= McDonnell Douglas F @-@ 4 Phantom II in UK service =

The United Kingdom operated the McDonnell Douglas F @-@ 4 Phantom II as one of its principal combat aircraft from the 1960s to the early 1990s . The UK was the first export customer for the Phantom , which was ordered in the context of political and economic difficulties around indigenous British designs for the roles that it was eventually purchased to undertake . The Phantom was procured to serve in both the Fleet Air Arm and Royal Air Force in several roles including air defence , close air support , low @-@ level strike and tactical reconnaissance .

Although assembled in the United States , the UK 's Phantoms were a special batch built separately and containing a significant amount of British technology as a means of easing the pressure on the domestic aerospace industry in the wake of major project cancellations . Two individual variants were eventually built for the UK ; the F @-@ 4K variant was designed from the outset as an air defence interceptor to be operated by the Fleet Air Arm from the Royal Navy 's aircraft carriers , while the F @-@ 4M version was procured for the RAF to serve in the tactical strike and reconnaissance roles . In the mid @-@ 1980s , a third Phantom variant was obtained when a quantity of second @-@ hand F @-@ 4J aircraft were purchased to augment the UK 's air defences following the Falklands War .

The Phantom entered service with both the Fleet Air Arm and the RAF in 1969 ; while in the Royal Navy it had a secondary strike role in addition to its primary use for fleet air defence , in the RAF it was soon replaced in the strike role by other aircraft designed specifically for strike and close air support missions , and by the mid @-@ 1970s was transferred to become the UK 's principal interceptor , a role in which it continued until the late 1980s .

= = Background = =

In the late 1950s , the British Government began the process of replacing its early second @-@ generation jet combat aircraft then in service with the Royal Air Force and Fleet Air Arm . At the time , the British aerospace industry was still a major source of equipment , with designs from different companies in service in various roles . The 1957 Defence White Paper brought about a significant change in the working practices , with the Government compelling major aerospace manufacturers to amalgamate into two large groups : British Aircraft Corporation (formed from the merger of English Electric , Vickers @-@ Armstrongs , Bristol and Hunting) and Hawker Siddeley (formed from the merger of Hawker Siddeley Aviation , Folland , de Havilland and Blackburn) .

The intention was to rationalise the industry to cut costs , with the government also offering incentives for amalgamation through promises of contracts for new aircraft orders for the armed forces . At the time , the RAF were looking to replace the English Electric Canberra light bomber in the long @-@ range interdictor role and the Hawker Hunter in the close air support role , while the Royal Navy sought an aircraft to assume the fleet air defence role from the de Havilland Sea Vixen . BAC , through its English Electric subsidiary , had begun developing a new high @-@ performance strike aircraft , the TSR @-@ 2 , which was intended to undertake long @-@ range , low @-@ level strike missions with conventional and tactical nuclear weapons as well as to conduct tactical reconnaissance . Hawker Siddeley was also developing a new aircraft , based on its P.1127 V / STOL demonstrator . The P.1154 was proposed as a supersonic version that could be marketed to both the RAF and Royal Navy to fulfil a number of roles : close air support , air superiority and fleet air defence .

During the early 1960s , aircraft development became increasingly expensive , with the result that major projects often became mired in political and economic concerns . The development of TSR @-@ 2 saw increasing cost overruns , combined with the presence of a potentially cheaper alternative then under development in the United States , the F @-@ 111 . The P.1154 was subject to the ongoing inter @-@ service rivalry between the Royal Navy and RAF , which led to two wildly differing specifications being submitted for the aircraft that were impossible to fit within a single airframe .

In 1964 , the Royal Navy withdrew from the P.1154 project , and instead made moves to procure a

new fleet air defence interceptor . It eventually selected the McDonnell Douglas F @-@ 4 Phantom II , then in service with the US Navy as its primary air defence aircraft , intended to be operated from both existing and new @-@ built aircraft carriers . This better suited the Royal Navy , as McDonnell Douglas F @-@ 4 Phantom II had two engines (providing redundancy in the event of an engine failure) , was cheaper than the P.1154 , and was immediately available . P.1154 was then left as a wholly RAF project . Later the same year , a General Election brought the Labour Party back into power . The new government undertook a defence review , which led to the 1966 Defence White Paper that cancelled several projects , including both the P.1154 and TSR @-@ 2 . As a consequence , the government was forced to order new aircraft to replace the Canberra and Hunter for the RAF , and eventually chose two types ? to replace the Canberra in the long @-@ range role (which was intended for TSR @-@ 2) , the F @-@ 111 was selected , with plans for a redesigned variant , while the roles undertaken by the Hunter (for which P.1154 was to be procured) would be undertaken by a further purchase of F @-@ 4 Phantoms . As the Phantom had been developed primarily for fleet air defence , the Royal Navy was happy with the choice of the aircraft as its Sea Vixen replacement , given that the type had been operational in that role with the US Navy since 1961 , whilst US aircraft had successfully undertaken touch @-@ and @-@ go landings on both HMS Hermes and HMS Victorious . The RAF was less enthusiastic , as the Phantom was primarily designed to operate in the air defence rather than the close air support role , and had been selected as its Hunter replacement more as a way of decreasing the per @-@ unit cost of the overall UK order .

Partly as a means of guaranteeing employment in the British aerospace industry , agreement was reached that significant amounts of the structure of the UK 's Phantoms would be built domestically . The F @-@ 4J variant , which was then the primary version in service with the US Navy , was taken as the basis for the UK aircraft , with major redesign . The most significant change was the substitution of the larger and more powerful Rolls @-@ Royce Spey turbofan for the GE J79 turbojet to allow operations from the Royal Navy 's carriers . Although several had received major upgrades , all of which were smaller than the USN carriers that J79 @-@ GE @-@ 8 and ? 10 powered Phantoms operated from . To accommodate the larger engines , BAC redesigned and built the entire rear fuselage section . The Westinghouse AN / AWG @-@ 10 radar carried by the F @-@ 4J was to be procured and built under licence by Ferranti as the AN / AWG @-@ 11 for Fleet Air Arm aircraft and AN / AWG @-@ 12 for those of the RAF . The overall changes to the aircraft led to the two variants being given their own separate series letters , with the FAA version being designated as the F @-@ 4K and the RAF version as the F @-@ 4M .

Initially , there was an intention to procure up to 400 aircraft for the Royal Navy and the RAF , but the development cost associated with the changes specified by the UK to accommodate the Spey turbofans meant that the per @-@ unit price eventually ended up being three times the price of an F @-@ 4J ; because the government then had a policy of negotiating fixed @-@ price contracts , these costs could not be evened out by a large production run , which left the total order at 170 .

= = Variants = =

= = = Prototypes = = =

The British Government ordered a total of four prototypes (two F @-@ 4K and two F @-@ 4M) , together with a pair of pre @-@ production F @-@ 4K aircraft . The first UK Phantom , a prototype F @-@ 4K (designated as YF @-@ 4K) , first flew on 27 June 1966 at the McDonnell Douglas plant in St. Louis . The second made its first flight on 30 August 1966 . The two pre @-@ production F @-@ 4K aircraft were constructed alongside the prototypes , and were initially used for fit check trials of the various systems they would be fitted with ? the first was used for catapult / arrestor and deck landing trials , while the second was primarily for testing the radar and missile systems . All four were delivered to the UK from 1969 to 1970 for continued use in testing work by both the Aeroplane and Armament Experimental Establishment and British Aerospace . One of the pre @-@

production examples was subsequently delivered to the RAF for operational use , but was lost in 1978 . The first F @-@ 4M prototype (designated YF @-@ 4M) first flew on 17 February 1967 , with both again used for fit check work before delivery to the UK .

= = = = Operators = = = =

United Kingdom

= = = F @-@ 4K Phantom FG.1 = = =

= = = = Royal Navy = = = =

In 1964 , a total of 140 new build Phantoms were ordered for the Fleet Air Arm to serve as the Royal Navy 's primary fleet air defence aircraft , combined with a secondary strike capability . These were procured to replace the Sea Vixen then in service in the role , with the intention that they operate from the decks of four brand new or modernised aircraft carriers . At the time , the Royal Navy 's carrier force consisted primarily of five fleet or light fleet carriers of differing sizes and ages . Of the five in service , only Eagle and Ark Royal , each displacing approximately 50 @,@ 000 tons , were big enough to accommodate the Phantom in sufficient numbers , and so plans were put in place to rebuild the two ships to enable the operation of the aircraft .

At the same time , plans were in place to construct two new aircraft carriers to a new design , termed as " CVA @-@ 01 " ; the requirements for the intended force of four carriers meant that up to five squadrons of Phantoms were planned to be purchased . However , in its 1966 Defence White Paper the Government decided to cancel CVA @-@ 01 (as well as cancelling TSR @-@ 2) , which led to reductions in the total procurement order for the Royal Navy 's Phantoms ; initially , 143 were ordered , which then went down to 110 , and finally 50 , with options for another seven . The intention was to form a pair of front @-@ line squadrons , each of twelve aircraft , that would operate from the two remaining , heavily modernised fleet carriers , with the remainder of the fleet as a reserve and for training .

The Royal Navy received its first F @-@ 4K Phantoms , which received the British designation FG.1 , in April 1968 . These were assigned to 700P Naval Air Squadron (NAS) , which was to serve as Intensive Flying Trials Unit . Upon completion of the successful flight trials , 767 Naval Air Squadron was commissioned in January 1969 as the FAA 's training squadron . This was followed at the end of March 1969 by 892 Naval Air Squadron , which commissioned as the Royal Navy 's first operational Phantom unit , intended to embark in Ark Royal once her three @-@ year refit had completed in 1970 .

At the same time as the Fleet Air Arm was receiving its first aircraft , the Aeroplane and Armament Experimental Establishment had three FG.1s delivered to its ' C ' Squadron for flight deck trials aboard Eagle . Two sets of trials were successfully carried out in March and June 1969 ; the first set was a set of approaches and touch and go landings , while the second set of trials involved full up catapult launch and arrested recovery . As a result of the reheat from the Spey turbofans , the ship 's jet blast deflectors (JBD) were not used ; instead a steel plate was fixed to the deck to absorb the heat of the engines building to launch , with fire hoses needed after each launch to prevent them melting .

Ark Royal had entered refit to accommodate the Phantom in 1967 ; this involved a major reconstruction , with a number of elements undertaken to allow the ship to operate the aircraft ? the flight deck was increased in area , and fully angled to 8 ½ ° ; the arresting gear was replaced with a new water @-@ spray system to allow for the Phantom 's higher weight and landing speed ; while bridle catchers and water @-@ cooled JBDs were fitted to the catapults . Once this work was complete , Eagle was then scheduled to undergo a similar modernization . However , in 1969 , the planned refit of Eagle was cancelled , while the options for seven additional FG.1s was not taken up . As a consequence , it was then decided to further reduce the FAA 's Phantom fleet to just 28

aircraft . The remaining 20 aircraft were then allocated to the Royal Air Force .

In 1970 , Ark Royal embarked 892 NAS , with a total of 12 aircraft , as part of her air group for the first time . However , the first operational use of the Royal Navy 's Phantoms had come in 1969 , when 892 NAS had embarked for training with the US aircraft carrier USS Saratoga in the Mediterranean , and had undertaken air defence missions alongside the ship 's own F @-@ 4Js . This deployment showed the necessity for the modifications fitted to Ark Royal , as the heat from the afterburners of the Spey , combined with the increased AoA resulting from the extendable nosewheel , during the initial launches from Saratoga caused the deck plates to distort , leading to subsequent catapult launches being undertaken at reduced weight without the use of re @-@ heat . During Ark Royal 's first three @-@ year commission , 892 NAS , which had initially used RNAS Yeovilton in Somerset as its home base , moved to RAF Leuchars in Fife where , during the periods when it was not embarked , it undertook Quick Reaction Alert (QRA) duties alongside the RAF 's 43 Squadron . The Phantom served in the Fleet Air Arm until 1978 , when Ark Royal was finally withdrawn from service , leaving no ship left in the Royal Navy capable of operating the type . The final catapult launch from Ark Royal was a Phantom of 892 NAS on 27 November 1978 during the disembarkation of the air group following the ship 's final deployment ; the squadron 's aircraft were delivered to RAF St Athan in Wales where they were then handed over to the RAF . During the type 's service with the Royal Navy , a total of 10 of the total FAA fleet of 28 were lost .

= = = = Royal Air Force = = = =

Following the cancellation of the planned refit of HMS Eagle to allow her to operate the Phantom , a total of 20 airframes that had originally been ordered for the Fleet Air Arm were diverted to the Royal Air Force to serve in the air defence role . At the time , the RAF 's primary interceptor was the English Electric Lightning , which suffered badly both in terms of range , loiter time and weapons fit , all of which hampered its effectiveness , especially in long interceptions of Soviet Air Forces and Soviet Naval Aviation bombers and reconnaissance aircraft over the North Sea and North Atlantic . So a new Phantom squadron was formed at RAF Leuchars , the UK 's most northerly air defence base at the time , to take advantage of the improvements that the Phantom provided over the Lightning ? it could carry more fuel , and could thus fly further for longer ; it was fitted with a more powerful radar ; and it could carry more missiles (up to 8 , compared to 2 for the Lightning) . On 1 September 1969 , 43 Squadron was formed at Leuchars , operating as part of the UK 's northern QRA zone alongside the Lightnings of 11 Squadron and , from 1972 , the Royal Navy Phantoms of 892 Naval Air Squadron .

Upon the withdrawal of HMS Ark Royal in 1978 , the Phantoms of the Fleet Air Arm were turned over to the RAF and used to form a second squadron at Leuchars . At the time , 111 Squadron was stationed there operating the FGR.2 version of the Phantom , having been there since 1975 . In 1979 , to save costs resulting from the differences between the FG.1 and FGR.2 , the squadron converted to the ex @-@ Navy aircraft , dispersing its existing airframes to other Phantom units . Both 43 and 111 Squadrons retained the FG.1 until 1989 , when they converted to the new Tornado F.3. Following the standing down of the two operational squadrons and the final withdrawal of the type from service , the bulk of the RAF 's FG.1 Phantoms were scrapped . The RAF lost a total of eight of their FG.1s in crashes throughout the type 's twenty year service .

= = = = Operators = = = =

United Kingdom
Aeroplane and Armament Experimental Establishment
Royal Navy
700P Naval Air Squadron
767 Naval Air Squadron
892 Naval Air Squadron
Royal Air Force

43 Squadron
64 (R) Squadron
111 Squadron

= = = = Gallery (FG.1) = = = =

= = = F @-@ 4M Phantom FGR.2 = = =

= = = = Close air support = = = =

Following the cancellation of both the TSR @-@ 2 and P.1154 programmes , the RAF were still left with a requirement to replace both the Canberra and Hunter in the long @-@ range strike , close air support and reconnaissance roles . This resulted in the procurement of two aircraft , the General Dynamics F @-@ 111K , intended for the long @-@ range interdiction roles carried out by the Canberra , and the F @-@ 4M Phantom , which would be used in the close air support role undertaken by the Hunter . While the F @-@ 111K was cancelled within a year of being ordered , the order for 150 Phantoms went ahead alongside the Phantom order for the Royal Navy . However , the final 32 units of the order were eventually cancelled . The RAF Phantom , given the designation FGR.2 , was broadly similar to the naval version , with some minor variations in terms of engines , avionics and structure , which related to its use as a land @-@ based , rather than carrier @-@ based aircraft .

The first RAF Phantom unit was 228 Operational Conversion Unit , which was stood up in August 1968 . The Phantom entered operational service in May 1969 , when 6 Squadron was formed at RAF Coningsby in the tactical strike role . 54 Squadron was formed in September the same year , while 41 Squadron came in 1972 as a tactical reconnaissance unit . A further four squadrons were formed in RAF Germany on the Phantom in these roles , with 2 , 14 , 17 and 31 Squadrons all formed at RAF Brüggen in 1970 and 1971 . 14 , 17 and 31 Squadrons were assigned , in addition to their conventional strike role , a tactical nuclear strike role under SACEUR , using weapons supplied by the United States . After initial work @-@ up , 2 Squadron moved to and operated from RAF Laarbruch in the tactical reconnaissance role . The aircraft assigned to the two tactical reconnaissance units were fitted with a recce pod containing 4 optical cameras , an infrared linescan and a sideways looking radar .

During the 1970s , the RAF was in the process of developing a new aircraft specifically for the tactical strike and reconnaissance missions , which eventually became the SEPECAT Jaguar . This was introduced into service in 1974 , and led to a re @-@ think in the use of the Phantom as , at the same time , the limitations of the Lightning as an interceptor were becoming more apparent . The conversion of the RAF 's FGR.2 squadrons to operate the Jaguar , combined with the use of the Blackburn Buccaneer , which had been purchased to assume some of the strike roles intended for the F @-@ 111K , meant that it was possible to begin transferring Phantoms to operate purely as interceptors in the air defence role .

= = = = Air defence = = = =

In October 1974 , 111 Squadron converted from the Lightning to the Phantom FGR.2 , becoming the first unit to operate the type in the air defence role (notwithstanding 43 Squadron , which had used the FG.1 version since 1969) . As more Jaguars were delivered , enabling the strike squadrons in the UK and Germany to convert , more Phantoms were released enabling existing Lightning squadrons to be converted ; 19 Squadron and 92 Squadron , the forward deployed air defence units in Germany , converted in 1976 and 1977 respectively , at the same time moving from RAF Gütersloh , which was the closest RAF base to the East German border , to RAF Wildenrath , taking advantage of the Phantom 's superior range over the Lightning . Three further UK based

squadrons , 23 , 29 and 56 , were also converted between 1974 and 1976 . 111 Squadron , which had been the first unit to use the FGR.2 as an interceptor , converted to the FG.1 version in 1979 following the transfer of the Royal Navy 's remaining airframes to the RAF . The Phantom subsequently served as the RAF 's primary interceptor for over a decade until the introduction into service of the Panavia Tornado F.3 in 1987 .

When Phantoms were first delivered to interceptor squadrons , they remained in the grey @-@ green camouflage colour scheme more associated with the strike and close air support missions they had undertaken . During the late 1970s , the RAF began experimenting with new colours for its air defence units , with 56 Squadron tasked with trialling proposed new schemes . In October 1978 , a Phantom FGR.2 of 56 Squadron became the first to be painted in the new air superiority grey colour , combined with small , low visibility roundels and markings . However , although the roundel remained in low visibility colours , individual squadron markings eventually returned to more observable sizes and colours .

In May 1982 , three Phantoms from 29 Squadron were forward deployed to RAF Wideawake on Ascension Island to provide air cover during the RAF 's operations as part of Operation Corporate , replacing Harriers of 1 Squadron , which were transiting to the war zone . In August 1982 , following the end of the conflict and the reconstruction of the runway , 29 Squadron detached a number of its aircraft to RAF Stanley to provide air defence for the Falkland Islands . Late the following year , 23 Squadron took up the role , remaining stationed there until October 1988 , when they were replaced by 1435 Flight . To make up for the loss of an entire squadron from the UK Air Defence Region , the RAF procured 15 second @-@ hand F @-@ 4J Phantoms that had previously been used by the US Navy . These aircraft were operated by 74 Squadron from 1984 until 1991 , when they were replaced by FGR.2 Phantoms that had been released by other squadrons following their conversion to the Tornado . Initially , it was intended that Phantoms and Tornados serve alongside each other ; a total of 152 Tornado F.3s were ordered for the RAF , enough to convert four squadrons of Phantoms and two of Lightnings , but insufficient to completely convert every air defence squadron ; both 23 and 29 Squadrons converted from the Phantom FGR.2 to the Tornado between 1987 and 1988 , alongside the conversion of the final two remaining Lightning squadrons ; the intention was to retain a pair of UK based Phantom squadrons at RAF Wattisham alongside a pair of Tornado units at RAF Coningsby to provide air defence cover for the southern half of the UK Air Defence Region , with another two squadrons stationed in Germany . The end of the Cold War however led to a more rapid withdrawal of Phantom units than had originally been planned ; under the Options for Change defence review the Phantom was to be withdrawn from service , with the two Germany based units disbanded as part of the gradual run down of the RAF 's presence , and a reduction in the number of air defence squadrons leading to the two UK based units being disbanded in late 1992 . However , just prior to the final withdrawal of the Phantom , it was recalled operationally as a result of Operation Granby , the UK 's participation in the First Gulf War , when a total of six aircraft from 19 and 92 Squadrons were forward deployed to provide air defence cover at RAF Akrotiri ; this was to replace the Tornados that had been originally deployed there on exercise , and were subsequently sent to the Gulf region . Following their final withdrawal from service , with a few exceptions , the bulk of the RAF 's FGR.2 fleet was scrapped . Over its service life , 37 FGR.2s were lost to crashes .

= = = = Operators = = = =

Royal Air Force

= = = = Gallery (FGR.2) = = = =

= = = F @-@ 4J (UK) Phantom F.3 = = =

Following the end of the Falklands War , the UK government began a programme of upgrading the

defences of the Falkland Islands to guard against any further potential aggression from Argentina . One of the measures taken was the deployment of an interceptor squadron to the islands themselves , with 23 Squadron forming at RAF Stanley in October 1983 . At the time , the air defence variant of the Panavia Tornado was still in development , meaning that the Phantom was the UK 's primary air defence aircraft (supported by two remaining squadrons of Lightnings) . The removal of a squadron of Phantoms to the Falkland Islands left a gap in the UK 's air defences with nothing immediately available to fill it , given that the Tornado was still some years from entering service . As a consequence , the UK government decided to purchase an additional squadron of Phantoms . However , because the aircraft in service with the RAF were the special production batch built to UK specifications , it would not be possible to obtain identical aircraft . So , a total of 15 second @-@ hand airframes were procured from among the best of the ex @-@ US Navy F @-@ 4Js stored at the Aerospace Maintenance and Regeneration Center at Davis ? Monthan Air Force Base in Arizona and the Naval Air Rework Facility at NAS North Island . The F @-@ 4J was chosen as it was the variant from which the RAF 's F @-@ 4Ks and F @-@ 4Ms had been developed , and thus the closest available to the British aircraft . The 15 that were selected were extensively refurbished and brought to a standard almost equivalent to the F @-@ 4S , which was the last variant in service with the US Navy , with the only differences being the absence of leading @-@ edge slats and a helmet gun sight .

The major difference between the F @-@ 4J and the British Phantoms was the absence of the Rolls @-@ Royce Spey turbofan , with instead the aircraft being fitted with the GE J79 @-@ 10B , which produced less power than the British engine , but had a faster afterburner light up , giving it better performance at high altitude , at the expense of slightly poorer acceleration at low level ; the high altitude performance was helped by the reduced drag from its smaller air intakes . Initially delivered capable of carrying the Sparrow and Sidewinder air @-@ to @-@ air missiles (AAM) , they were soon made compatible with the Skyflash and SUU @-@ 23A gun pod , bringing them into line with the rest of the RAF 's Phantoms . However , in spite of some modifications to allow them to operate with the rest of the fleet , the F @-@ 4Js retained the vast bulk of the equipment they were originally fitted with , which even led to their crews requiring American flying helmets .

Although the new Phantoms were assigned a British designation as the F.3 , they were generally referred to as the F @-@ 4J (UK) . They were assigned to 74 Squadron at RAF Wattisham , which stood up in October 1984 , just two months after the first flight . The aircraft remained in service through the transition to the Tornado , which began entering service in 1987 . In 1990 , thanks to the conversion of F @-@ 4M squadrons to the Tornado , the RAF were able to transfer the best of its remaining FGR.2s to 74 Squadron , which meant that the F.3 was able to be withdrawn in January 1991 . With a couple of exceptions , all of the RAF 's F @-@ 4Js were broken up for scrap . One of the 15 airframes was lost in a crash in 1987 , killing both crew members .

= = = = Operators = = = =

Royal Air Force
74 Squadron

= = = = Gallery (F.3) = = = =

= = Variations = =

= = = FG.1 and FGR.2 = = =

The Phantom FG.1 and FGR.2 as built were similar , being fitted as they were with broadly the same engines and avionics , although in both cases there were minor differences . The FGR.2 was fitted with the Mark 202 version of the Rolls @-@ Royce Spey turbofan , while the FG.1 had the

Mark 203 ; this was fundamentally the same , but had a modified control system for the afterburner , which allowed it to light faster , to enable power to be applied quickly in the event of a bolter on the small decks of the Royal Navy 's aircraft carriers . Both variants were fitted with a licence built version of the Westinghouse AN / AWG @-@ 10 avionics package ; the FG.1 was fitted with the AN / AWG @-@ 11 , which differed primarily in having a nose radome that was hinged and able to fold backwards against the aircraft 's fuselage to allow for storage in the hangar of an aircraft carrier ; the system was designed to be integrated with both the AGM @-@ 12 Bullpup missile and WE.177 as required . The AN / AWG @-@ 12 fitted to the FGR.2 was not foldable , and featured a better ground mapping mode , to take into account the strike role for which the type was originally procured ; allied to this was a Ferranti inertial navigation / attack system (removed when the type converted to the air defence role) . It was also configured to be able to control the SUU @-@ 23A gun pod , which the Royal Navy 's FG.1s were not fitted with .

= = = British Phantoms and other Phantoms = = =

Although there were some minor differences between the two types of Phantom built for the UK , there were many significant ones between the British Phantoms and those built for the United States . The most obvious one was the substitution of the Rolls @-@ Royce Spey turbofan for the General Electric J79 turbojet . The Spey was shorter in length than the J79 , but wider in diameter , which meant that the intakes had to be redesigned for a higher airflow , making them 20 % larger (with a consequent increase in drag) , while the fuselage was widened by 152 mm (6 @.@ 0 in) . The position of the afterburner also meant that the rear of the fuselage had to be made deeper . In addition auxiliary intake doors were fitted on the rear fuselage .

Estimates on the performance of the Spey engined Phantom as opposed to its American equivalent had the aircraft requiring a 30 % shorter take @-@ off distance , 20 % faster climb to altitude , higher top speed and longer range . The Spey was certainly more efficient at lower altitudes , and had better acceleration at low speed , giving British Phantoms better range and acceleration , which was shown during the deployment of 892 NAS to the Mediterranean aboard USS Saratoga in 1969 , when the F @-@ 4K was repeatedly quicker off the deck than the F @-@ 4J used by the Americans . But , it was less efficient at higher altitudes , with British Phantoms lacking speed compared with J79 powered versions owing to the increased drag of the re @-@ designed fuselage . This discrepancy became apparent when the F @-@ 4J was obtained by the UK in 1984 ; this was regarded as being the best of the three variants to serve in the RAF .

The small size of the aircraft carriers Eagle and Ark Royal , from which the Royal Navy 's Phantoms were intended to operate , compared to the US Navy carriers of the period , meant that the F @-@ 4K version required significant structural changes compared to the F @-@ 4J , from which it was descended , and which performed a similar role . In addition to the folding nose radome to allow for storage in the smaller hangars of the British ships , it had to have a significantly strengthened undercarriage to account for the higher landing weight (British policy was to bring back unused ordnance) ; a telescopic nosewheel oleo that extended by 40 inches (100 cm) to provide an increased take @-@ off attitude (the extension of the nosewheel put the Phantom at a 9 ° attitude) due to the shorter and less powerful catapults ; and drooping ailerons , enlarged leading edge flaps and a slotted tailplane , increased flap and leading edge blowing , all to improve the lift and handling characteristics of operation from the much smaller carriers of the Royal Navy .

As the Phantom continued in service , other changes were made , most notably the addition of the Marconi ARI.18228 Radar Warning Receiver in an installation mounted on top of the vertical stabiliser , the only Phantom variants to be so fitted . The RWR installation was fitted in the mid @-@ 1970s to both the FG.1 and FGR.2 Phantoms , but was not fitted to the F.3. From 1978 , the Skyflash AAM , derived from the AIM @-@ 7 Sparrow , began to be delivered to RAF Phantom units , and was used concurrently with the Sparrow ; all three UK Phantom variants were eventually fitted to operate the Skyflash .

UK versions compared

= = = List of aircraft = = =

The first batch of Phantoms produced for the UK received serials in the XT range , with a total of 44 production models (20 FG.1s and 24 FGR.2s) , as well as the four prototypes and two pre @-@ production models being given XT serial numbers . The bulk of the UK 's specially built Phantoms were delivered with XV serials (94 FGR.2s and 28 FG.1s) , while the two cancelled sets of airframes (32 FGR.2 and 7 FG.1) also received XV numbers . The second @-@ hand examples (15 F.3) obtained in 1984 received serials in the ZE range .

= = = Phantom locations = = =

The RAF operated the Phantom from a number of bases in the UK , Germany and the Falkland Islands during its operational service , while the Royal Navy initially based its Phantom units at its main air station at Yeovilton ; following the disbanding of the Fleet Air Arm 's dedicated training squadron , its sole operational Phantom squadron was subsequently moved to take up residence at the RAF 's base at Leuchars .

= = = Basic specifications = = =

= = = Other UK Phantom proposals = = =

Although the Phantom was ordered in 1966 , the variants that were eventually constructed were not the first to be offered to the UK . McDonnell Aircraft had been conducting studies into the possibility of the Royal Navy using the Phantom on its carriers since 1959 , when they had concluded on the need for more power than could be provided by the J79 turbojet in order to operate from the smaller decks of British carriers , with the company talking to Rolls @-@ Royce about whether the RB @-@ 168 Spey turbofan , then in development for use in the Blackburn Buccaneer , could be fitted to the aircraft . In 1960 , McDonnell approached the RAF with its model number 98CJ , which was an F4H @-@ 1 (later F @-@ 4B) with various modifications , including the installation of the Rolls @-@ Royce Spey Mk.101 turbofan . The company continued studies , with afterburning Spey 101 engines proposed in 1962 , while trials of an F @-@ 4B fitted with an extendable nosewheel oleo took place aboard USS Forrestal in 1963 . In 1964 , the model 98FC was proposed , which was identical to the F @-@ 4D variant , but would have been fitted with the RB.168 @-@ 25R version of the Spey engine .

= = = = RF @-@ 4M = = = =

A further proposal came after the order for the F @-@ 4M was being finalized , and was a result of the UK 's need for an aircraft to perform the tactical reconnaissance role . For this , McDonnell offered two options :

The standard F @-@ 4M fitted with a reconnaissance pod in place of the centerline fuel tank

A modified airframe , designated as RF @-@ 4M , with the reconnaissance equipment carried internally

Although the RF @-@ 4M would have had some advantages , it was discounted as the cost would have been greater , with consequently fewer aircraft purchased , while only those that had been modified would have been able to undertake the reconnaissance mission . Ultimately , the RAF chose the standard F @-@ 4M and external pod , which allowed all of its aircraft to perform all designated roles .

= = = = F @-@ 4 (HL) = = = =

Another idea that McDonnell proposed was a variation of a carrier @-@ based Phantom , with the

goal of improving both catapult performance and lower approach speeds . The F @-@ 4 (HL) would have had a longer fuselage and wingspan , with less sweep , stabilators with increased area and air intakes with auxiliary blow @-@ in doors to increase airflow at low speeds . In the event , this proposal was not taken forward .

= = Replacement = =

In the early 1970s , the RAF issued an Air Staff Requirement for the development of a new interceptor intended to replace both the Phantom and the Lightning . One initial proposal was a plan introduced by McDonnell Douglas for a variable geometry wing Phantom . This was rejected by the RAF owing to the fact that there was little apparent improvement in performance over the existing Phantom , and that it might affect the development of the " Multi @-@ Role Combat Aircraft " (MRCA) . Another idea that the MRCA concept , which eventually evolved into the Panavia Tornado , could be used in the interceptor role , was ruled out , as both its avionics and engines were optimised for the low level interdictor mission . The UK 's partners in the MRCA project displayed no enthusiasm for the idea of developing an air defence version of the Tornado , so the UK alone began the process , with the authorisation for what came to be known as the Tornado ADV issued in March 1976 . With the aircraft in development , the initial plan was for the Tornado to replace the remaining two squadrons of Lightnings , as well as all seven squadrons of Phantoms . However , while the Tornado was in development , the RAF looked at interim measures to replace the Phantom , which had been in service for over a decade by 1980 , and was beginning to suffer from fatigue issues ; one proposal looked at was the possibility of leasing or purchasing a quantity of F @-@ 15 Eagles to re @-@ equip 19 and 92 Squadrons , the units stationed in Germany . Further suggestions were that up to 80 F @-@ 15s be procured , to replace the Phantom and Lightning squadrons then in service , or even cancel the Tornado entirely and purchase the F @-@ 15 with UK adaptations (specifically to be fitted with the AI.24 Foxhunter radar developed for the Tornado , and capable of carrying the Skyflash air @-@ to @-@ air missile) . Ultimately , the F @-@ 15 option was not seriously considered , as it was felt there would not be time or cost savings over this plan against the Tornado . Subsequent to this came a decision that the Tornado , once it had entered service , would only re @-@ equip three of the Phantom squadrons , with two retained in the UK and two in Germany . Eventually , the Tornado accounted for the two FG.1 squadrons at RAF Leuchars (43 and 111 Squadrons) , plus two FGR.2 units (23 Squadron and 29 Squadron) , with 56 and 74 Squadrons remaining with the Phantom .

In the Royal Navy , the withdrawal of the conventional aircraft carrier was envisaged to see the end of fixed @-@ wing aviation at sea . Because of this policy , 892 Naval Air Squadron used a black capital Omega (?) letter on the tailfins of their aircraft , as it was believed they would be the final fixed @-@ wing squadron to be commissioned . However , in the 1970s the Royal Navy was developing what was known as the " Through Deck Cruiser " , a 20 @,@ 000 ton ship with a full length flight deck intended to embark a squadron of large anti @-@ submarine warfare helicopters . Almost as soon as the first ship , HMS Invincible , was ordered , an additional specification was added to the design ; as well as the helicopters , a small squadron of STOVL aircraft would form part of the air group to act as a deterrent to long range reconnaissance aircraft . To this end , a navalised version of the Hawker Siddeley Harrier was developed ? over the design process , the Sea Harrier was given , in addition to its air defence role , responsibility for reconnaissance and maritime strike missions . In March 1980 , 14 months after 892 Naval Air Squadron was decommissioned and its Phantoms turned over to the RAF , 800 Naval Air Squadron was formed as the first operational Sea Harrier squadron .

= = = Aircraft replaced by and replacing the Phantom = = =

Sir Sydney Camm , the Chief Designer at Hawker for many years , once said that no British aircraft could be considered a success until it was able to match the capabilities of the Phantom . The Phantom 's versatility was such that , in the RAF and Royal Navy , it was the direct replacement in

squadron service for a total of four different aircraft types , with nine separate variants amongst them . In turn , when the Phantom was replaced in service , its major roles required three separate aircraft (see table) :

= = Aircraft on display = =

Phantom aircraft on display that have entered service with the Royal Air Force or Royal Navy . The remaining aircraft were either lost in crashes or scrapped following withdrawal .

= = = YF @-@ 4K (prototype) = = =

XT596 Fleet Air Arm Museum , RNAS Yeovilton , Somerset , England .

= = = F @-@ 4K = = =

XT597 Bentwaters Airfield , Woodbridge , Suffolk , England ? not on public display .
XT864 Maze @-@ Long Kesh , Lisburn , Ulster Aviation Society , Northern Ireland .
XV582 RAF Leuchars , Fife , Scotland .
XV586 RNAS Yeovilton , Somerset , England ? stored not on display .

= = = F @-@ 4M = = =

XT891 RAF Coningsby , Lincolnshire , England .
XT889 Kbely Museum , Czech Republic .
XT905 Bentwaters Airfield , Woodbridge , Suffolk , England ? not on public display .
XT907 Bentwaters Airfield , Woodbridge , Suffolk , England
XT914 Wattisham Airfield , Suffolk , England .
XV401 Bentwaters Airfield , Woodbridge , Suffolk , England .
XV406 Soloway Aviation Museum , Carlisle Airport , Cumbria , England .
XV408 Tangmere Military Aviation Museum , West Sussex , England .
XV411 Defence Fire Training and Development Centre , Manston Airport , Kent , England ? not on public display .
XV415 RAF Boulmer , Alnwick , Northumberland , England .
XV424 Royal Air Force Museum London , England .
XV470 RAF Akrotiri , Cyprus ? stored and not on public display .
XV474 Duxford Aerodrome , Cambridgeshire , England .
XV497 Bentwaters Airfield , Woodbridge , Suffolk , England .

= = = F @-@ 4J (UK) = = =

ZE359 American Air Museum , Duxford Aerodrome , Cambridgeshire , England . Painted in United States Navy markings .
ZE360 Defence Fire Training and Development Centre , Manston Airport , Kent , England ? not on public display .

= = Specifications (F @-@ 4M) = =

Data from Thunder & Lightnings ? Phantom History
General characteristics
Crew : 2
Length : 57 ft 7 in (17 @.@ 55 m)
Wingspan : 38 ft 4 @.@ 5 in (11 @.@ 7 m)
Height : 16 ft 1 in (4 @.@ 9 m)

Empty weight : 31 @,@ 000 lb (14 @,@ 061 kg)
Max. takeoff weight : 56 @,@ 000 lb (25 @,@ 402 kg)
Powerplant : 2 × Rolls @-@ Royce Spey 202 / 204 low bypass turbofans , 12 @,@ 140 lbf dry thrust (54 kN) , 20 @,@ 500 lbf in afterburner (91 @.@ 2 kN) each
Performance
Maximum speed : Mach 1 @.@ 9 (1 @,@ 386 mph) at 40 @,@ 000 ft (12 @,@ 190 m)
Ferry range : 1 @,@ 750 mi (2 @,@ 816 km)
Service ceiling : 60 @,@ 000 ft (18 @,@ 300 m)
Armament
Air defence
4 × AIM @-@ 7 Sparrow or Skyflash in fuselage recesses plus 4 × AIM @-@ 9 Sidewinders on wing pylons ;
1 × 20 mm (0 @.@ 787 in) M61 Vulcan 6 @-@ barrel Gatling cannon in SUU @-@ 23 gun pod
Strike
Up to 180 SNEB 68mm unguided rockets ;
11 × 1000lb free fall or retarded bombs
B28 / B43 / B57 tactical nuclear weapons
Avionics
Ferranti AN / AWG @-@ 12 Multi @-@ Mode Radar
Marconi ARI18228 Radar Warning Receiver
Marconi AN / ASN @-@ 39A computer
AN / ARN @-@ 91 TACAN bearing / distance navigation system
Cossor IFF
STR @-@ 70P Radio Altimeter
EMI Reconnaissance Pod containing :
2 × F.135 forward facing camera
4 × F.95 oblique facing camera
Texas Instruments RS700 Infra @-@ Red Linescan
MEL / EMI Q @-@ Band Sideways Looking Reconnaissance Radar