

= British Aerospace Sea Harrier =

The British Aerospace Sea Harrier is a naval short take @-@ off and vertical landing / vertical take @-@ off and landing jet fighter , reconnaissance and attack aircraft ; the second member of the Harrier Jump Jet family developed . It first entered service with the Royal Navy in April 1980 as the Sea Harrier FRS1 and became informally known as the " Shar " . Unusual in an era in which most naval and land @-@ based air superiority fighters were large and supersonic , the principal role of the subsonic Sea Harrier was to provide air defence of Royal Navy aircraft carriers .

The Sea Harrier served in the Falklands War , both of the Gulf Wars , and the Balkans conflicts ; on all occasions it mainly operated from aircraft carriers positioned within the conflict zone . Its usage in the Falklands War was its most high profile and important success , where it was the only fixed @-@ wing fighter available to protect the British Task Force . The Sea Harriers shot down 20 enemy aircraft during the conflict with one lost to enemy ground fire . They were also used to launch ground attacks in the same manner as the Harriers operated by the Royal Air Force .

The Sea Harrier was marketed for sales abroad , but by 1983 India was the only operator other than Britain after sales to Argentina and Australia were unsuccessful . A second , updated version for the Royal Navy was made in 1993 as the Sea Harrier FA2 , improving its air @-@ to @-@ air abilities and weapons compatibilities , along with a more powerful engine ; this version continued manufacture until 1998 . The aircraft was withdrawn from service early by the Royal Navy in 2006 . The Sea Harrier remained in service for another decade with the Indian Navy until its retirement in 2016 thus ending the career of the historic British jet .

= = Development = =

In the post @-@ war era , the Royal Navy began contracting in parallel with the break @-@ up of the British Empire overseas and the emergence of the Commonwealth of Nations , reducing the need for a larger navy . By 1960 , the last battleship , HMS Vanguard , was retired from the Navy , having been in service for less than fifteen years . Perhaps the biggest sign of the new trend towards naval austerity came in 1966 , when the planned CVA @-@ 01 class of large aircraft carriers destined for the Royal Navy was cancelled . During this time , requirements within the Royal Navy began to form for a vertical and / or short take @-@ off and landing (V / STOL) carrier @-@ based interceptor to replace the de Havilland Sea Vixen . Afterward , the first V / STOL tests on a ship began with a Hawker Siddeley P.1127 landing on HMS Ark Royal in 1963 .

A second concept for the future of naval aviation emerged in the early 1970s as the first of a new class of " through deck cruisers " was planned . These were very carefully and politically designated as cruisers to deliberately avoid the term " aircraft carrier " , in order to increase the chances of funding from a hostile political climate against expensive capital ships , they were considerably smaller than the previously sought CVA @-@ 01 . These ships were ordered as the Invincible class in 1973 , and are now popularly recognised as aircraft carriers . Almost immediately upon their construction , a ski @-@ jump was added to the end of the 170 @-@ metre deck , enabling the carriers to effectively operate a small number of V / STOL jets . The Royal Air Force 's Hawker Siddeley Harrier GR1s had entered service in April 1969 . A navalised variant of the Harrier was developed by Hawker Siddeley to serve on the upcoming ships , this became the Sea Harrier . In 1975 , the Royal Navy ordered 24 Sea Harrier FRS.1 (standing for ' Fighter , Reconnaissance , Strike ') aircraft , the first of which entered service in 1978 . During this time Hawker Siddeley became part of British Aerospace through nationalisation in 1977 . By the time the prototype Sea Harrier was flown at Dunsfold on 20 August 1978 the order had been increased to 34 . The Sea Harrier was declared operational in 1981 on board the first Invincible class ship HMS Invincible , and further aircraft joined the ageing HMS Hermes aircraft carrier later that year .

Following their key role in the 1982 Falklands War , several lessons were learned from the aircraft 's performance , which led to approval for an upgrade of the fleet to FRS.2 (later known as FA2) standard to be given in 1984 . The first flight of the prototype took place in September 1988 and a contract was signed for 29 upgraded aircraft in December that year . In 1990 , the Navy ordered 18

new @-@ build FA2s , at a unit cost of around £ 12 million , four further upgraded aircraft were ordered in 1994 . The first aircraft was delivered on 2 April 1993 .

= = Design = =

The Sea Harrier is a subsonic aircraft designed to fill strike , reconnaissance and fighter roles . It features a single Rolls @-@ Royce Pegasus turbofan engine with two intakes and four vectorable nozzles . It has two landing gear on the fuselage and two outrigger landing gear on the wings . The Sea Harrier is equipped with four wing and three fuselage pylons for carrying weapons and external fuel tanks . Use of the ski jump allowed the aircraft to take off from a short flight deck with a heavier loadout than otherwise possible , although it can also take off like a conventional loaded fighter without thrust vectoring from a normal airport runway .

The Sea Harrier was largely based on the Harrier GR3 , but was modified to have a raised cockpit with a " bubble " canopy for greater visibility , and an extended forward fuselage to accommodate the Ferranti Blue Fox radar . Parts were changed to use corrosion resistant alloys or coatings were added to protect against the marine environment . After the Falklands War , the Sea Harrier was fitted with the new anti @-@ ship Sea Eagle missile .

The Sea Harrier FA2 featured the Blue Vixen radar , which was described as one of the most advanced pulse doppler radar systems in the world ; the Blue Fox radar was seen by some critics as having comparatively low performance for what was available at the time of procurement . The Blue Vixen formed the basis for development of the Eurofighter Typhoon 's CAPTOR radar . The Sea Harrier FA2 also carried the AIM @-@ 120 AMRAAM missile , the first UK aircraft to be provided with this capability . An upgraded model of the Pegasus engine , the Pegasus Mk 106 , was used in the Sea Harrier FA2 ; in response to the threat of radar @-@ based anti aircraft weapons electronic countermeasures were added . Other improvements included an increase to the air @-@ to @-@ air weapons load , look @-@ down radar , increased range , and improved cockpit displays .

The cockpit in the Sea Harrier includes a conventional centre stick arrangement and left @-@ hand throttle . In addition to normal flight controls , the Harrier has a lever for controlling the direction of the four vectorable nozzles . The nozzles point rearward with the lever in the forward position for horizontal flight . With the lever back , the nozzles point downward for vertical takeoff or landing . The usefulness of the vertical landing capability of the Sea Harrier was demonstrated in an incident on 6 June 1983 , when Sub Lieutenant Ian Watson lost contact with the aircraft carrier HMS Illustrious and had to land Sea Harrier ZA176 on the foredeck of the Spanish cargo ship Alraigo .

In 2005 , although already timetabled to be retired , a Sea Harrier was modified with an ' Autoland ' system to allow the fighter to perform a safe vertical landing without any pilot interaction . Despite the pitching of a ship posing a natural problem , the system was designed to be aware of such data , and successfully performed a landing at sea in May 2005 .

= = Operational history = =

= = = Royal Navy = = =

= = = = Entry into service = = = =

The first three Sea Harriers were a development batch and were used for clearance trials . The first production aircraft was delivered to RNAS Yeovilton in 1979 to form an Intensive Flying Trials Unit (also known as 700A Naval Air Squadron) . In March 1980 the Intensive Flying Trials Unit became 899 Naval Air Squadron and would act as the landborne headquarters unit for the type . The first operational squadron 800 Naval Air Squadron was also formed in March 1980 initially to operate from HMS Invincible before it transferred to HMS Hermes . In January 1981 , a second operation squadron 801 Naval Air Squadron was formed to operate from HMS Invincible .

===== Falklands War =====

Sea Harriers took part in the Falklands War of 1982 , flying from the aircraft carriers HMS Invincible and HMS Hermes . The Sea Harriers performed the primary air defence role with a secondary role of ground attack ; the RAF Harrier GR3 provided the main ground attack force . A total of 28 Sea Harriers and 14 Harrier GR3s were deployed in the theatre . The Sea Harrier squadrons shot down 20 Argentine aircraft in air @-@ to @-@ air combat with no air @-@ to @-@ air losses , although two Sea Harriers were lost to ground fire and four to accidents . Out of the total Argentine air losses , 28 % were shot down by Harriers .

A number of factors contributed to the failure of the Argentinian fighters to shoot down a Sea Harrier . Although the Mirage III and Dagger jets were faster , the Sea Harrier was considerably more manoeuvrable . Moreover , the Harrier employed the latest AIM @-@ 9L Sidewinder missiles and the Blue Fox radar . Contrary to contemporary reports that " viffing " proved decisive in dogfights , the maneuver was not used by RN pilots in the Falklands as it was only used in emergencies against enemies unfamiliar with the aircraft . The British pilots had superior air @-@ combat training , one manifestation of which was that they thought they noticed Argentinian pilots occasionally releasing weapons outside of their operating parameters . This is now thought to have been Mirages releasing external fuel tanks rather than weapons , and turning away from conflict with the Sea Harrier . This later reduced their capability to fight an effective campaign against the Sea Harrier due to reduced range and lack of external fuel tanks .

British aircraft received fighter control from warships in San Carlos Water , although its effectiveness was limited by their being stationed close to the islands , which severely limited the effectiveness of their radar . The differences in tactics and training between 800 Squadron and 801 Squadron has been a point of criticism , suggesting that the losses of several ships were preventable had Sea Harriers from Hermes been used more effectively .

Both sides ' aircraft were operating in adverse conditions . Argentine aircraft were forced to operate from the mainland because airfields on the Falklands were only suited for propellor @-@ driven transports . In addition , fears partly aroused by the bombing of Port Stanley airport by a British Vulcan bomber added to the Argentinians ' decision to operate them from afar . As most Argentine aircraft lacked in @-@ flight refuelling capability , they were forced to operate at the limit of their range . The Sea Harriers also had limited fuel reserves due to the tactical decision to station the British carriers out of Exocet missile range and the dispersal of the fleet . The result was that an Argentine aircraft could only allow five minutes over the islands to search and attack an objective , while a Sea Harrier could stay near to 30 minutes waiting in the Argentine approach corridors and provide Combat Air Patrol coverage for up to an hour .

The Sea Harriers were outnumbered by the available Argentinian aircraft , and were on occasion decoyed away by the activities of the Escuadrón Fénix or civilian jet aircraft used by the Argentine Air Force . They had to operate without a fleet early warning system such as AWACS that would have been available to a full NATO fleet in which the Royal Navy had expected to operate , which was a significant weakness in the operational environment . However , it is now known that Chile did provide early radar warning to the Task Force . The result was that the Sea Harriers could not establish complete air superiority and prevent Argentine attacks during day or night , nor could they completely stop the daily C @-@ 130 Hercules transports ' night flights to the islands . A total of six Sea Harriers were lost during the war to either enemy fire , accidents or mechanical failure . The total aggregate loss rate for both the Harriers and Sea Harriers on strike operations was 2 @. 3 % .

===== Operations in the 1990s =====

The Sea Harrier saw action in war again when it was deployed in the 1992 ? 1995 conflict in Bosnia , part of the Yugoslav Wars . It launched raids on Serb forces and provided air @-@ support for the international taskforce units conducting Operations Deny Flight and Deliberate Force against the

Army of Republika Srpska . On 16 April 1994 , a Sea Harrier of the 801 Naval Air Squadron , operating from the aircraft carrier HMS Ark Royal , was brought down by a Igla @-@ 1 surface @-@ to @-@ air missile fired by the Army of Republika Srpska while attempting to bomb two Bosnian Serb tanks . The pilot , Lieutenant Nick Richardson , ejected and landed in territory controlled by friendly Bosnian Muslims .

It was used again in the 1999 NATO campaign against the Federal Republic of Yugoslavia in Operation Allied Force , Sea Harriers which operated from HMS Invincible frequently patrolled the airspace to keep Yugoslavian MiGs on the ground . They were also deployed to Sierra Leone on board HMS Illustrious in 2000 , which was itself part of a Royal Navy convoy to supply and reinforce British intervention forces in the region .

= = = Retirement = = =

The Sea Harrier was withdrawn from service in 2006 and the last remaining aircraft from 801 Naval Air Squadron were decommissioned on 29 March 2006 . The plans for retirement were announced in 2002 by the Ministry of Defence . The aircraft 's replacement , the F @-@ 35 Lightning II , was originally due in 2012 , the MoD arguing that significant expenditure would be required to upgrade the fleet for only six years of service . By March 2010 , the F @-@ 35 's introduction had been pushed back to 2016 at the earliest , with the price doubled . The decision to retire the Sea Harrier early has been criticised by some officers within the military .

Both versions of Harrier experienced reduced engine performance (Pegasus Mk 106 in FA2 ? Mk 105 in GR7) in the higher ambient temperatures of the Middle East , which restricted the weight of payload that the Harrier could return to the carrier in ' vertical ' recoveries . This was due to the safety factors associated with aircraft " land @-@ on " weights . The option to install higher @-@ rated Pegasus engines would not have been as straightforward as on the Harrier GR7 upgrade and would have likely been an expensive and slow process . Furthermore , the Sea Harriers were subject to a generally more hostile environment than land @-@ based Harriers , with corrosive salt spray a particular problem . A number of aircraft were retained by the School of Flight Deck Operations at RNAS Culdrose .

The Royal Navy 's Fleet Air Arm would continue to share the other component of Joint Force Harrier . Harrier GR7 and the upgraded Harrier GR9 were transferred to Royal Navy squadrons in 2006 , but were retired prematurely a few years later due to budget cuts . The UK plans to purchase the STOVL F @-@ 35B to be operated from the Royal Navy 's Future Queen Elizabeth @-@ class aircraft carrier . Although withdrawn from active Royal Navy service , Sea Harriers are used to train naval aircraft handlers at the Royal Navy School of Flight Deck Operations .

= = = Indian Navy = = =

In 1977 , the Indian government approved of plans to acquire the Sea Harrier for the Indian Navy ; prior to this , rumours reportedly were circulating of a potential Indian purchase of the Soviet V / STOL @-@ capable Yak @-@ 36 . The BAE Sea Hawk was phased out from the Indian Navy in 1978 , in preparation for the purchase of Sea Harriers . In November 1979 , India placed its first order for six Sea Harrier FRS Mk 51 fighters and two T Mk 60 Trainers ; the first three Sea Harriers arrived at Dabolim Airport on 16 December 1983 , and were inducted the same year . Ten more Sea Harriers were purchased in November 1985 ; eventually a total of 30 Harriers were procured , 25 for operational use and the remainder as dual @-@ seat trainer aircraft . Until the 1990s , significant portions of pilot training was carried out in Britain due to limited aircraft availability .

The introduction of the Sea Harrier allowed for the retirement of India 's previous carrier fighter aircraft , the Hawker Sea Hawk , as well as for the Navy 's aircraft carrier , INS Vikrant (ex @-@ HMS Hercules) , to be extensively modernised between 1987 and 1989 . India has operated Sea Harriers from both the aircraft carriers INS Vikrant and INS Viraat (ex @-@ HMS Hermes) . The Sea Harrier allowed several modern missiles to be introduced into naval operations , such as the British anti @-@ ship Sea Eagle missile , and the French Matra Magic missile for air @-@ to @-@

air combat . Other ordnance has included 68 mm rockets , runway @-@ denial bombs , cluster bombs , and podded 30 mm cannons .

There have been a significant number of accidents involving the Sea Harrier ; this accident rate has caused approximately half the fleet to be lost with only 11 fighters remaining in service . Following a crash in August 2009 , all Sea Harriers were temporarily grounded for inspection . Since the beginning of operational service in the Indian Navy , seven pilots have died in 17 crashes involving the Sea Harrier , usually during routine sorties .

In 2006 , the Indian Navy expressed interest in acquiring up to eight of the Royal Navy 's recently retired Sea Harrier FA2s in order to maintain their operational Sea Harrier fleet , Neither the Sea Harrier FA2 's Blue Vixen radar , the radar warning receiver or AMRAAM capability was proposed to be included ; certain US software would be also be uninstalled prior to shipment . By October 2006 , reports emerged that the deal had not materialised due to the cost of airframe refurbishment .

In 2006 , the Indian Navy was in the process of upgrading up to 15 Sea Harriers in collaboration with Israel by installing the Elta EL / M @-@ 2032 radar and the Rafael ' Derby ' medium @-@ range air @-@ to @-@ air BVR missile . This will enable the Sea Harrier to remain in Indian service until beyond 2012 , and also see limited service off the new carriers it will acquire by that time frame . By 2009 , crashes had reduced India 's fleet to 12 (from original 30) . India plans to introduce larger aircraft carriers that can operate Russian MiG @-@ 29K carrier fighters from their flight decks to replace the Sea Harrier .

The Sea Harriers operated from INS Viraat for the last time on 6 March 2016 . On 11 May 2016 , a ceremony was held at INS Hansa , Dabolim , Goa to commemorate the phasing out of Sea Harriers from INAS 300 (" White Tigers ") . Sea Harriers and MiG 29Ks performed an air display at the ceremony , marking the final flight of the Sea Harriers in the Indian Navy . INAS 300 subsequently inducted MiG 29K / Kub fighters to replace the retired Sea Harrier fleet .

= = Variants = =

Sea Harrier FRS.1

57 FRS1s were delivered between 1978 and 1988 ; most survivors converted to Sea Harrier FA2 specifications from 1988 .

Sea Harrier FRS.51

Single @-@ seat fighter , reconnaissance and attack aircraft made for the Indian Navy , similar to the British FRS1 . Unlike the FRS1 Sea Harrier , it is fitted with Matra R550 Magic air @-@ to @-@ air missiles . These aircraft were later upgraded with the Elta EL / M @-@ 2032 radar and the Rafael Derby BVRAAM missiles .

Sea Harrier F (A) .2

Upgrade of FRS1 fleet in 1988 , featuring the Blue Vixen Pulse @-@ Doppler radar and the AIM @-@ 120 AMRAAM missile .

= = Operators = =

India

Indian Navy

Indian Naval Air Arm (1983 @-@ 2016)

United Kingdom

Royal Navy

Fleet Air Arm (1978 ? 2006)

= = Survivors = =

A number of surviving Sea Harrier airframes are held by museums and private owners , and some others are at the Royal Navy School of Flight Deck Operations at RNAS Culdrose . The following is an incomplete list of some of the surviving aircraft .

India

One BAe Sea Harrier FRS 51 (IN @-@ 621) preserved at the Naval Aviation Museum (India) in Goa , India .

United Kingdom

Nine Sea Harrier FA2s - XZ440 , ZD579 , ZE690 , ZE692 , ZH797 , ZH798 , ZH802 , ZH803 , ZH813 - are still used by the School of Flight Deck Operations at RNAS Culdrose , as of November 2012

Four Sea Harriers ZD611 , ZH804 and ZH811 are stored at RNAS Culdrose , as of 2012 .

Sea Harrier FA2 ZE694 is exhibited at the Midland Air Museum , Coventry .

Two Sea Harriers , an FRS1 XZ493 / 001 / N and an FA2 (XZ499) are also on public display at the Fleet Air Arm Museum at Yeovilton .

Sea Harrier FA2 ZH796 moved to Cosford DSAE in April 2014

Sea Harrier FRS1 / FA2 ZA176 is preserved at the Newark Air Museum

Sea Harrier FRS1 / FA2 XZ457 is restored and on public display at Boscombe Down Aviation Collection

Sea Harrier FA2 ZA195 is displayed at the Tangmere Military Aviation Museum

Sea Harrier FA2 XZ459 is preserved by a private owner near Shoreham Airport .

Sea Harrier T.8 ZD992 was written off in an accident at Yeovilton on 16 November 2000 but was later restored to non @-@ airworthy condition by Everett Aero in Suffolk and is now believed to be privately owned in the Manchester area .

United States

Sea Harrier FA2 serial number XZ439 , Hawker @-@ Siddeley build number 912002 Nalls Aviation St Mary 's County , Maryland . The former Royal Navy Sea Harrier FA2 was purchased in 2006 by Art Nalls , who spent the next two years restoring it to flying condition . In December 2007 , it was damaged in a hard landing , while undergoing testing at Naval Air Station Patuxent River and had to be repaired . The aircraft made its first public appearance at an air show in Culpeper , Virginia in October 2008 . The aircraft is the only privately owned , civilian @-@ flown Harrier in the world . Nalls recently purchased Sea Harrier T.8 ZD993 .

= = Specifications (Sea Harrier FA2) = =

Data from Wilson , Bull , Donald Spick

General characteristics

Crew : 1

Length : 46 ft 6 in (14 @.@ 2 m)

Wingspan : 25 ft 3 in (7 @.@ 6 m)

Height : 12 ft 2 in (3 @.@ 71 m)

Wing area : 201 @.@ 1 ft ² (18 @.@ 68 m ²)

Empty weight : 14 @,@ 052 lb (6 @,@ 374 kg)

Max. takeoff weight : 26 @,@ 200 lb (11 @,@ 900 kg)

Powerplant : 1 × Rolls @-@ Royce Pegasus turbofan , 21 @,@ 500 lbf (95 @.@ 64 kN)

Performance

Maximum speed : 635 knots (735 mph , 1 @,@ 182 km / h)

Combat radius : 540 nmi (620 mi , 1 @,@ 000 km)

Ferry range : 1 @,@ 740 nmi (2 @,@ 000 mi , 3 @,@ 600 km)

Service ceiling : 51 @,@ 000 ft (16 @,@ 000 m)

Rate of climb : 50 @,@ 000 ft / min (250 m / s)

Armament

Guns : 2 × 30 mm (1 @.@ 18 in) ADEN cannon pods under the fuselage , with 130 rounds each

Hardpoints : 4 × under @-@ wing pylon stations , and 1 fuselage pylon on centerline plus 2 attach points for gun pods with a total capability of 8 @,@ 000 lb (3 @,@ 630 kg) of payload .

Rockets : 4 × Matra rocket pods with 18 SNEB 68 mm rockets each

Missiles : Air @-@ to @-@ air missiles :

AIM @-@ 9 Sidewinder
AIM @-@ 120 AMRAAM
R550 Magic (Sea Harrier FRS51)
Air @-@ to @-@ surface missile :
ALARM anti @-@ radiation missile (ARM)
Martel missile ARM
Anti @-@ ship missiles :
Sea Eagle
Bombs : A variety of unguided iron bombs (including 3 kg and 14 kg practice bombs) .
Others :
reconnaissance pods or
2 x auxiliary drop tanks for ferry flight or extended range / loitering time
Avionics
Ferranti Blue Vixen all @-@ weather airborne radar
BAE Systems AD2770 Tactical Air Navigation System
Thales MADGE Microwave Airborne Digital Guidance Equipment
Allied Signal AN / APX @-@ 100 mk12 IFF

= = Notable appearances in media = =

The Harrier 's unique characteristics have led to it being featured a number of films and video games .