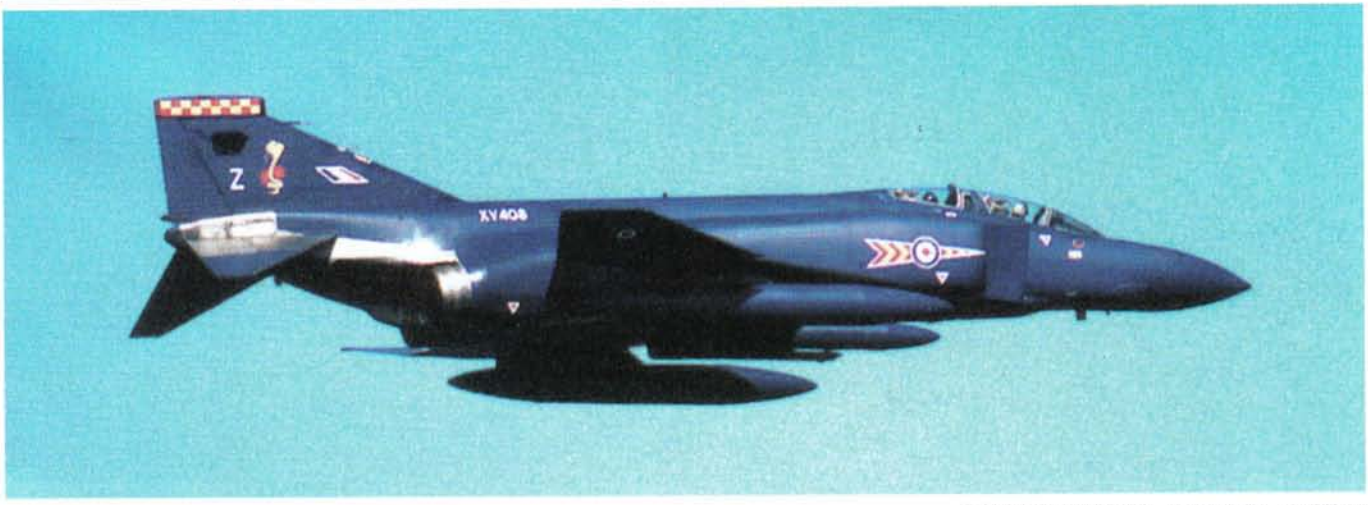
McDONNELL DOUGLAS PHANTOM FG.1. Rear cockpit. Colours as front cockpit above.

NEW MISSILES FOR OLD

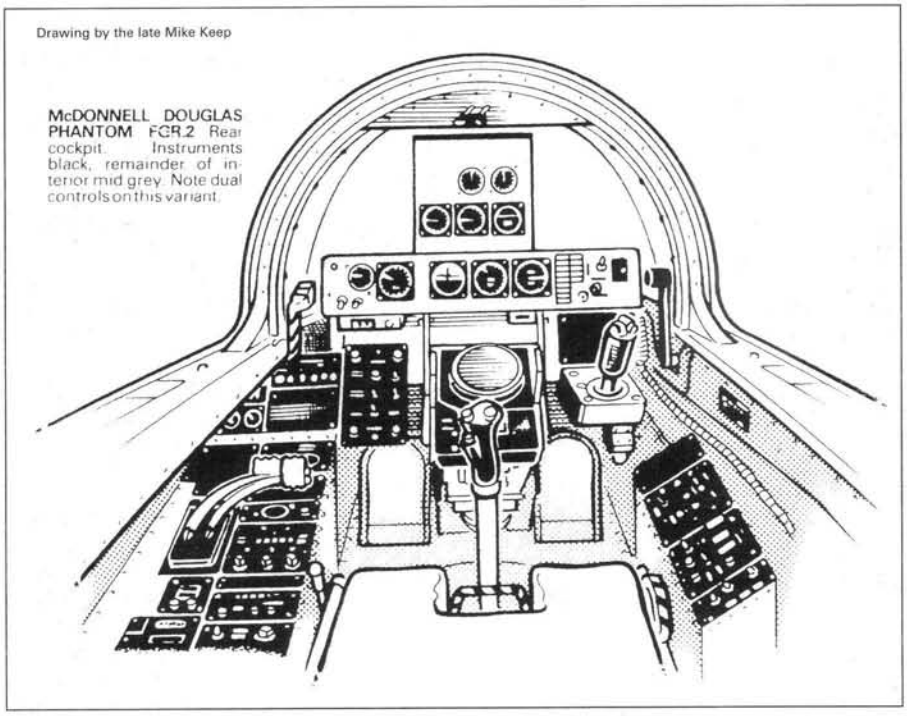
As with all aircraft the Phantom and its weapons system were the subjects of continuous modification and upgrading throughout their time in service. Apart from the addition of the radar warning receiver other important improvements concerned the AWG-11/-12 and the associated guided missiles. When the Phantom first entered British service it carried AIM-9D Sidewinders which was essentially a rear-hemisphere weapon and in this respect was inferior to the British Red Top missile carried by the RN Sea Vixen and RAF Lightning fighters.

Improvements over the years meant that during the 1970s it was replaced by later variants, the AIM-9G then finally, on RAF aircraft, the AIM-9L with a range in the order of eight miles. The latter was the definitive version bought by the UK and although it was still a passive, infrared homing missile one important improvement was the greater cooling of its IR detector which produced a more sensitive homing head. In turn this gave the missile the ability to home on to a high-speed target from any aspect, either on to the hot jet pipe from astern or on to skin friction hot-spots such as wing leading edges from ahead. Its enlarged, 25 lb warhead, also had a better proximity fuse.

Modifications to the radar system were generally closely linked to developments in the AIM-7 Sparrow missile because as missile performance was improved so radar performance needed to be improved to allow the missile to be used to maximum effect. The AWG-11A/-12A systems introduced during the early 1970s were substantial reworkings of the original systems and most significantly featured the replacement of analogue by digital sub-systems which took up less space thereby permitting further equipment additions, and increased computer speed and capacity. Associated with the change were improved displays and additional functions for the weapons system, together with improved maintenance, self-testing and fault identification features.



Another all blue special colour scheme was used on Phantom XV408:Z of No. 92 Squadron. The picture was taken at the Brize Norton photo day in September 1991 but by that time No. 19 Squadron had taken over 92's aircraft as the former had been disbanded. (Richard L. Ward)



Drawing by the late Mike Keep

McDONNELL DOUGLAS PHANTOM FGR.2 Rear cockpit. Instruments black, remainder of interior mid grey. Note dual controls on this variant.

Once the Phantom was in service MoD (Air) set about acquiring a British medium range air-to-air missile (MRAAM) to replace the Sparrow, making use of the latest technological advances. Following work undertaken by both the Royal Aircraft Establishment and British defence electronics companies it was decided that the best course of action was to use the basic AIM-7E Sparrow airframe and to fit a British-designed homing head and improved warhead and radar proximity fuse. The projected weapon known as XJ521 resulted in an Air Staff Requirement for a medium-range missile able to engage fast moving, multiple targets at low level as well as at height, with both a snap-up and a shoot-down capability. The system also had to be able to operate in an environment of active radar jamming without any significant loss of performance. The missile was not only for the Phantom but was destined also to become the main armament of the interceptor version of the Tornado when it entered service with the RAF.

Project definition was completed in 1973 and Hawker-Siddeley Dynamics (later BAe Dynamics) was named as the main contractor, with Marconi building the radar homing head and EMI the proximity fuse unit. From the time missile production was authorised in December 1973 it took just under two years for missile test firings to begin, these being carried out in the USA using hired USN F-4Js because of the better range facilities available there. Large range areas and high speed targets were required, together with the resources to create a realistic electronic warfare environment, and all of these were readily available at Point Magu and China Lake, two USN weapons testing facilities in California. Initial test and development firings were carried out between November 1975 and December 1977 with excellent results, and deliveries of the new missile, by now named Sky Flash, began during 1977.

Sky Flash was used only by the RAF but because of the stocks of Sparrow held, the two types were used concurrently. Some live firings of Sky Flash were undertaken on the RAE range at Aberporth, Cardigan Bay, but generally it was the older Sparrows which were fired during armament practice camps in order to use up the existing stocks. By the time the missile deliveries began the

Phantoms in the Falklands. To provide air defence for the air exclusion zone round the Falkland Islands No. 29 Squadron deployed firstly to Ascension Island and then to the small airport at Stanley. No. 23 Squadron then took over their aircraft and remained on duty after the crisis abated. This picture shows a No 29 Squadron aircraft being towed into the Operational Readiness area. The hangars were all prefabricated and erected by Royal Engineers airfield construction teams shortly after the end of hostilities as the Falklands weather was not conducive to working on aircraft in the open. (A.W.Hall)

No. 29 Squadron maintained daily patrols round the Falkland Islands after deploying there in October 1982. This aircrew are about to set off on another sortie., (A.W.Hall)

RN Phantoms had barely a year of service left so the Fleet Air Arm did not receive Sky Flash.

FULL CIRCLE

As originally planned the air defence Phantoms were to have been replaced by the Panavia Tornado ADV (Air Defence Version) from the middle of the 1980s but problems with the aircraft and weapons system, particularly its Foxhunter radar, meant that the ADV programme suffered serious delays. Consequently the Phantoms had to be given major refurbishment at St Athan to enable them to remain in operational use into the next decade. Then came the Falklands Conflict and the need to deploy a squadron of Phantoms south to provide air defence for the islands should Argentina attempt to re-invade. This left 11 Group a squadron short at home, and with the two Lightning squadrons at Binbrook due to re-equip with the Tornado before the majority of the Phantom squadrons, it looked as though Britain's air defences would become increasingly stretched for some years to come.

By now the dwindling number of Phantoms was giving cause for concern. Not only had attrition during over 13 years of service flying reduced numbers, but the use of the aircraft for low-level, ground attack flying meant that many of the remaining airframes were well advanced in their fatigue lives. In all probability there would be insufficient Phantoms available to maintain Britain's air defences at full strength for a period of up to five years until the Tornado ADV did become available in sufficient numbers in the late 1980s, so a contingency plan was needed as a matter of urgency.

In perhaps the last and greatest irony of the British Phantom story, the cancellation of aircraft ordered in the 1960s as being surplus to requirements left the government some 20 years later with little choice but to buy more Phantoms direct from the USA!

It made sense at the time to buy more Phantoms because even though they would have to be US variants there was still a lot of commonality with the British versions. Of all the marks of Phantom available the F-4J was the logical choice in view of the fact that it was an air defence fighter and the very version upon which the Spey Phantoms were based. In some respects it also had an even better performance than the Spey Phantom. There was also no shortage of available aircraft either, because the US Navy was then in the process of re-equipping its F-4J squadrons with later versions or with F-14 Tomcats. Accordingly in 1983 the MoD contracted to buy 15 refurbished former USN F-4Js together with support equipment and spares for £125 million, with delivery to begin the following year. This would be some 18 years after the F-4J's maiden flight.

The selected airframes which had been held in storage at Davis-Monthan AFB, Arizona, were transferred to the Naval Air Rework Facility at NAS North Island, California, where they were completely overhauled and partially upgraded to something resembling the USN's F-4S.

They were not fitted with leading edge manoeuvring slats as a cost saving and also because the RAF was not looking for a close combat, dog-fighting aircraft, and neither was INAS installed. All unnecessary USN equipment was removed together with the catapult launch fittings. However, the MoD did specify certain modifications to bring the aircraft up to much the same standard as the RAF Phantom FGR.2s. The airframes were made compatible with the Sky Flash missile and the SUU-23A ventral gun pod, whilst their AN/AWG-10 weapons system was given the basic digital conversion to produce the AWG-10B, leaving other refinements to be added after delivery. Also added was the telescopic sighting system for the navigator, and although the original ejection seats were initially retained the Martin Baker Mk 7A-4 seat used on the Phantom FG.1 eventually replaced them.

The opportunity was also taken to install J79-GE-10B engines which eliminated the tell-tale smoke trail associated with earlier Phantoms and which gave a better high altitude performance than the Spey. Unlike the Spey Phantoms however, the F-4J(UK)s still relied upon external air starter units which made them more dependent upon ground facilities. The aircraft also retained the night formation strip lights on the nose, centre fuselage and tail sides and the wingtips, which were then becoming common on US combat types but which were still a novelty in the British forces.

THE END OF THE LINE

Whilst refurbishment was under way groups of aircrew began training on US Marine Corps F-4S Phantoms with VMFAT-101 at MCAS Yuma, Arizona, and by August 1984 the first aircraft were ready for delivery to the UK. As the RAF crews qualified they flew the Phantoms to RAF Wattisham by way of CFB Goose Bay, usually in batches of three, with the first arriving on 30 August and the last one, ZE351, on 4 January 1985.

At Wattisham the F-4J(UK)s were operated by No. 74 Squadron which was established there, minus aircraft, on 1 July 1984. Having received six aircraft and begun its work-up the squadron was officially formed on 19 October 1984 and continued operations alongside No. 56 Squadron until 1990. By then the F-4J(UK) had already been in service longer than the five years originally

Before deploying to the Falklands No. 29 Squadron was based at RAF Coningsby. It is interesting to see the changes in the position of squadron insignia after the move. (MAP)

Phantom replacements. Above: For a while two No. 14 Squadrons existed side by side at RAF Bruggen. The first Jaguar was delivered on 7 April 1975 with the designate squadron forming two days later. The Phantoms were declared non-operational at the end of November the same year. Right: No. 228 Operational Conversion Unit (No. 64 Shadow Squadron) disbanded in January 1991 but before they went a prototype Tornado arrived at Coningsby to show the crews what their new aircraft was like. This staged picture was taken with the two side by side. (Both MoD)

envisaged and rising operating costs together with shortage of spares, which on occasions resulted in some aircraft being robbed of components to keep the others flying, prompted the MoD to withdraw the type early in 1991.

By the end of 1990 sufficient surplus Phantom FGR.2s were available for No. 74 Squadron to be re-equipped with the type with the first arriving that December. As more were delivered so the F-4J(UK)s were withdrawn and the squadron became operational on the FGR.2 on 1 February 1991. The last F-4J(UK) to leave Wattisham was ZE353 in March of that year.

Although the aircraft still had many available flying hours left in them, none flew again, the majority going to various RAF stations for use as fire rescue or battle damage repair trainers. In common with all the Phantoms used by the RN and RAF the US government had insisted upon a clause in the original contracts prohibiting the disposal of any aircraft to a foreign buyer or to any non-government organisation. In effect this meant that most aircraft were eventually scrapped or used as targets.

The run-down of the Phantom interceptor force had finally begun on 31 March 1987 when No. 29 Squadron disbanded at Coningsby to be replaced by the new, Tornado-equipped No. 29 Squadron which formed there the following day.

In order to make way for the Tornado at RAF Coningsby, 228 OCU moved north to Leuchars on 22 April 1987 where it operated on a smaller scale as the Phantom training commitment diminished. There was then a long interval whilst the Binbrook Lightning Wing was re-equipped during 1988, then came the turn of the Leuchars Phantom Wing. The first unit to receive Tornado F.3s was No. 43 Squadron which eventually disbanded as a Phantom squadron on 31 July 1989, to be followed by No. 111 Squadron during the first half of 1990.

For the 1990 display season 228 OCU inherited the all-black Phantom FG.1 XV582 previously used by No. 111 Squadron, then with its training task all but gone the OCU disbanded on 31 January 1991 leaving Wattisham as the last RAF base operating the Phantom. On 1 February 1991 the Phantom Training Flight (PTF) was established at Wattisham with a small staff of instructors using aircraft borrowed from the resident squadrons as required, to carry out what little aircrew training was necessary, before it too disbanded that December.

The following year saw No. 56 Squadron disbanded on 30 June and No. 74 Squadron on 1 October. To mark the occasion as well

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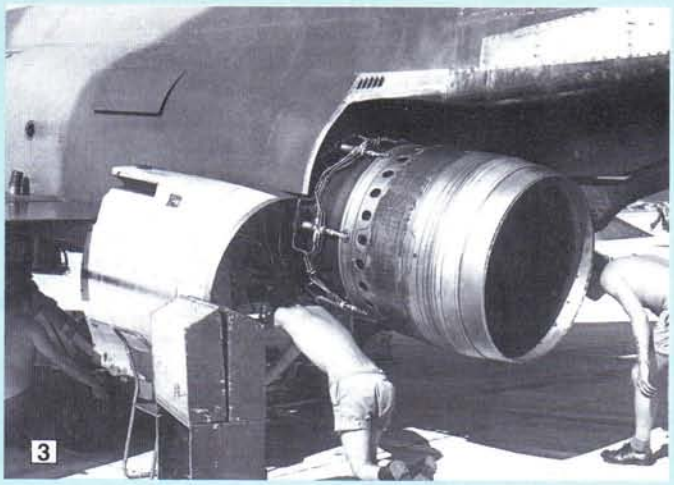
1

PHANTOM IN DETAIL

Close up pictures of the F-4K and F-4M Phantom

2

1. The underside of a Phantom FG.1 showing the various intakes and undercarriage detail. 2. A poor but understandable main undercarriage leg and tyre. 3. The port Spey engine uncowled with ground crew doing the daily servicing. Probably a good reference for a diorama model. 4. A close up of the nose undercarriage door and the markings thereon. Also shown is part of the undercarriage bay and the recesses for the Sparrow missiles. 5. A rear view of the Phantom FGR.2 illustrating the angle of the tailplanes, the large orifices of the Spey engines and the housing for the tail brake parachute. An SUU-23A multi-barrel cannon is fastened to the underfuselage station. 6. This colour picture of a No. 74 Squadron Phantom shows the rudder position and the fuel venting pipe that extends beyond the tail unit. The housing for the parachute brake is in the extreme end of the fuselage. (All pictures G.Mangion and A.W.Hall)



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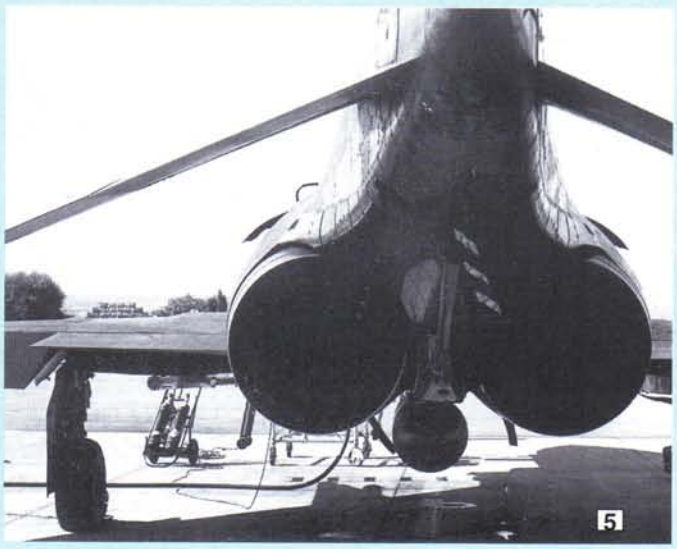

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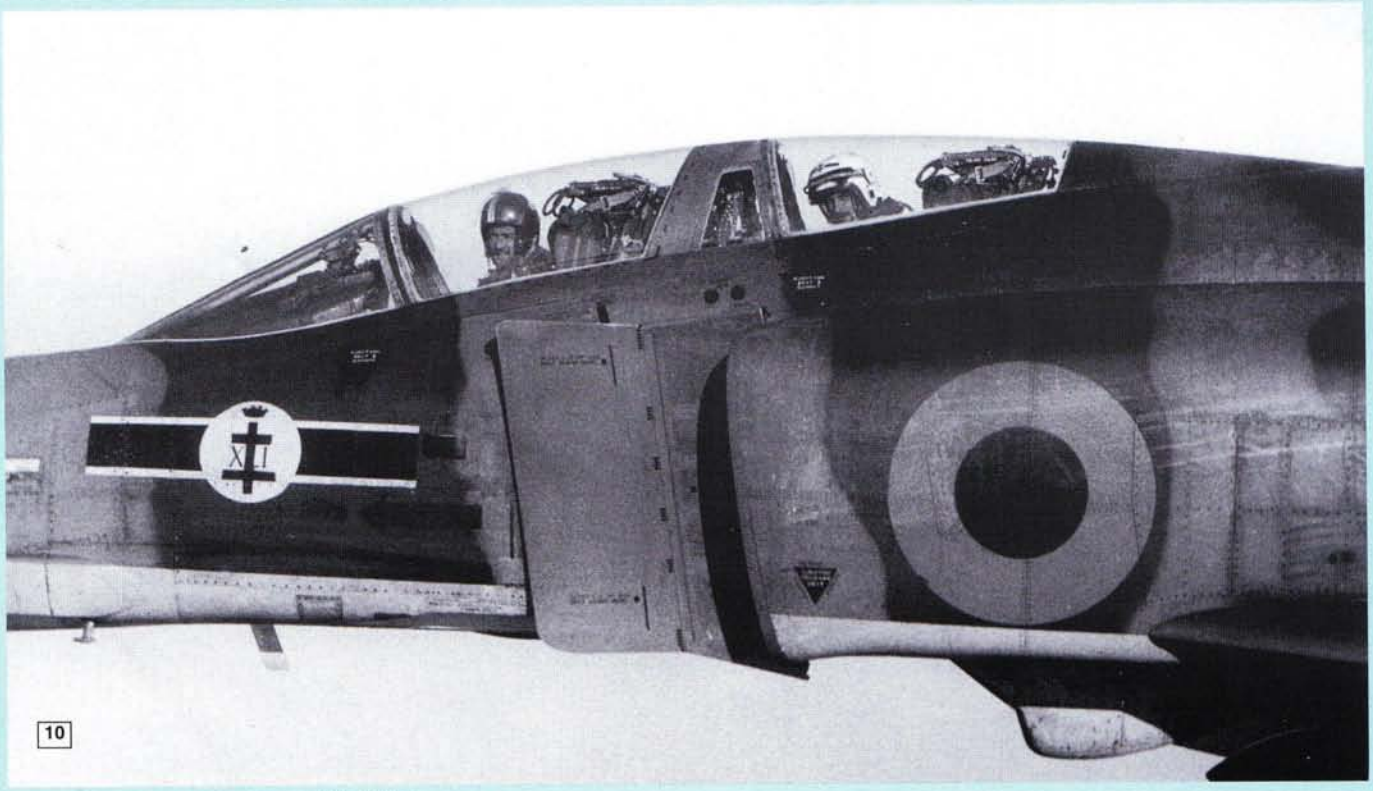
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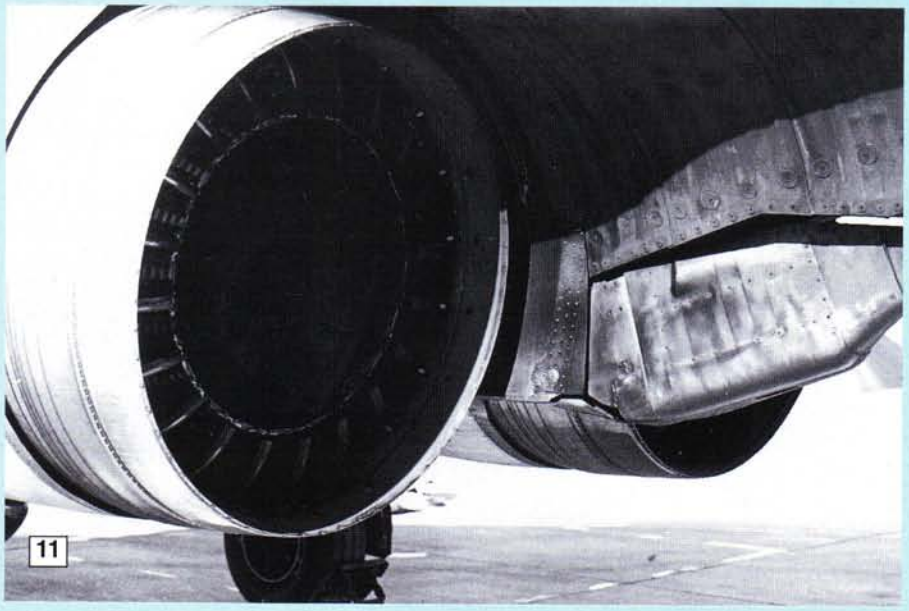
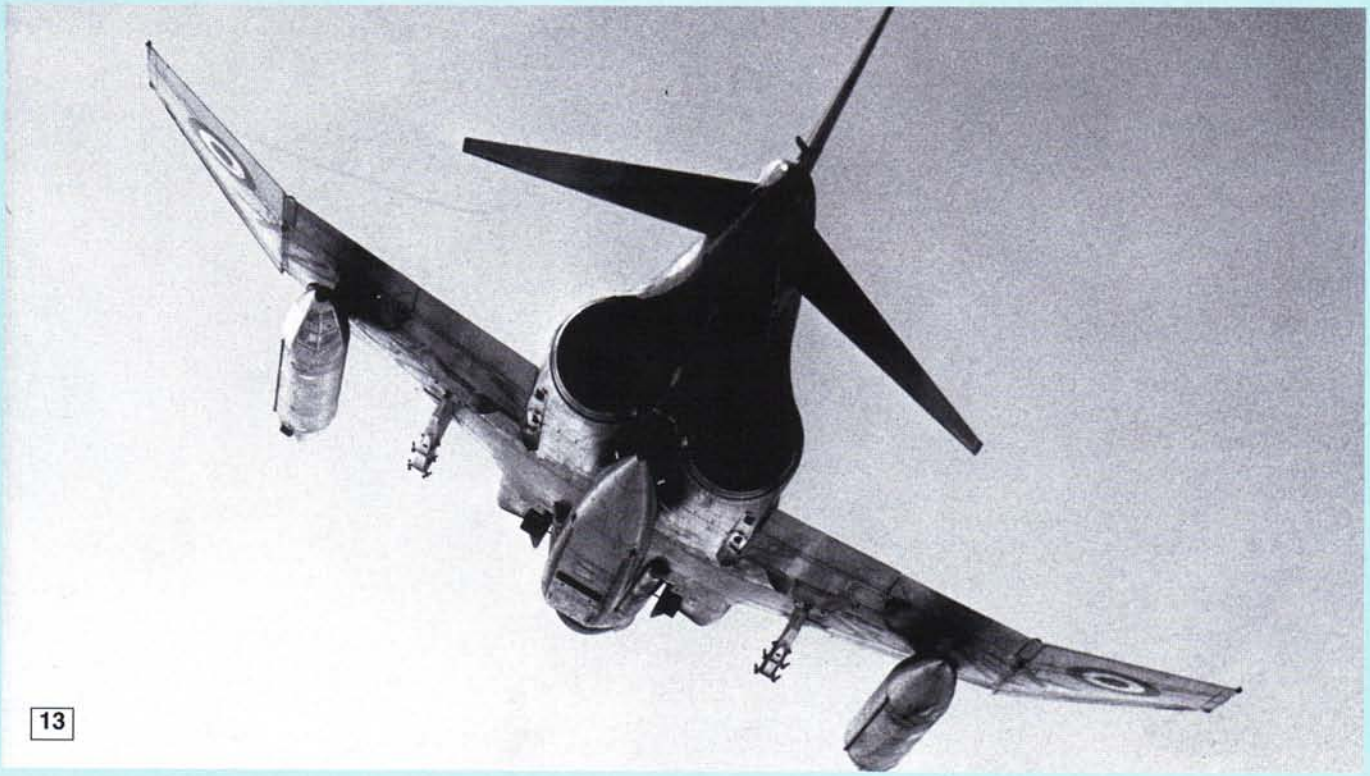
7. Phantom nose showing the splitter plates each side of the jet intakes, air intakes right behind the radar and a full missile load of Sparrows and Sidewinders. 8. Nose undercarriage detail. Note how the tension bar is offset to the left. 9. No. 56 Squadron ground crews had such pride in their aircraft that they even painted the intake covers in their red and white checks. 10. How close can you get? Although taken on a telepho lens this picture shows a No. 41 Squadron aircraft cockpit detail to advantage. 11. Jet orifice of a Phantom FGR.2 Spey engine which should be compared with the picture below... 12. The jet orifice of an F-4J(UK) Phantom ZE354. Both pictures also show the housing of the arrester hook. 13. The underside of a No. 2 Squadron Phantom with the surveillance pack on the centre line.

PHANTOM
In Detail 2





Letting the Navy have the last word. A Phantom FG.1 of 892 Squadron, shore-based at RAF Luqa, when serving on HMS Ark Royal's last Mediterranean cruise, taxies majestically along the perimeter track. Note the VF-11 'Red Rippers' zap on the fin. (G.Mangion)

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as an end of an era, No. 74 Squadron had XV404 withdrawn from storage and painted in an overall tiger colour scheme, for ground photographs only, and performed the final Phantom formation flypast.

Most of the Wattisham Phantoms were broken up on site having been towed out onto the hard-standings to join the large number of aircraft from other Squadrons which had been accumulating there over the months. They were marked with prominent blue crosses so that they could be identified by Russian satellites as combat aircraft withdrawn from use and were scrapped in the open for similar reasons.

Most of the Phantoms were scrapped following withdrawal from service, but some were given a stay of execution by being disposed of to various airfields as crash rescue or fire fighting hulks, or as battle damage repair training aids. In most cases however, the airframes were eventually disposed of as scrap or burned.

Some Phantoms were also used for ground training, such as XV435 at Llanbedr, for destructive testing or as targets on MoD ranges such as Pendine and Shoeburyness. Some even managed to find their way to RAF Leeming where they appear to have been used as airfield decoys for a time. Of the two YF-4M prototypes XT852 ended its days at West Freugh as an instructional and ground test airframe whilst XT853 was used as a battle damage repair trainer at Scampton before being broken up there and its remains dumped on the airfield.

Fortunately some Phantoms of all three marks were preserved for display purposes at various locations but even here they were technically supposed to be with government rather than private institutions, although it was possible to bend the rules in some cases.

Even preserved examples were not safe however, as with XV422 which was displayed at the RAF Signals Unit at Stornoway airport but which was eventually scrapped, and XV467 which met the same fate at Benbecula.

Once aircraft were scrapped however, it proved possible to dispose of the sections to anyone willing to buy them, so various sections, usually the forward fuselage, were acquired by preservation groups both in the UK and abroad.

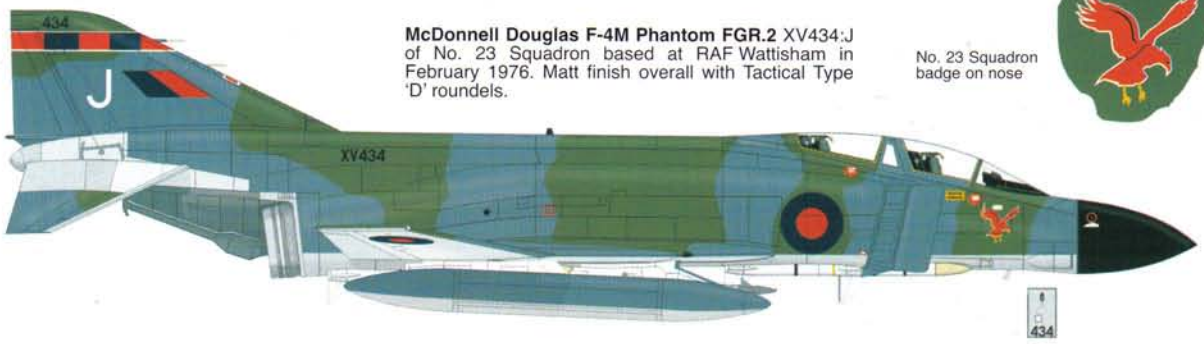
RAF/RN Phantom kits, decals and accessories

Scale	Type	Manufacturer	Reference	Remarks
1:72	Phantom F-4J(UK)	Fujimi	FU26017	Complete kit. No.74 Squadron
1:72	Phantom FG.1	Fujimi	FU27006	Complete kit. 'Silver Jubilee'
1:72	Phantom FGR.2	Fujimi	FU27007	No.56 Squadron 'Firebirds'
1:72	Phantom F-4K	Fujimi	FU27008	Complete kit Royal Navy
1:72	Phantom FG.1	Fujimi	FU27017	Complete kit. 'Silver Jubilee'
1:72	Phantom FGR.2	Fujimi	FU27018	Complete kit
1:72	Phantom FG.1	Fujimi	FU27019	Complete kit. No. 56 Squadron
1:72	Phantom FGR.2	Fujimi	FU27020	Complete kit. Shark mouth markings
1:72	Phantom F-4J(UK)	Hasegawa	HAKX102	Complete kit
1:72	Phantom FG.1	Matchbox	PK412	Complete kit
1:72	Phantom FGR.2	Matchbox	PK421	Complete kit
1:72	Phantom	Plastyk	PYS120	Complete kit. Version not known
1:48	Phantom FG.1	Hasegawa	HA09331	Complete kit No. 111 Squadron
1:48	Phantom FG.1	Hasegawa	HACH08	Complete kit 'High Grade'
1:48	Phantom FGR.2	Hasegawa	HACH09	Complete kit 'Alcock and Brown'
1:48	Phantom FG.1	Hasegawa	HAP15	Complete kit 892 Squadron
1:48	Phantom FGR.2	Hasegawa	HAP16	Complkete kit
1:48	Phantom FGR.2	Hasegawa	HASP043	Complete kit 'Black Mike'
1:72	Phantom	PP Aeroparts	PPAL721	Brass etched ladder for rear cockpit
1:48	Phantom	PP Aeroparts	PPAL 404	Brass etched ladder for rear cockpit

DECALS

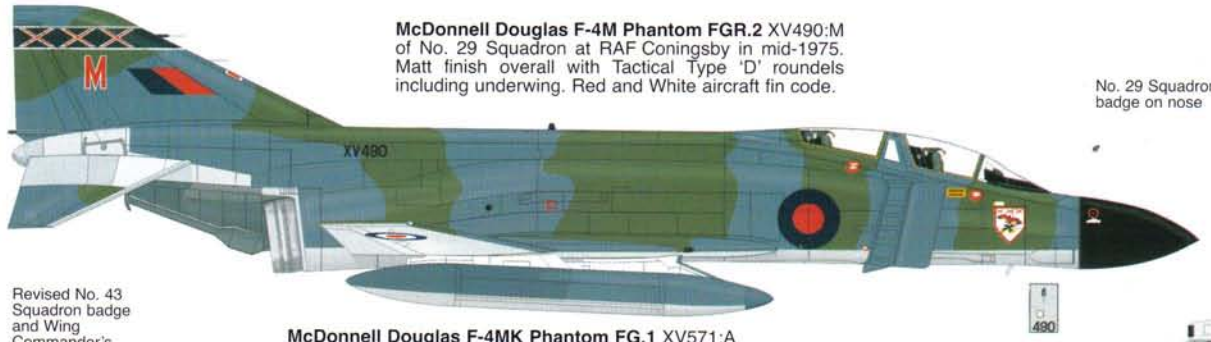
Many decals have been produced for RAF and RN Phantoms that it is almost impossible to list all of the sheets that contain examples. Often sheets duplicate each other and the problem of sorting out each has proved to be a near impossible task. It has also been impossible to state with accuracy those that are still in production and available from the manufacturer or leading stockists. The list that follows is therefore given in the knowledge that it may be possible to add others which have not been found and delete many that have gone out of production. The list is based on Hannants past and present catalogues.

Refernce	Contents
AKA4801	Phantom FG.1, 700P Squadron, 892 Squadron, Phantom Training Flight
AKA4802	Phantom FGR.2, XV495, 41 Sqdn., XV495 228 OCU, XV436 54 Sqdn, XV429 56 Sqdn.
CAM32131	Phantom FGR.2, 60th Anniversary 1979 Alcock and Brown flight
MD037	Phantom FGR.2 56 Sqdn 1976, 2 Sqdn 1971
MD055	Phantom FGR.2 IAT 1979, XV 424 Alcock and Brown
MD064	Phantom FG.1 43 Sqdn, FGR.2 19, 23 and 56 Sqdns all three tone grey, 19 Sqdn in grey/green
MD065	Phantom Fg.1 111 Sqdn, FGR.2 92, 64/228 OCU, 29 Sqdns in grey, FGR.2 23 and 19 Sqdns in grey/ green
MD073	Phantom FGR.2 2, 23, 29 and 56 Sqdns. 23 Sqdn at RAF Stanley 1983.
MD076	Phantom F-4J(UK) 74 Sqdn 1984
MD089	Phantom FG.1 XV571:A 43 Sqdn anniversary schene. FGR.2 XT900:CO, XV393:CA 228 OCU/64 Sqdn 1987
MD090	Phantom FG.1 XV574:Z 111 Sqdn.Black spine and fin.
MD094	Phantom FGR.2 2, 6, 14, 17 and 31 Sqdns in mid 1970s
MD115	Phantom FGR.2 1435 Flt, Falklands
X00472	PhantomFG.1 (2) 43 Sqdn, XV571:A with black and white checks 111 Sqdn XV564:Z with black and yellow fin
YH7201	F-4J(UK) Phantom 74 Sqdn 1988 Tiger Meet special scheme.
ZA372	Phantom FGR.2 XV408:Z 92 Sqdn overall blue scheme



McDonnell Douglas F-4M Phantom FGR.2 XV434:J of No. 23 Squadron based at RAF Wattisham in February 1976. Matt finish overall with Tactical Type 'D' roundels.

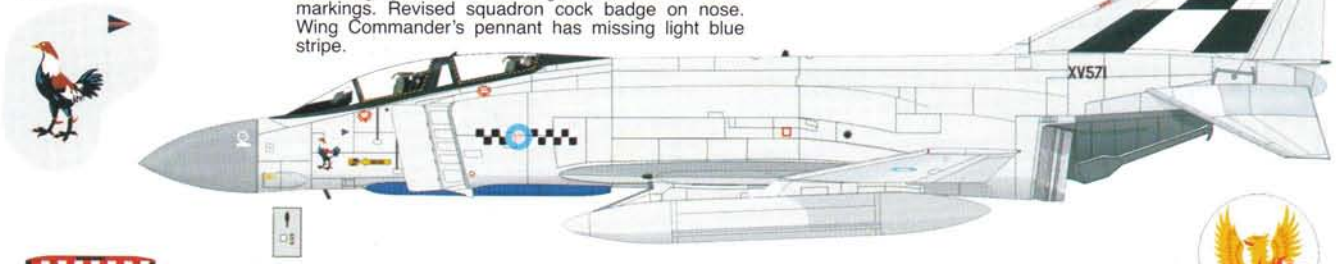
No. 23 Squadron badge on nose



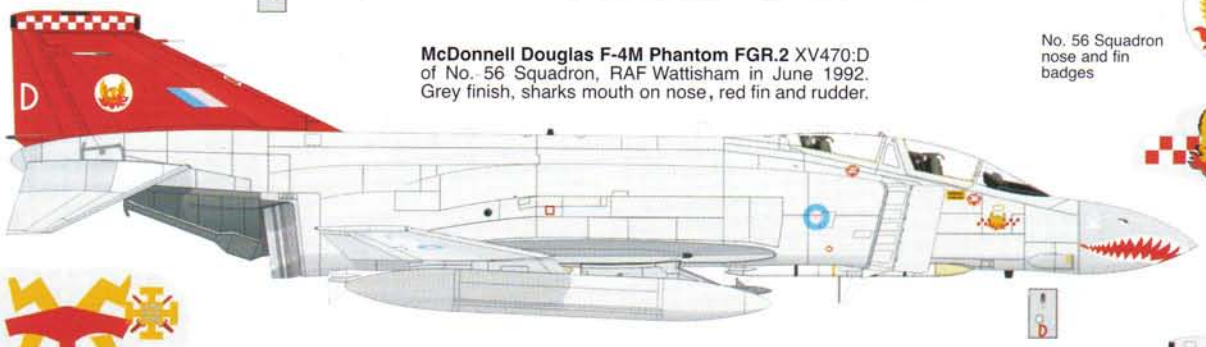
McDonnell Douglas F-4M Phantom FGR.2 XV490:M of No. 29 Squadron at RAF Coningsby in mid-1975. Matt finish overall with Tactical Type 'D' roundels including underwing. Red and White aircraft fin code.

No. 29 Squadron badge on nose

Revised No. 43 Squadron badge and Wing Commander's pennant on nose



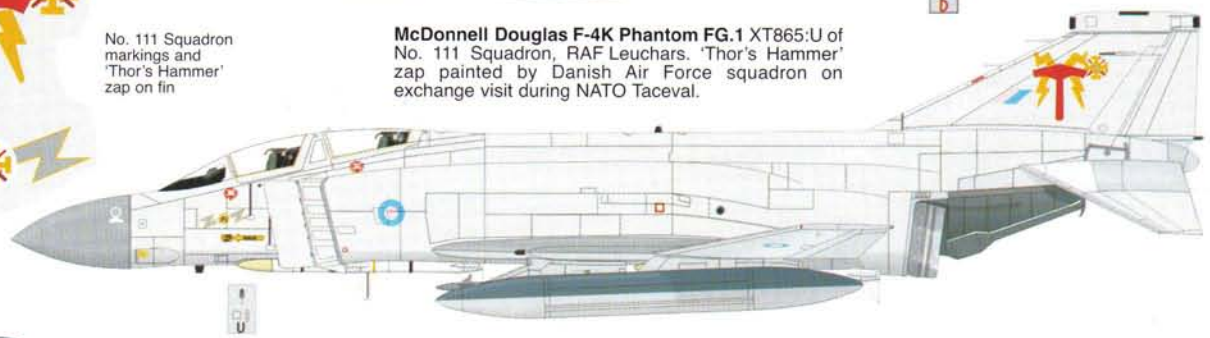
McDonnell Douglas F-4MK Phantom FG.1 XV571:A flown by OC No. 43 Squadron, RAF Leuchars in 1987. Overall grey scheme with large black and white tail markings. Revised squadron cock badge on nose. Wing Commander's pennant has missing light blue stripe.



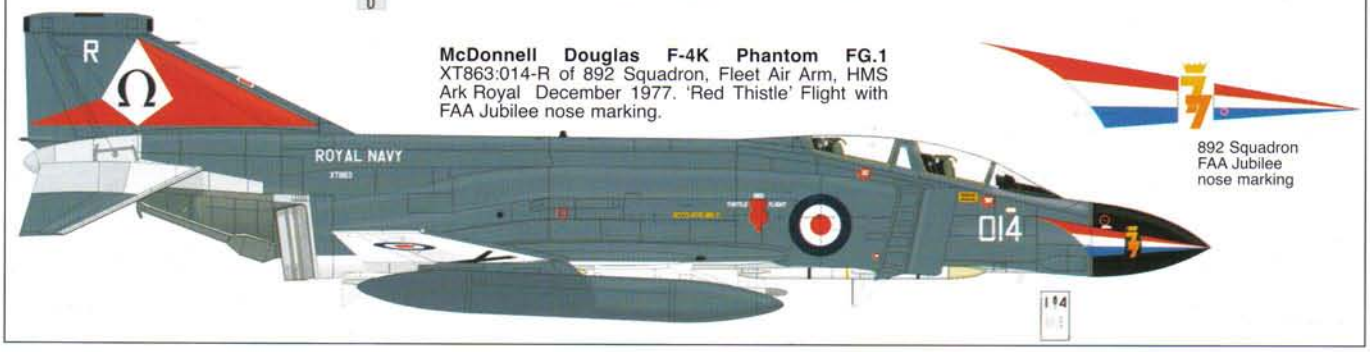
McDonnell Douglas F-4M Phantom FGR.2 XV470:D of No. 56 Squadron, RAF Wattisham in June 1992. Grey finish, sharks mouth on nose, red fin and rudder.

No. 56 Squadron nose and fin badges

No. 111 Squadron markings and 'Thor's Hammer' zap on fin



McDonnell Douglas F-4K Phantom FG.1 XT865:U of No. 111 Squadron, RAF Leuchars. 'Thor's Hammer' zap painted by Danish Air Force squadron on exchange visit during NATO Taceval.



McDonnell Douglas F-4K Phantom FG.1 XT863:014-R of 892 Squadron, Fleet Air Arm, HMS Ark Royal December 1977. 'Red Thistle' Flight with FAA Jubilee nose marking.

892 Squadron FAA Jubilee nose marking

Above: Spot the odd man out!. One of the few times that No. 56 Squadron put up a 16 aircraft formation was shortly after the change over to the grey camouflage scheme. All are grey apart from one which remained in the grey-green scheme. (MoD) Below: Snow clearance in the Falklands. A No. 23 Squadron Phantom, XV466:E, gets airborne from Mount Pleasant airfield leaving behind a totally clean and dry runway cleared by the heat and thrust of the two Spey engines. (C.F.E.Smedley)

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