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AIRCRAFT IN DETAIL

BAe Sea Harrier FRS.1 and F/A.2



**Andy Evans describes the
development, history and
operational record of Britain's
V/STOL shipboard strike fighter**



Opposite: Dramatic photograph of a Sea Harrier FA.2 at the hover, armed with a single 1000lb bomb on the centreline. Note the overall Medium Sea Grey scheme.(BAE)

Above: A Sea Harrier FRS.1, possibly XZ454, coded '50' seen loaded with Sea Eagle missiles on the inboard pylons and AIM-9G Sidewinder AAMs on the outboard pylons. Note the initial Extra Dark Sea Grey/White scheme (BAE)

On 27 November 1978, the Fleet Air Arm launched its last fixed wing aircraft, a Phantom FG.1 from *HMS Ark Royal's* catapult. This followed the then UK Government's decision to cancel the Royal Navy's fixed wing abilities, having already abandoned the P1154RN and a new 'super' aircraft carrier destined to replace the *Ark Royal*. The decision makers settled instead for building helicopter based 'Commando Carriers', or 'Through Deck Cruisers', (commonly referred to as 'see through cruisers' as they were so obviously designed with the Harrier in mind!).

The first of these ships was ordered from Vickers in April 1973, to be named *HMS Invincible*, with a second, *HMS Illustrious*, being laid down by Swan Hunter in June 1976, and both were fitted with Harrier 'ski-ramps'.

The Harrier had been flying off ships since the early 1960s, in fact Bill Bedford had landed the Hawker P1127, XP831, onto *Ark Royal's* deck on 8 February 1963. The Hawker Kestrel had also undertaken deck trials from *HMS Bulwark* in 1966, ably demonstrating that V/STOL could be used as a 'stand-alone' force or integrated with other assets. Land based Harriers were operated from the Navy's carriers in the ensuing years, GR.1s completing trials aboard *HMS Eagle* as well as *Ark Royal*, and the 'Crabs' of No 1(F) Sqn received their Service Clearance

Right: XZ450, the first Sea Harrier takes off from Dunsfold in 1980. (Dennis Calvert)

to operate from decks in 1970 - a clear pointer towards the future.

During 1971, a Naval Air Staff requirement was developed for a sea going aircraft based on the RAF's Harrier GR.3, and Hawker Siddeley were given a contract to study and develop a suitable design, but there were two major hurdles for the HSA team to overcome in order to meet the Navy's requirements.

Firstly, as the aircraft's primary role was to be that of air defence, it had to be fitted with a radar, and secondly it was necessary to replace components in the GR.3's make-up that would be prone to salt water corrosion. Following a successful study, an order for twenty-four Sea Harrier FRS.1s was announced in May 1975, and the need for four, two-seat trainers, was also established. A subsequent order followed in 1982 for seven attrition replacements, and a further order was forthcoming in 1984 for another nine.

The 'FRS' designation represented

'Fighter', 'Reconnaissance' and 'Strike', the latter referring to the aircraft's ability to carry nuclear weapons should the need ever arise.

To save costs, the Sea Harrier was to be, what was frequently referred to as a 'minimum change' derivative of the RAF's Harrier GR.3, however the FRS.1 introduced a number of new and key features.

Firstly the cockpit floor was raised by some 10 inches to provide more equipment space and allow, for the first time in a Harrier, some semblance of a decent downward view over the massive intakes. This revision was further enhanced with the fitting of a 'bubble' canopy, which gave a better 'all round' view as well.

The radar was a miniature masterpiece called 'Blue Fox', developed by Ferranti, and a version of their already in service ARI.5979 'Sea Spray' set, fitted to the Navy's Lynx helicopter fleet. This I-band pulse modulated set was



designed for air-to-air interception and air-to-surface search and strike with ground mapping abilities, and this was housed in a pointed nose radome that folded sideways for space-saving aboard the carriers.

To avoid the problems of setting up the inertial platform on a moving deck, the FE.541 INS was replaced by a Twin Gyro Platform and a Decca 72 Doppler, giving a very small navigational error after a typical 50-minute sortie. In the cockpit a new HUD was fitted, driven by a digital computer, and as well as displaying its symbology it also served as a Weapons Aiming Computer (WAC) for air-to-air and air-to-surface deliveries. Tie down lugs were fitted to the mainwheels and outriggers, and an enhanced water injection system to aid carrier recoveries was added.

A Martin Baker Mk.10 ejection seat was fitted, and a revised RWR was also added, as was a radio altimeter, and a starboard facing F.95 oblique camera in the nose - however the moving map display of the GR.3 was deleted. Because of its primary 'Fighter' role, the Sea Harrier was fitted out to carry Sidewinder AAMs on LAU-7A/5 launch shoes on the outer pylons and retained the Aden cannons on their under fuselage stations. The engine for this latest version was a Pegasus Mk.104, a specially developed and 'Navalised' version of the Mk.103 for the Sea Harrier, eliminating the major magnesium components, and having a similarly rated thrust as the Mk.103 at 21,500lbs.

The first production Sea Harrier FRS.1, XZ450 took its maiden flight from Dunsfold on 20 August 1978. The first Sea Harrier handed over to the Royal Navy was XZ451, which was delivered to RNAS Yeovilton on 18 June 1979. The first unit to form on the new aircraft was No.700A Intensive Flying Trials Unit (IFTU) during May 1979, later disbanding to become No 899 Sqn, the Headquarters and Training Unit for all Naval Sea Harriers and their pilots.

The 899 Squadron 'Mailed Fist' emblem, which had last adorned Sea Vixens was reinstated on the Sea Harrier's fins, and their camouflage scheme of Extra Dark Sea Grey upper surfaces with White undersides was firmly re-established in the Navy's tradition.

Plans were laid to equip three front line squadrons - Nos 800, 801 and 802, each having a peacetime complement of five Sea Harriers - and a Harrier OCU, but the reality of the situation saw only Nos 800 and 801 being commissioned. In April 1980 the first front line unit was commissioned, No 800 Squadron, with its extremely flamboyant tail markings of a red arrowhead, edged in white on to which a gold trident with crossed swords was placed.

Falklands Firefight

After Argentina's invasion of the Falklands in March 1982, a Task Force was assembled under the aegis of 364



Above: The eight Sea Harrier FRS.1s of 809 NAS., (and six of No 1 Sqn's Harrier GR.3s), aboard *Atlantic Conveyor* en-route to the action zone. (BAE)

Below: A mix of Sea Harrier FRS.1s and Harrier GR.3s ranged on *HMS Hermes'* deck, with two CAP armed Sea Harriers waiting to take off in the background. Note the Sea Harrier in the foreground with the damage repair plate on the starboard tailplane. (BAE)



'Operation Corporate' to re-capture the Islands. Included in the flotilla of warships were the two aircraft carriers *HMS Hermes*, the flagship, and *HMS Invincible*, both of which embarked Sea Harrier Air Groups. When the Task Force sailed on 14 April it took with it twenty Sea Harrier FRS.1s drawn from the two operational units Nos 800 and 801 Squadrons, and aircraft from the shore based training establishment No 899 Sqn. Additionally, a further Sea Harrier unit, No 809 Sqn., was hastily formed bringing together *all* the airframes that remained in the UK, except for four that were to remain at RNAS Yeovilton for training purposes.

The newly re-formed 809 Squadron took its eight aircraft to the South Atlantic aboard the container ship *Atlantic Conveyor*, and on arrival in the area, four aircraft joined *HMS Hermes'* Air Group and four joined *HMS Illustrious'* Air Group.

As they left the UK, aircraft initially deployed on the two carriers from Nos 800, 801 and 899 Squadrons, all wore the standard 'peacetime' scheme of Extra Dark Sea Grey upper surfaces, and White lower surfaces, with full colour unit markings and national insignia. En-route, the on-board paint shops worked overtime to produce an all over 'war paint' camouflage scheme of glossy Extra

Above right: Sea Harrier FRS.1s aboard *HMS Hermes*, illustrating the two different colour schemes worn by the type await another round of sorties. Note the Harrier GR.3 in the foreground. (BAE)

Right: A pair of Sea Harriers and a Harrier GR.3 being readied for launch aboard *HMS Hermes*. (BAE)

Below: XZ499/99, one of 809 Sqn's four Sea Harrier FRS.1s temporarily based aboard *HMS Invincible*. It is in the Medium Sea Grey/Barley Grey scheme and armed for a CAP mission. (BAE)



Dark Sea Grey, with toned down red and blue roundels and either black or roundel blue code numbers. All of the unit markings were obliterated, as were the 'ROYAL NAVY' legends, and the only visible markings were those for the emergency escape systems.

No 809's eight aircraft were all resprayed at Dunsfold in a much lighter scheme of Medium Sea Grey upper surfaces and Barley Grey under the wings and tailplanes. They also had a pale red and pale blue 'phoenix' badge on their tails, pale blue 'ROYAL NAVY' titles on the fin, (which were overpainted on reaching the war zone), and pale red and pale blue roundels on the nose.

War fit

The Sea Harriers received several modifications for their war role; the attack system was altered to allow for loft bombing from an IP offset, and to permit blind delivery against ground based targets, and the aircraft were also cleared for higher take-off weights using the larger 330 imperial gallon ferry tanks.

Some aircraft also received a Tracor AN/ALE-40 chaff/flare dispenser fit behind the airbrake. Those not so fortunate made use of ramming as much 'chaff' into the airbrake well as possible, allowing a 'one-shot' dump, and smaller amounts of chaff were liberally 'stuffed' between the weapons and pylons on the wings and centreline.

Once in the Falklands area, the Task Force set up a TEZ, (Total Exclusion Zone), around the islands and prepared to use whatever means necessary to enforce it. The 'air war' began on 1 May, with a night-time 'Black Buck' bombing raid by an RAF Vulcan. This was followed by a dawn strike against Port Stanley airfield by nine *Hermes*-based No 800 Squadron aircraft, eight of which were armed with three BL755 CBUs and one with three 1000lb bombs, and a three 'ship' attack on Goose Green, ably supported by nine 'air defence' configured Harriers from *Invincible*-based 801 Squadron.

ZA192 flown by F/Lt. Dave Morgan took a 20mm shell hit in the fin, which was quickly repaired once back on the *Hermes*. No aircraft had been lost in the attack, much to the relief of the Commanders, who had anticipated losing at least three!

The Sea Harriers took up CAP stations, flying at 15,000ft where the performance of the Mirage IIIs would be degraded if engaged in air combat. The first air-to-air 'kill' of the war fell to Lt Paul Barton of 801 Sqn., flying XZ452. Barton

'splashed' a Mirage IIIEA from *Grupo 8*, which, "exploded in a brilliant blue fireball" and a few minutes later his wingman Lt Steve Thomas in XZ453 damaged another Mirage, which later attempted an emergency landing at Port Stanley, only to be shot down by AAA gunners - a tragic 'own goal'.

The third 'kill' of the day was that of a Dagger from *Grupo 6*, 'shredded' by an AIM-9L, followed shortly afterwards by No 801 despatching one of three Canberra bombers from *Grupo 2*. For their Air Defence role the Sea Harriers were armed with two AIM-9 'Lima' Sidewinders, two wing tanks and the twin 30mm Aden cannon pods.

May the saw the first Sea Harrier loss of the conflict when Lt Nick Taylor, flying XZ450 was making a low-level attack on Goose Green. The small Sea Harrier Force was also dealt a double blow when 801 Squadron's XZ452 and XZ453 collided in thick fog; both pilots were killed.

21 May saw the most successful day for the SHARs, bringing the total to an impressive 10 - 0. However, the Task

Force lost a further two Sea Harriers in non-combat accidents - L/Cdr Gordon Batt of 800 Squadron was killed when ZA192 exploded and hit the water following a night launch, and on the 29th L/Cdr Mike Broadwater's ZA174 slid off *Invincible*'s deck; thankfully Broadwater was able to eject safely. Later Lt Ian Mortimer in XZ456 was hit by a Roland SAM. Again Mortimer was able to eject safely and was picked up by an 820 Sqn Sea King.

By 5 June 'HMS Sheathbill' - an 850ft aluminium planked refuelling strip - had been laid near San Carlos, making life a little easier for the combined Harrier and Sea Harrier Force. The final air engagements of the war took place on 8 June, when Dave Morgan, flying ZA177 shot down two A-4B's from *Grupo 5*, and Lt Dave Smith in XZ499 'bagged' a third.

Aircraft began to sport 'kill' markings in the shape of either black or white silhouettes of Dagger/Mirages, Pucaras or Skyhawks. Examples being XZ457 - 'Black 14' with two Mirage and one Pucara credited; ZA177 with two Mirages credited and ZA194 with one Dagger.



Top right: An 800 Squadron FRS.1, XZ493/123, still in the Extra Dark Sea Grey scheme at Yeovilton in 1984, showing the squadron markings on the fin. (Andy Evans)

Middle: An 801 NAS FRS.1 also still in the overall EDSD finish and toned-down (black) unit markings on the fin. (Andy Evans)

Right: Back on the 899 Squadron Ramp at Yeovilton after the Falklands War, ZA193/254, in the Medium Sea Grey/Barley Grey scheme. (Dennis Calvert)



Left: Sea Harrier FRS.1, XZ499/255 of 809 NAS, at Yeovilton in July 1982. Note the detail of the 30mm ADEN gun pods and the nose wheel. (Andy Evans)

Below: XZ498/001 from 801 Squadron on the deck of *HMS Invincible*, post-Falklands War, showing the re-instated 'toned-down' fin markings. (Dennis Calvert)

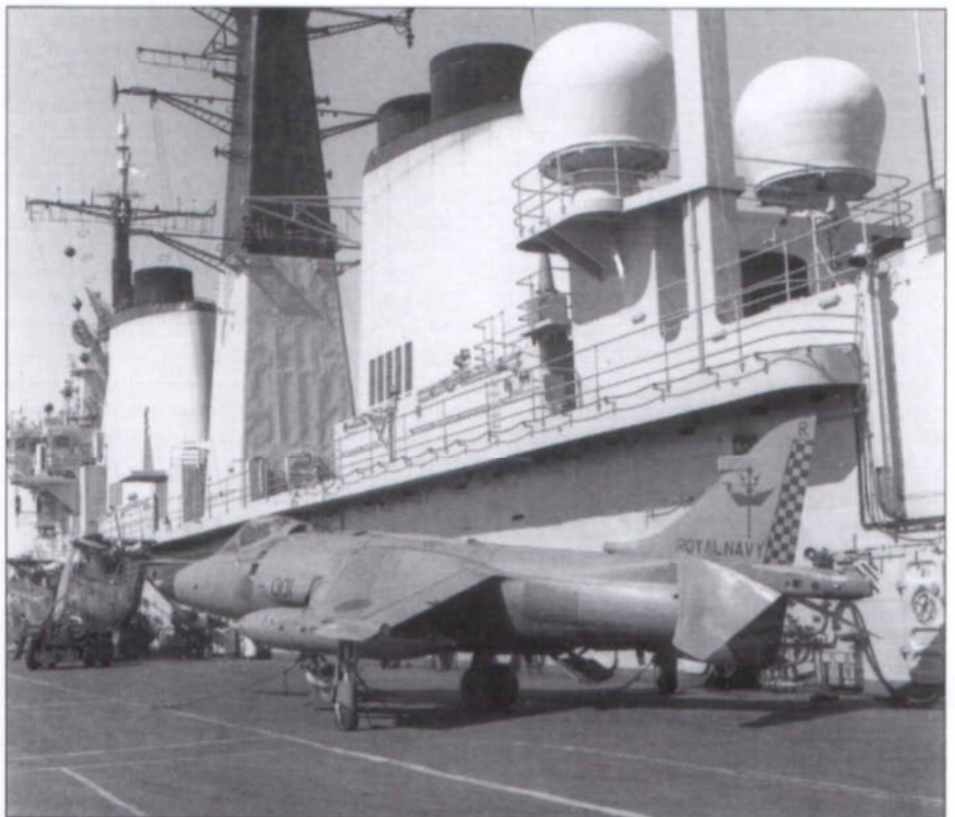
Bottom of page: An Indian Navy FRS.51 from the 'White Tigers' Squadron on acceptance trials in the UK circa mid-1980s, before transit to its base at Goa. (BAE)

Post war

Post War, 809 Squadron's Sea Harriers deployed to *HMS Illustrious* between August and December 1982, and all sported names in small back script below the canopies, although it seems only 'Ethel' painted on XZ499/255 survived once back in the UK. Other 'names' were still just discernible though, having been through the 'official censor' - one example being XZ459/256, which bore the name 'Emmanuelle' with a small heart. Also of note was the short lived practice of stencilling the deck crew names on the nosewheel doors, and the last digit of the aircraft's code inside the rear face of the airbrake.

In the period following the Falklands War the aircraft all visited the paint shop after service to emerge in a fleet wide scheme of Dark Sea Grey BS381C:638, although other shades were experimented with, and it would be quite difficult to note all the various marking/colour permutations of the Sea Harriers in the period immediately after the Falklands War.

One aircraft noted with the Dark Sea Grey scheme was ZA177 of 899 Sqn in December 1982, which sadly crashed





Above: The first development FRS.2, ZA195, carrying four AIM-120B AMRAAM (Advanced Medium Range Air to Air Missile), all-weather, fire-and-forget system. (BAE)

chequerboard added to the rudder; up to a slightly more colourful Trident with wings and black and white chequerboard! A further addition was the carriage of four Sidewinder AAMs on revised launch rails rather than the normal pair.

Indian Navy FRS.51

The Indian Navy also decided to purchase sea-going Harriers, ordering six FRS.51s and two T.60A trainers in 1979, and formed up the 'White Tigers' squadron at Goa. A further batch of ten single and one two-seater was ordered in 1985, followed by another seven single and one two-seater in 1986.

The Indian Sea Harriers are basically the same as the original FRS.1s of the Royal Navy, apart from their LOX system being replaced by OBOGS and the use of Matra Magic AAMs rather than Sidewinders. The FRS.51s originally carried the same Extra Dark Sea Grey and White scheme of their Royal Navy counterparts; however, this colour has currently been subtly altered to more of a medium slate grey hue. Upgrades to the Indian Harriers have been mooted; however, to date, nothing has so far been apparent.

Enter the FA.2

One of the many consequences of the Falklands Conflict of 1982 was the need to have a better-equipped Sea Harrier Force. Thus, in early December 1988 the MOD awarded BAe a contract to update all existing FRS.1s to a new FRS.2 standard, and in March 1990 announced an order for ten new-build FRS.2s. It was later decided to change the designation of the aircraft to reflect its new capabilities. So out went the FRS.2 368

designation and in came F/A.2, for 'Fighter Attack'. This designation then slightly changed again, deleting the forward oblique/slash to simply read FA.2

Central to the Sea Harrier FA.2's abilities is its new radar, the Ferranti 'Blue Vixen' set, which is a multi-mode, track-while-scan Pulse Doppler, giving an all weather, look-down shoot-down, ability and interfaces with the new AMRAAM missile system. The radar is housed in a re-styled bulbous nose, being larger and more rounded than that of the FRS.1, and the latter's pitot tube has been re-located on the leading edge of the fin. The original F.95 surveillance camera was retained in the nose.

The missile of choice for the FA.2 was the AIM-120B AMRAAM (Advanced Medium Range Air to Air Missile) which is an all-weather, fire-and-forget system, equipped with an active radar seeker. When combined with the Blue Vixen set, it made the Sea Harrier FA.2 one of the most potent combat aircraft in the world.

The AIM-120s, were wing mounted on Frazer Nash Common Rail Launchers, or on LAU-106 launch rails in place of the underfuselage gun packs. AIM-9M/L Sidewinder air-to-air missiles on LAU-7 launcher shoes also provide the Sea Harrier with the capability for firing close range at an approaching enemy aircraft. It can also carry a pair of 30mm ADEN gun packs under the fuselage, with 120 rounds per gun. Typical air combat loads would be two AIM-120 AMRAAM or four AIM-9 Sidewinders and two gun packs. The gun pods can be replaced with two additional AMRAAMs.

For the upgrade the FRS.1's fuselage was lengthened by just under 14 inches to improve stability and provide space for the extra equipment. This was originally to be a 'plug' just behind the engine, however all new build aircraft have a completely new rear fuselage, and the

aircraft has grown a number of additional air scoops associated with cooling the new systems. On the wings the leading edge has been slightly altered - another small fence added and one of the vortex generators removed, with wing hardpoints being beefed up to carry up 1000lb each. The FA.2s power plant remains the single turbofan Rolls-Royce Pegasus Mark 104 or Mark 106.

A modern 'office' for the pilot was designed, with a new HUD, with two multi function displays added. HOTAS allows the pilot to select the radar and weapons.

The FRS.1's ARI 18223 RWR has been replaced by the Sky Guardian 200, with the addition of a microwave airborne digital guidance equipment (MADGE) transponder, and the AN/ALE-40 chaff and flare dispenser. The AN/ALE-40 is capable of launching chaff, flares and active expendable GEN-X radar decoys. Also fitted is an IPG-100F global positioning system an AD120 VHF radio an AN/ARC-164 ARC radio and the AN/APX-100 MK12 IFF. The cockpit is further equipped with a Martin Baker Mk 10H ejection seat.

Into Service

BAe began to convert FRS.1 airframes to 'FRS.2' standard in the early part of 1991, and the first aircraft completed, ZE695, was handed back to the Royal Navy in April 1993. To bring the aircraft to Squadron service an Operational Evaluation Unit was formed at Boscombe Down on 1 June 1993 as an off-shoot of 899 Sqn and received its first aircraft, ZE695 and ZD616 in the August, carrying the 'Winged Fist' tail motif with small white 'OEU' lettering on top of the tailfin. No.899 Sqn itself took on charge its first FRS.2, ZA176, later that same month.

Anxious to get the aircraft out to one of the carriers for extended sea trials, four newly designated F/A.2s - ZD612,



Left: Sea Harrier FA.2, ZH799/004, of No 801 NAS, being positioned aboard HMS *Invincible*'s flight deck, circa 1999. (BAE)

ZD615, ZE696 and ZE697 all from 899 Sqn OEU - joined HMS *Invincible* on an Adriatic cruise, working with 800 Sqn's Sea Harrier FRS.1s.

The Royal Navy's first fully operational F/A.2 Squadron was No 801, which received its first two aircraft, ZA176 and XZ455, on 5 October 1994, and the unit replaced 800 Squadron's FRS.1s aboard HMS *Illustrious* off the coast of Italy, where they gave support to 'Operation Sharp Guard'.

Flying a dual role, the aircraft were armed with a single 1000lb bomb on the centreline and two AIM-120Bs on the outboard wing stations, together with Aden cannons and the internal F95 recce camera. On its return to RNAS Yeovilton, No 800 Sqn retired its FRS.1s and the first F/A.2 joined the unit on 17 March 1995. The first totally 'new build' F/A.2 was delivered in October 1995.

Bosnia

The Sea Harriers' involvement in Bosnia began with the deployment of HMS *Ark Royal* carrying eight 800 NAS FRS.1s into the war zone on 27 January 1993, for their part in 'Deny Flight' operations, being relieved by HMS *Invincible*, with 801 Sqn embarked, in the July. It was a busy deployment as the aircraft were also operating as part of operation 'Sharp Guard' in the waters around the former Yugoslavia.

HMS *Invincible* handed over to *Ark Royal* again in early February 1994, with FRS.1s from No.800 Sqn embarked and were called into action in an abortive mission on 22 February to support a convoy of Swedish soldiers that had come under fire. The RN's only combat related FRS.1 casualty came during a CAS mission on 16 April 1994, when a pair of Sea Harrier FRS.1s from No 801

were trying to find their target near Gorazde in bad weather. During a sixth attempt at finding the site, one of the duo, XZ498/002 became caught in a 'SAM trap' and was hit by a SAM-7 missile, the pilot, Lt N Richardson, ejected safely and was rescued by the SAS and a French Puma helicopter.

An earlier loss had occurred on 15 December 1994 when XZ493 from 800 Sqn lost power on its return to HMS *Invincible*. The pilot ejected and was picked out of the sea by a Spanish Naval helicopter. *Ark Royal* subsequently returned to the UK, with HMS *Illustrious* taking up the Adriatic station.

The carrier arrived on station in September with four Sea Harrier FA.2s on board from the SHOEU, and six FRS.1s from No.800 Sqn making their 'swansong' deployment. Flying CAP and OCA alongside the FRS.1s the FA.2's set about proving their worth as part of the carrier's air wing, although not before a pair were targeted by an SA-2 Guideline SAM on 22 November! Happily it was no problem for the crews.

Interestingly, the FRS.1s had been upgraded for their Adriatic 'jaunts' with MK X11 Mode 4 IFF, cockpit mounted GPS, Vinten F-95 camera pods and the latest AIM-9M Sidewinder AAM's.

Following their final 'ocean odyssey,'

the six FRS.1s joined the queue of other airframes being re-manufactured as FA.2s on the British Aerospace production line, with ZE968 having the honour of being the last FRS.1 to depart HMS *Invincible* on 25 February 1995 for conversion.

Iraq

HMS *Illustrious*, with seven FA.2s from 801 NAS embarked, left Portsmouth on 17 January 1997 bound for the Persian Gulf. On 7 March, five FA.2s, each armed with a pair of AIM-120 AMRAAM missiles launched from HMS *Illustrious* in the Gulf to undertake the first Royal Navy air defence mission in support of 'Operation Southern Watch' over Iraq.

Daily operations were flown until 12 March, providing top cover for allied reconnaissance aircraft. In mid-November 1997, HMS *Invincible* with eight FA.2s of 800 NAS and six GR.7s of 1(F) Sqn embarked, headed for the Gulf in response to the Iraqi brinkmanship.

The Future

It was announced in February 1999 that RAF Harrier GR.7 and Royal Navy Sea Harrier FA.2 squadrons were to be merged into a single unit called Joint Force Harrier from April 2000. The aircraft themselves to be based at RAF Cottesmore for the front line units and RAF Wittering for the two training squadrons. The aim of this change was to create a unique joint force, capable of reaching trouble spots quickly, and deploying effectively once there.

However, in early 2002, the MoD surprisingly announced the withdrawal of the Royal Navy Sea Harrier FA.2 from service by 2006. Fleet air defence will be provided by upgraded Harrier GR.7s, designated Harrier GR.9 and surface-to-air missiles until the F-35 Joint Strike Fighter enters service in around 2010. The MoD press release stated that the Sea Harrier has 'certain limitations in its capabilities', but the real reason for the early withdrawal is that the Sea Harrier needs an expensive engine overhaul which the MoD cannot afford to complete. As a potential air defence aircraft a Harrier GR.9 also has got very serious limitations, the most striking being the lack of any sort of radar.

Andy Evans

Sea Harrier FA.2 detail pictures on P389



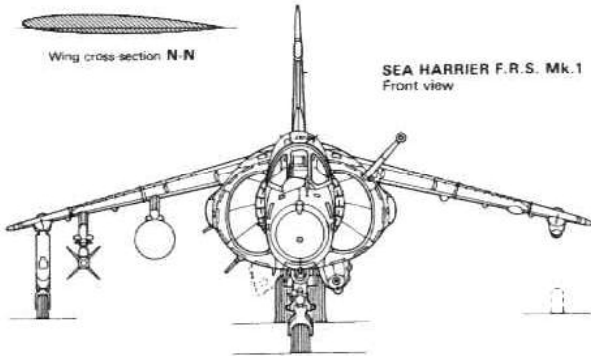
Right: Sea Harrier FA.2, ZD814/122, of No 800 NAS, pictured at RAF Valley in the unit's new fin markings, circa early 2002. (Andy Evans)

SAM plans

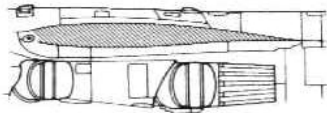
BaE SEA HARRIER FRS.1

1:72 scale plans by Mike Keep

SEA HARRIER F.R.S. Mk.1
Lower plan view (note optional
fuselage strakes or gun pods
are shown, also fairings under
port wing when pylons are
not being carried)



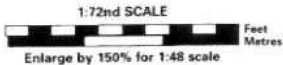
SEA HARRIER F.R.S. Mk.1
Front view



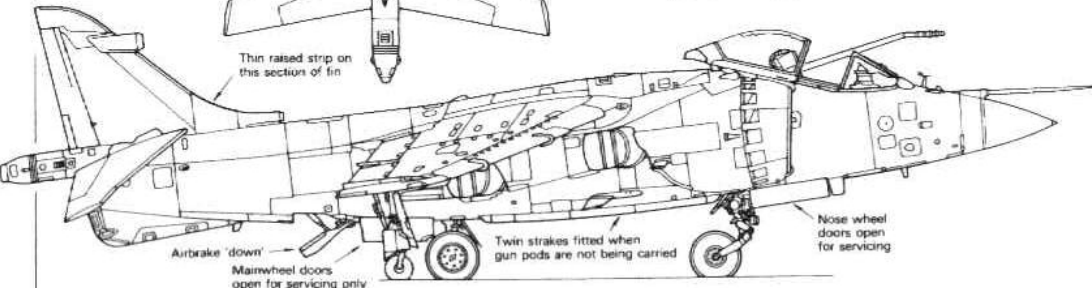
Wing root cross-section and area of
fuselage normally obscured by wing
(port side shown - starboard similar)



100 gallon underwing
fuel tank and pylon



SEA HARRIER F.R.S. Mk.1
Starboard side view



Thin raised strip on
this section of fin

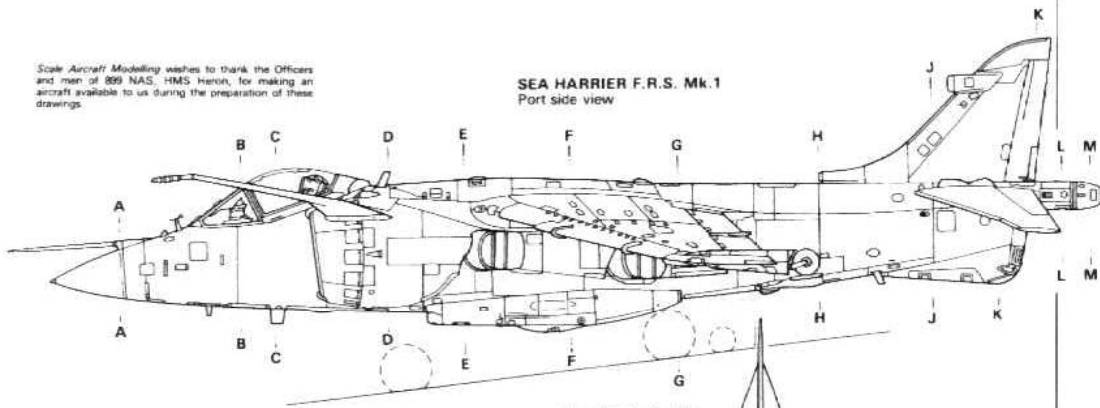
Airbrake 'down'
Mainwheel doors
open for servicing only

Twin strakes fitted when
gun pods are not being carried

Nose wheel
doors open
for servicing

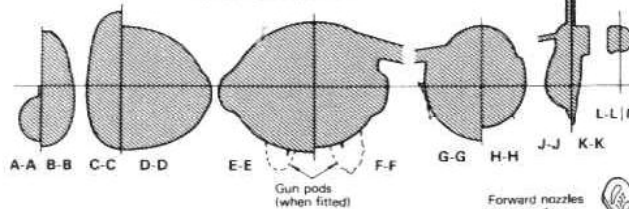
Scale Aircraft Modelling wishes to thank the Officers
and men of 899 NAS, HMS Haron, for making an
aircraft available to us during the preparation of these
drawings.

SEA HARRIER F.R.S. Mk.1
Port side view



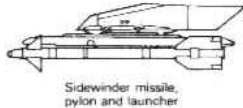
Nose in folded position

SEA HARRIER F.R.S. Mk.1
Fuselage cross-sections



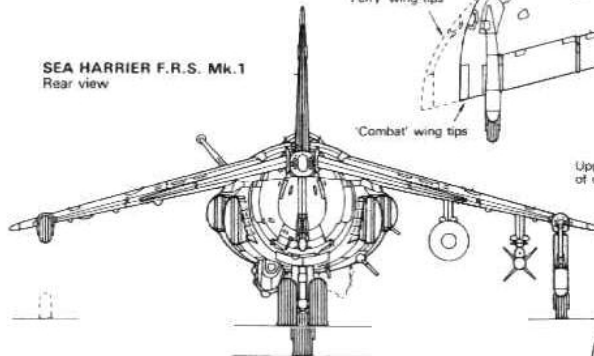
Gun pods
(when fitted)

Forward nozzles
upper surface
detail



Sidewinder missile,
pylon and launcher

SEA HARRIER F.R.S. Mk.1
Rear view

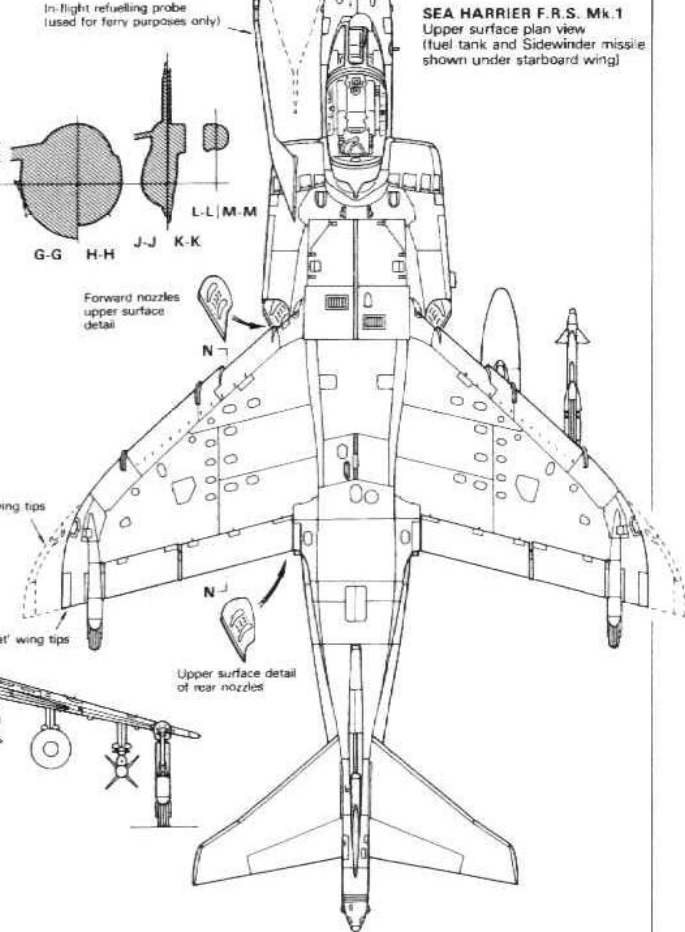


'Ferry' wing tips

'Combat' wing tips

Upper surface detail
of rear nozzles

SEA HARRIER F.R.S. Mk.1
Upper surface plan view
(fuel tank and Sidewinder missile
shown under starboard wing)



SAM plans

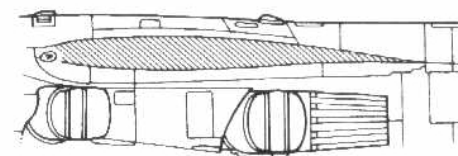
Bae SEA HARRIER FRS.1

1:72 scale plans by Mike Keep

SEA HARRIER F.R.S. Mk.1
Lower plan view (note optional fuselage strakes or gun pods are shown, also fairings under port wing when pylons are not being carried)

Wing cross-section N-N

SEA HARRIER F.R.S. Mk.1
Front view

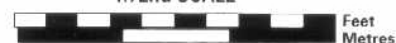


Wing root cross-section and area of fuselage normally obscured by wing (port side shown — starboard similar)



100 gallon underwing fuel tank and pylon

1:72nd SCALE



Enlarge by 150% for 1:48 scale

SEA HARRIER F.R.S. Mk.1
Starboard side view

Thin raised strip on this section of fin

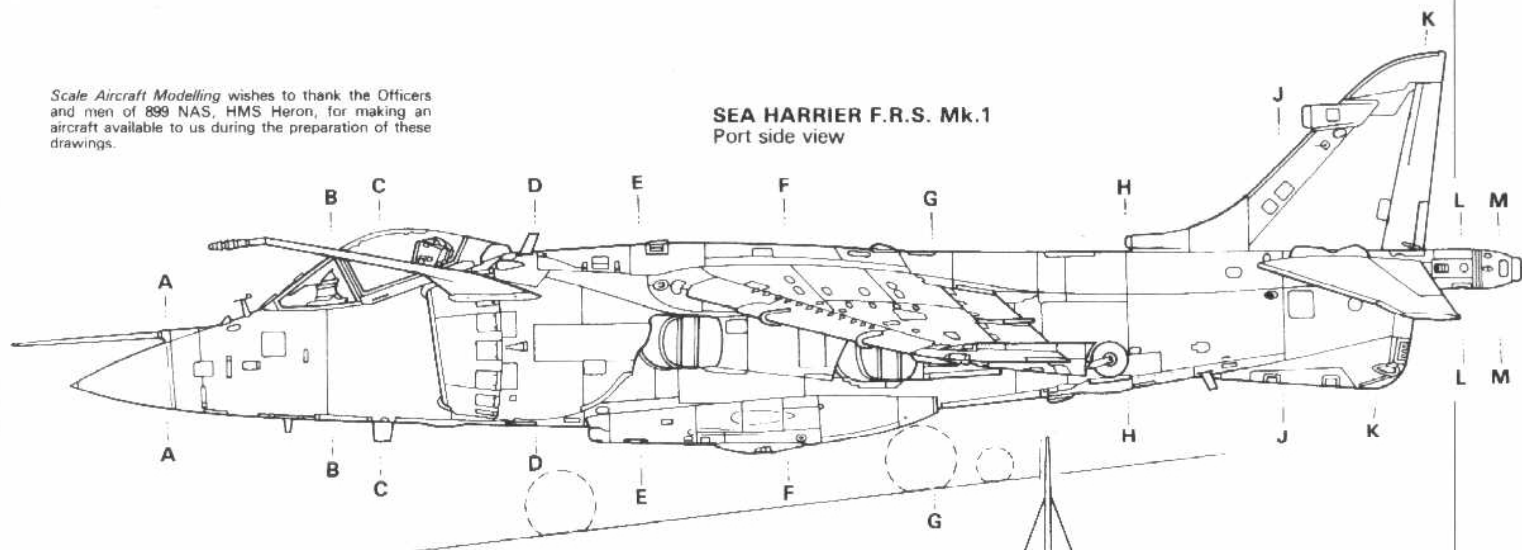
Airbrake 'down' —
Mainwheel doors open for servicing only

Twin strakes fitted when gun pods are not being carried

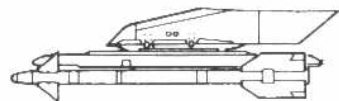
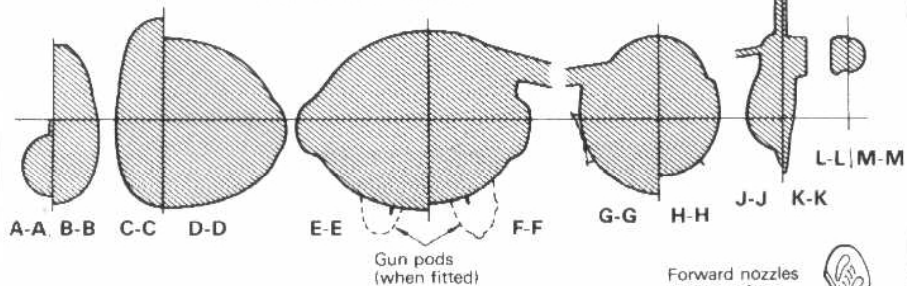
Nose wheel doors open for servicing

Scale Aircraft Modelling wishes to thank the Officers and men of 899 NAS, HMS Heron, for making an aircraft available to us during the preparation of these drawings.

SEA HARRIER F.R.S. Mk.1
Port side view

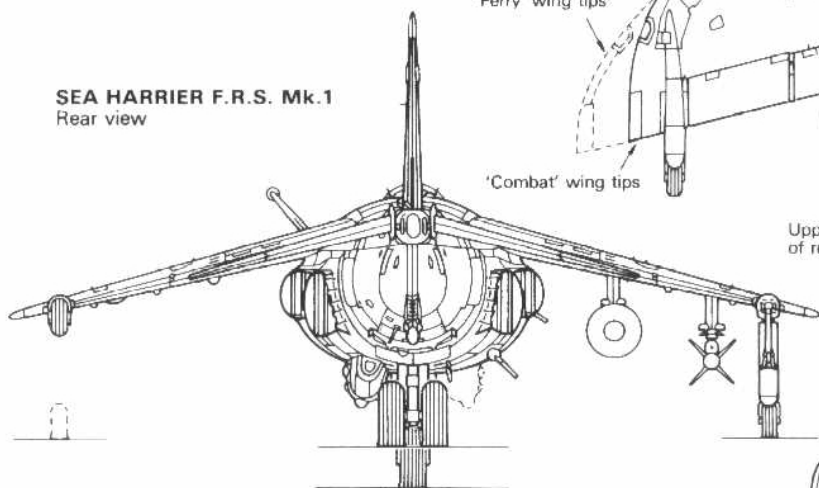


SEA HARRIER F.R.S. Mk.1
Fuselage cross-sections

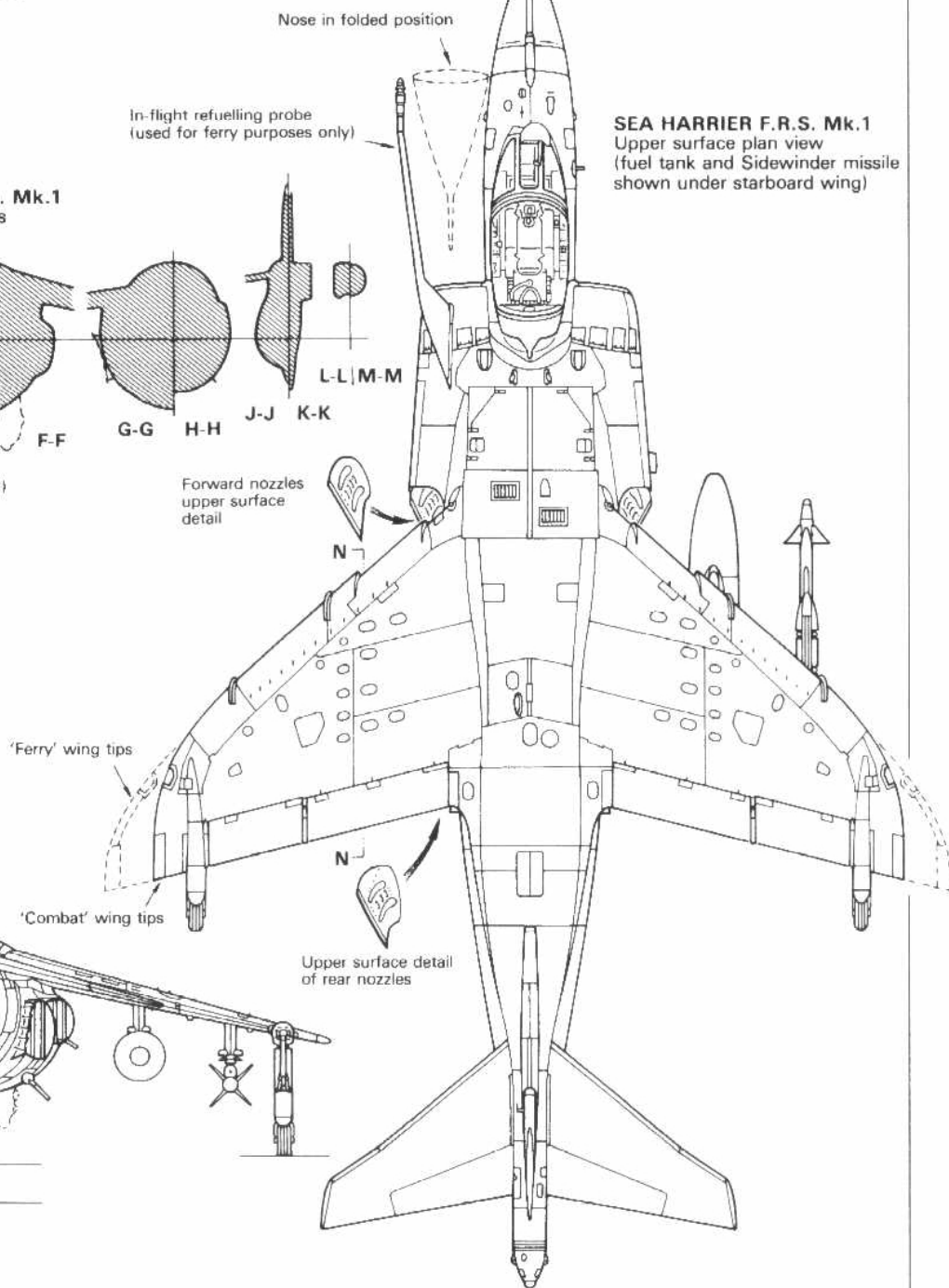


Sidewinder missile,
pylon and launcher

SEA HARRIER F.R.S. Mk.1
Rear view



SEA HARRIER F.R.S. Mk.1
Upper surface plan view
(fuel tank and Sidewinder missile
shown under starboard wing)

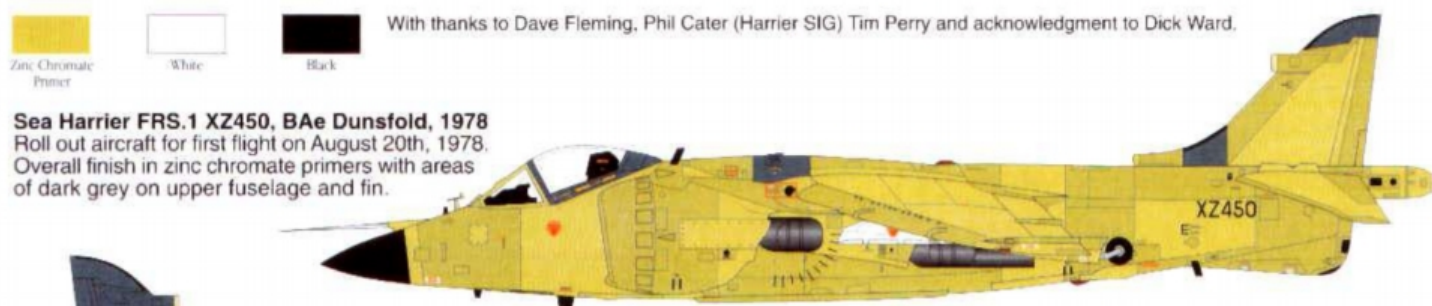


Sea Harrier FRS.1, FRS.51, FRS.2 and FA.2

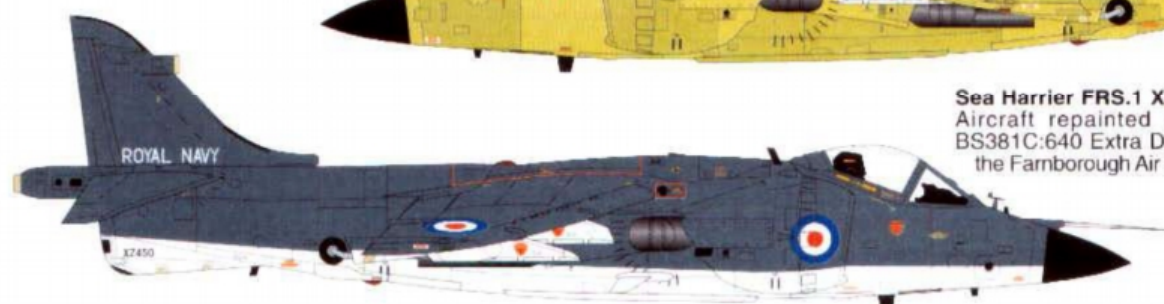
Artwork by Jonathan Mock



Sea Harrier FRS.1 XZ450, BAe Dunsfold, 1978
Roll out aircraft for first flight on August 20th, 1978.
Overall finish in zinc chromate primers with areas of dark grey on upper fuselage and fin.



Sea Harrier FRS.1 XZ450, BAe Dunsfold, 1978
Aircraft repainted in FAA colours of gloss BS381C:640 Extra Dark Sea Grey and white for the Farnborough Air Show 13 days after first flight.



Sea Harrier FRS.1 XZ451/100, 700A Flight, RNAS Yeovilton, 1979
FAA colours of gloss Extra Dark Sea Grey and white.
700A fin emblem in red and white, bird is grey with black detail.



Sea Harrier FRS.1 XZ454/250, 800 NAS, RNAS Yeovilton, 1980
FAA colours of gloss Extra Dark Sea Grey and white.
800 NAS fin emblem in red, gold and white with black detail.



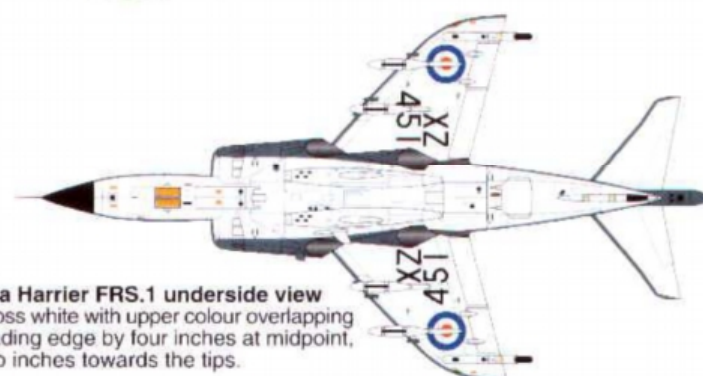
Sea Harrier FRS.1 XZ493/001, 801 NAS, RNAS Yeovilton, 1980
FAA colours of gloss Extra Dark Sea Grey and white,
aircraft flown by Lieutenant Commander Nigel "Sharkey" Ward. A replica of this machine now resides in the FAA Museum, Yeovilton.



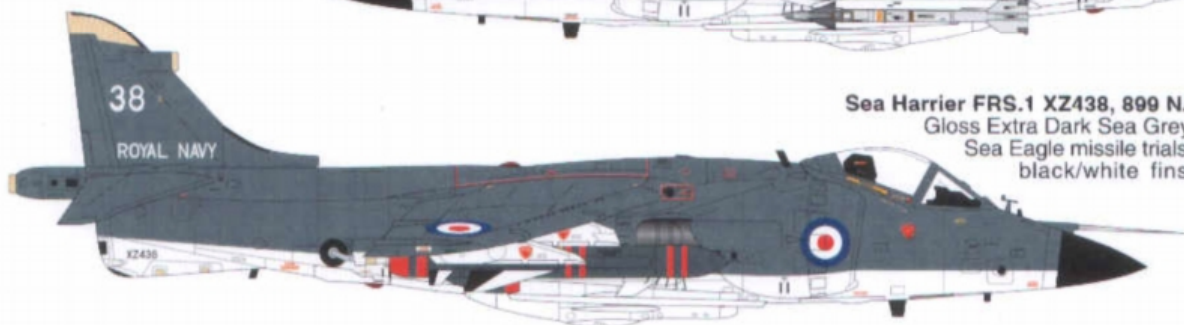
Sea Harrier FRS.1 plan view
Overall gloss BS381C:640 Extra Dark Sea Grey.



Sea Harrier FRS.1 underside view
Gloss white with upper colour overlapping leading edge by four inches at midpoint, two inches towards the tips.

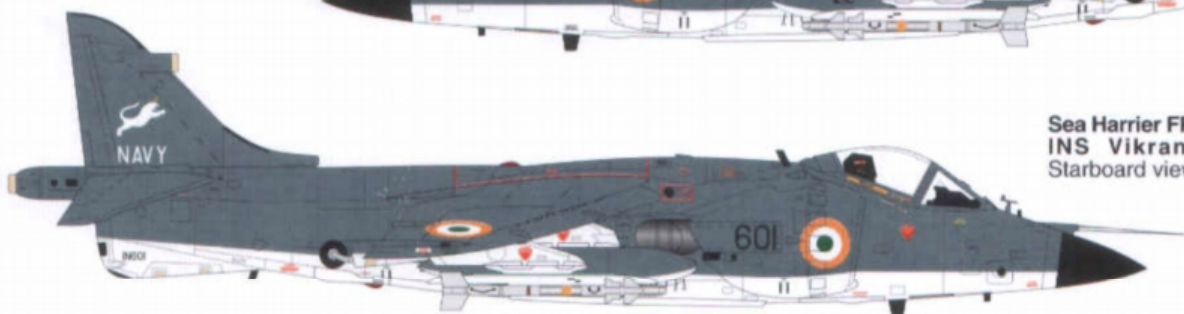


Sea Harrier FRS.1 XZ457, 899 NAS, RNAS Yeovilton, 1979
Gloss Extra Dark Sea Grey and white. 899 NAS emblem in black and white.



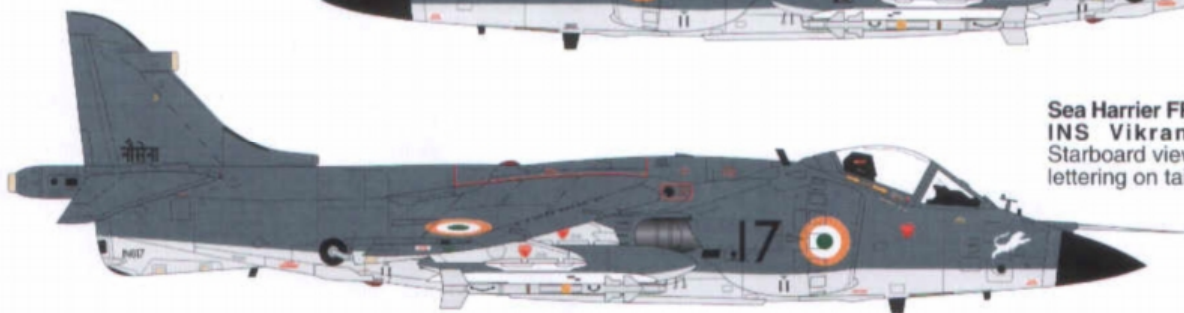
Sea Harrier FRS.1 XZ438, 899 NAS, RNAS Yeovilton, 1979
Gloss Extra Dark Sea Grey and white. Aircraft used for Sea Eagle missile trials. Missile body dark grey with black/white fins and day-glo red bands.

Sea Harrier FRS.51 IN601, 300 Squadron, INS Vikrant, Indian Navy, 1982
FAA colours of gloss Extra Dark Sea Grey and white. Roundels same size and proportions as FAA, with colour in green, white and orange.



Sea Harrier FRS.51 IN601, 300 Squadron, INS Vikrant, Indian Navy, 1982
Starboard view of original colour scheme.

Sea Harrier FRS.51 IN617, 300 Squadron, INS Vikrant, Indian Navy 1994
Revised colours of matt BS381C:640 Extra Dark Sea Grey and light grey (close to Barley Grey BS4800.18B.21). "Navy" legend on port side of tail only.

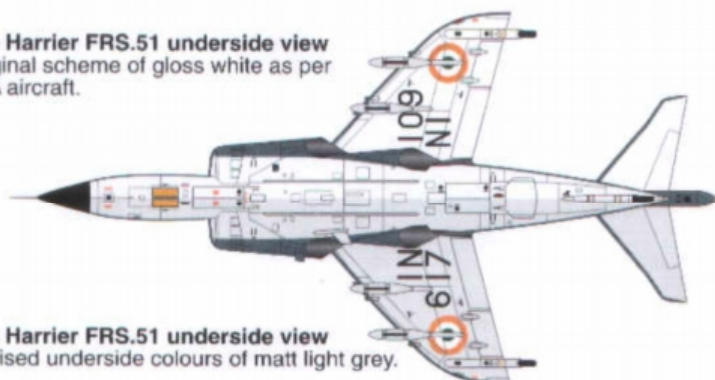


Sea Harrier FRS.51 IN617, 300 Squadron, INS Vikrant, Indian Navy 1994
Starboard view of revised scheme. Indian lettering on tail in black.

Sea Harrier FRS.51 plan view
Overall gloss BS381C:640 Extra Dark Sea Grey on original scheme, matt on later aircraft.

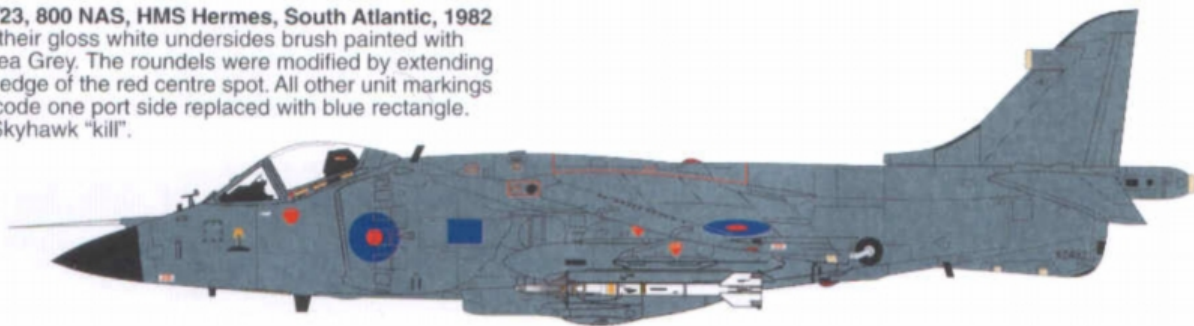


Sea Harrier FRS.51 underside view
Original scheme of gloss white as per FAA aircraft.



Sea Harrier FRS.51 underside view
Revised underside colours of matt light grey.

Sea Harrier FRS.1 XZ492/23, 800 NAS, HMS Hermes, South Atlantic, 1982
 HMS Hermes aircraft had their gloss white undersides brush painted with BS381C:640 Extra Dark Sea Grey. The roundels were modified by extending the blue portions up to the edge of the red centre spot. All other unit markings were painted out. Aircraft code one port side replaced with blue rectangle. This aircraft claimed one Skyhawk "kill".



Sea Harrier FRS.1 ZA193/93, 800 NAS, HMS Hermes, South Atlantic, 1982
 Overall Extra Dark Sea Grey. Underwing roundels on this aircraft apparently remained unchanged. Aircraft carried a single Mirage "kill" on starboard side of fuselage.



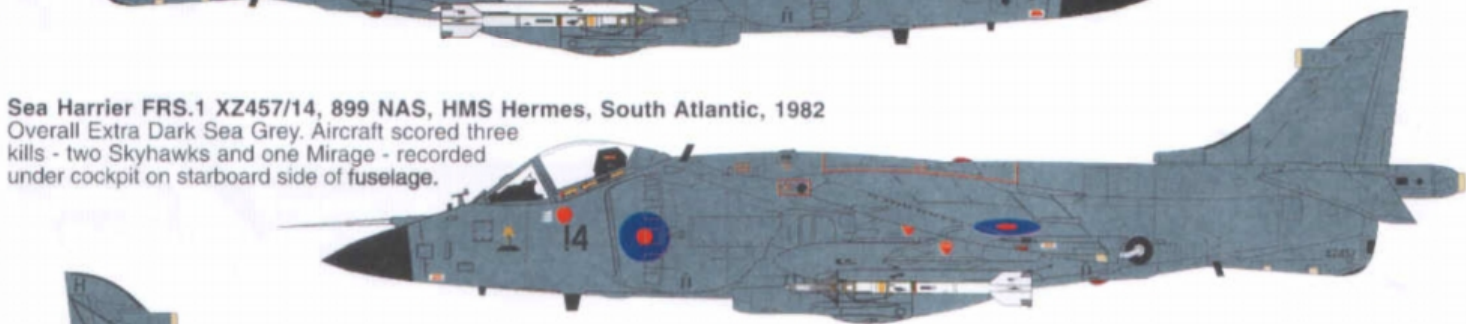
Sea Harrier FRS.1 XZ455/000, 801 NAS, HMS Invincible, South Atlantic, 1982
 Overall Extra Dark Sea Grey. HMS Invincible aircraft were apparently stripped back to bare metal, primed and then spray painted.



Sea Harrier FRS.1 XZ498/005, 801 NAS, HMS Invincible, South Atlantic, 1982
 Overall Extra Dark Sea Grey. Aircraft at some stage fitted with replacement canopy painted in Medium Sea Grey. Last number of code was usually painted in white on the starboard outrigger fairing on 801 NAS aircraft.



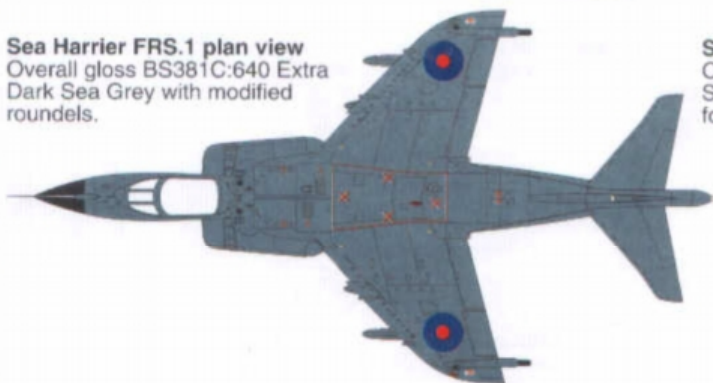
Sea Harrier FRS.1 XZ457/14, 899 NAS, HMS Hermes, South Atlantic, 1982
 Overall Extra Dark Sea Grey. Aircraft scored three kills - two Skyhawks and one Mirage - recorded under cockpit on starboard side of fuselage.



Sea Harrier FRS.1 ZA175/125, 899 NAS, Port Stanley airfield, Falkland islands, South Atlantic, late 1982
 Overall Extra Dark Sea Grey. 800 unit emblem repainted on fin in overall black. Aircraft retained modified roundels.



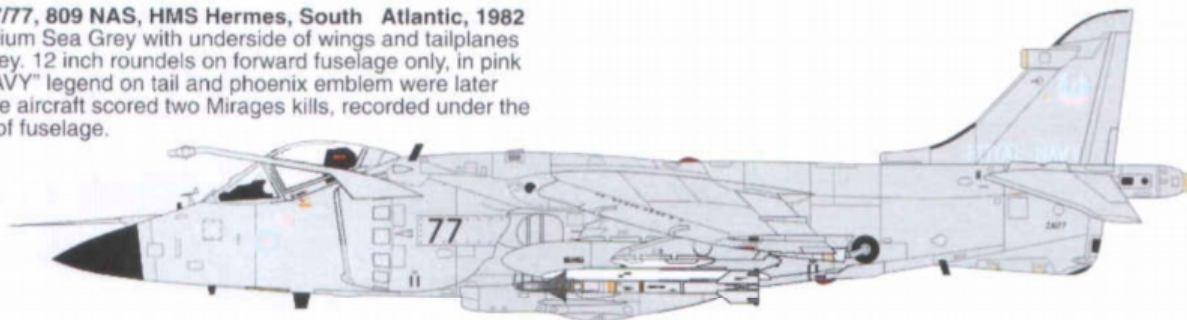
Sea Harrier FRS.1 plan view
 Overall gloss BS381C:640 Extra Dark Sea Grey with modified roundels.



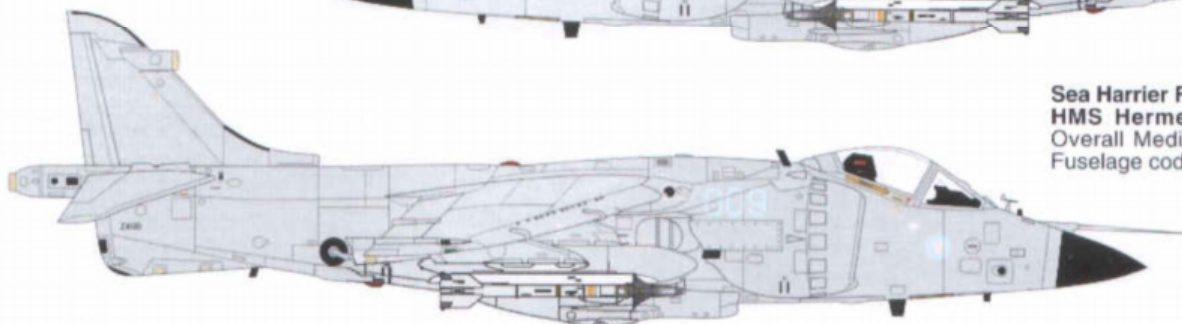
Sea Harrier FRS.1 underside view
 Overall gloss BS381C:640 Extra Dark Sea Grey with modified roundels (except for ZA193).



Sea Harrier FRS.1 ZA177/77, 809 NAS, HMS Hermes, South Atlantic, 1982
Overall BS381C: 637 Medium Sea Grey with underside of wings and tailplanes BS4800.18B.21 Barley Grey. 12 inch roundels on forward fuselage only, in pink and pale blue. "ROYAL NAVY" legend on tail and phoenix emblem were later removed in combat and the aircraft scored two Mirages kills, recorded under the cockpit on starboard side of fuselage.



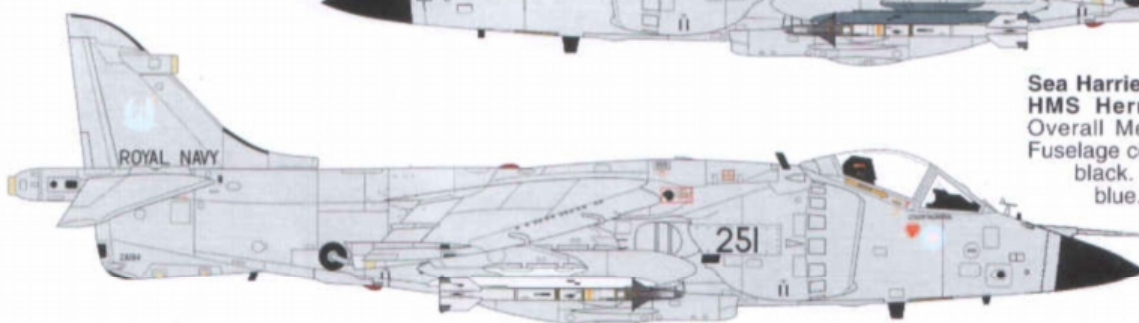
Sea Harrier FRS.1 ZA190/009, 809 NAS, HMS Hermes, South Atlantic, 1982
Overall Medium Sea Grey/Barley Grey. Fuselage code in pale blue.



Sea Harrier FRS.1 XZ499/99, 809 NAS, HMS Hermes, South Atlantic, 1982
Overall Medium Sea Grey/Barley Grey. Fuselage code in black. Replacement rudder in Extra Dark Sea Grey.



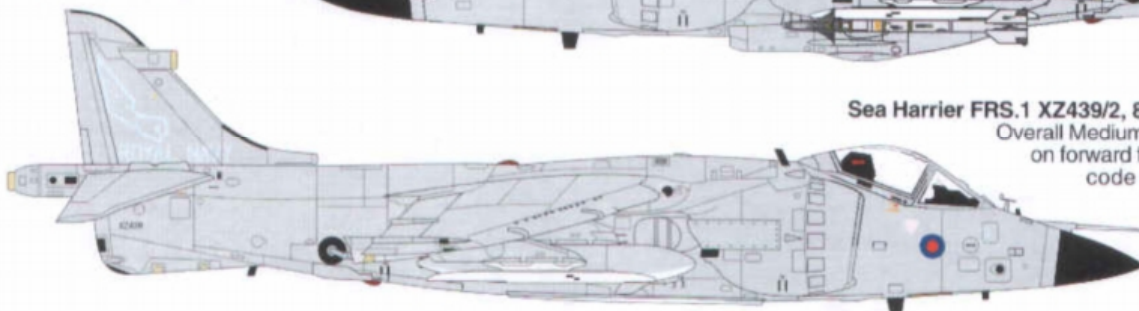
Sea Harrier FRS.1 ZA194/251, 809 NAS, HMS Hermes, South Atlantic, 1982
Overall Medium Sea Grey/Barley Grey. Fuselage code and "ROYAL NAVY" titles in black. Phoenix emblem on fin in pale blue. Roundel position on nose slight higher and serial number moved to ventral fin.



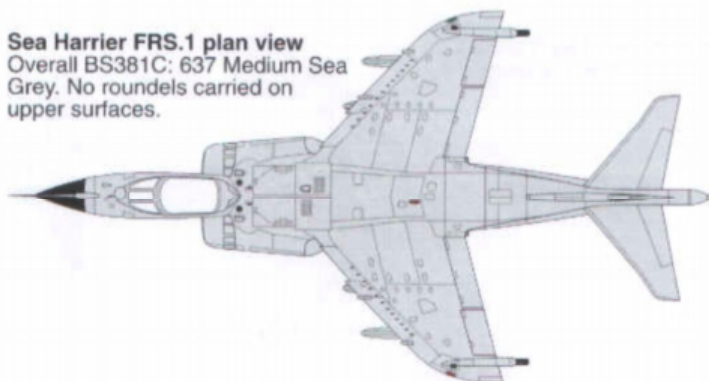
Sea Harrier FRS.1 XZ496/257, 809 NAS, HMS Illustrious, South Atlantic, 1982
Overall Medium Sea Grey/Barley Grey. Code and "ROYAL NAVY" titles in black. Phoenix emblem on fin in pink and pale blue, with black detail. This aircraft - "Mrs. Robinson" - was one of a number to received short-lived artwork on the starboard side of the nose.



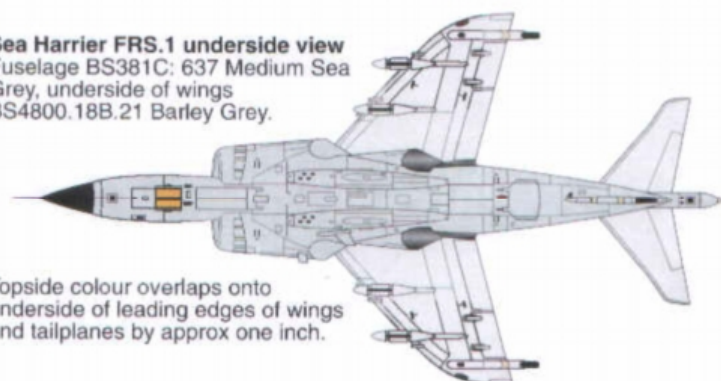
Sea Harrier FRS.1 XZ439/2, 899 NAS, RNAS Yeovilton, 1982
Overall Medium Sea Grey/Barley Grey. Roundels on forward fuselage in red/blue, 899 emblem, code number on nose and "ROYAL NAVY" titles in pale blue. XZ439 later became the first "production" Sea Harrier FRS.2 aircraft.



Sea Harrier FRS.1 plan view
Overall BS381C: 637 Medium Sea Grey. No roundels carried on upper surfaces.



Sea Harrier FRS.1 underside view
Fuselage BS381C: 637 Medium Sea Grey, underside of wings BS4800.18B.21 Barley Grey.



Topside colour overlaps onto underside of leading edges of wings and tailplanes by approx one inch.

Sea Harrier FRS.1 XZ455/127, 800 NAS, RNAS Yeovilton, 1983
Overall BS381C: 638 Dark Sea Grey with large red/blue roundel (correct proportions) approx 24 inch diameter on fuselage and 30 inch on wings.



Sea Harrier FRS.1 ZD612/128, 800 NAS, RNAS Yeovilton, 1983
Overall Dark Sea Grey with revised red/blue roundels of 18 inch diameter on fuselage and wings.



Sea Harrier FRS.1 XZ451/000, 801 NAS, RNAS Yeovilton, 1983
Overall Dark Sea Grey with 801 emblem in black.



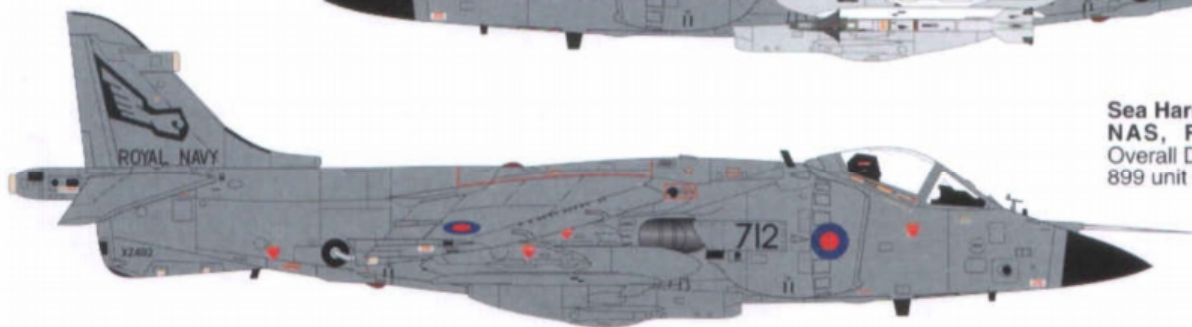
Sea Harrier FRS.1 ZA175/717, 801 NAS, RNAS Yeovilton, 1988
Overall Dark Sea Grey with revised 801 unit emblem on fin.



Sea Harrier FRS.1 ZA175/717, 899 NAS, RNAS Yeovilton, 1983
Overall Dark Sea Grey with smaller 18 inch roundels and solid black 899 unit emblem on fin. Aircraft used as colour scheme "test bed" during this period.



Sea Harrier FRS.1 XZ492/712, 899 NAS, RNAS Yeovilton, 1988
Overall Dark Sea Grey with standard 899 unit emblem on fin.



Sea Harrier FRS.1 plan view
Overall Dark Sea Grey.



Sea Harrier FRS.1 underside view
Overall Dark Sea Grey.



Sea Harrier FRS.1 ZA175/717, 899 NAS, RNAS Yeovilton, 1992/3
Overall Dark Sea Grey. Special markings applied for 899 NAS's 50th anniversary in 1992.



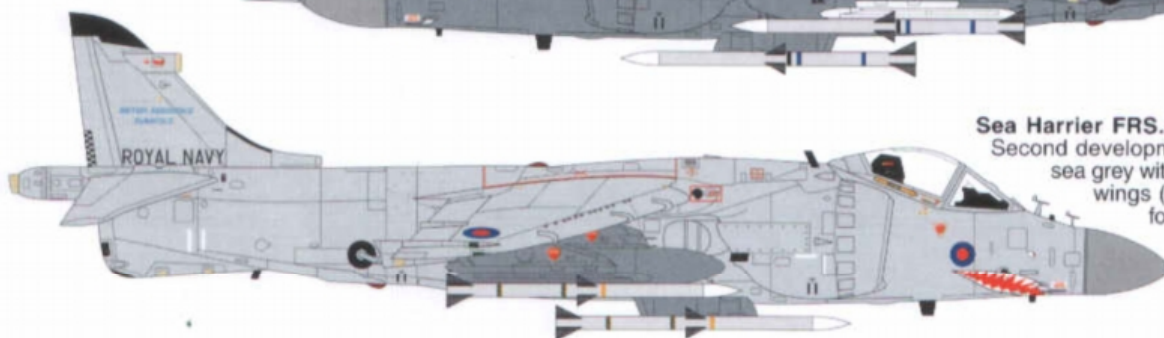
Sea Harrier FRS.1 ZE691/713, 899 NAS, RNAS Yeovilton, 1992/3
Overall Dark Sea Grey. Variation on 50th anniversary markings.



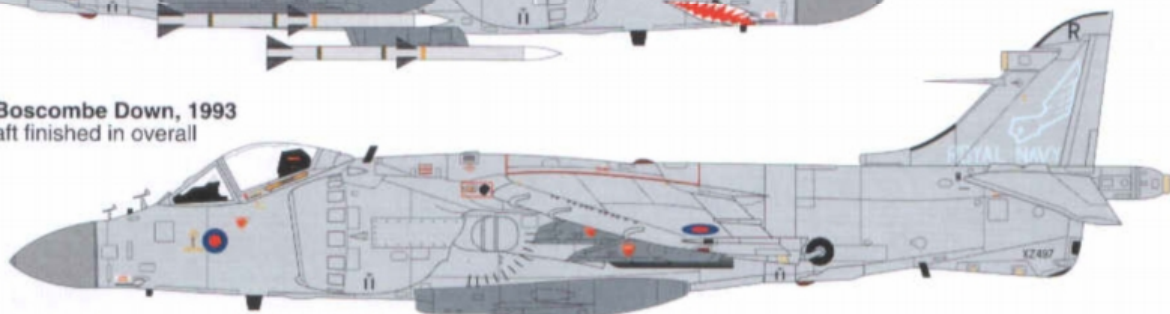
Sea Harrier FRS.2 ZA195, BAE Dunsfold 1988
Prototype FRS.2 aircraft finished in overall Dark Sea Grey. Pitot tube originally fitted to nose. Dummy AMRAAM missiles fitted on later flights.



Sea Harrier FRS.2 XZ439 Elgin, USA, 1993.
Second development aircraft. Overall medium sea grey with serial numbers carried under wings (ie FRS.1 style). Aircraft used for live firing AMRAAM trials. Pitot tube relocated to fin.



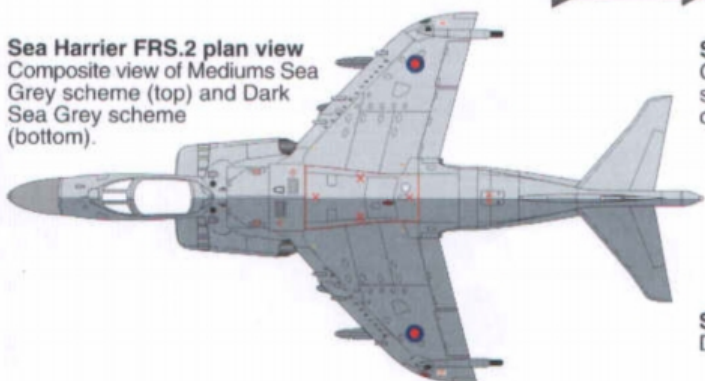
Sea Harrier FRS.2 XZ497, Boscombe Down, 1993
First production FRS.2 aircraft finished in overall medium sea grey.



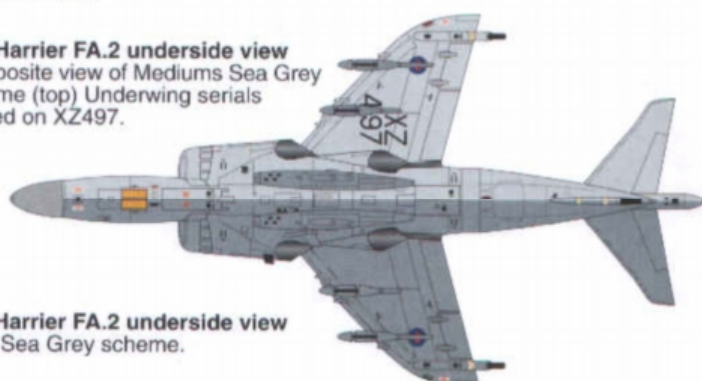
Sea Harrier FRS.2 ZE695/124, RNAS Yeovilton, 1993
Overall Dark Sea Grey with white codes.



Sea Harrier FRS.2 plan view
Composite view of Mediums Sea Grey scheme (top) and Dark Sea Grey scheme (bottom).



Sea Harrier FA.2 underside view
Composite view of Mediums Sea Grey scheme (top) Underwing serials carried on XZ497.



Sea Harrier FA.2 underside view
Dark Sea Grey scheme.

Sea Harrier FRS.2 ZD613/712, 899 NAS, RAF St Athen, 1993/4
Overall Dark Sea Grey. Aircraft part-way through conversion programme and retained original 899 NAS anniversary markings. Various areas are painted in zinc chromate primer.



Sea Harrier FRS.2 ZD611/716, 899 NAS, RNAS Yeovilton, 1994
Overall Dark Sea Grey with 899 NAS fin emblem in black.



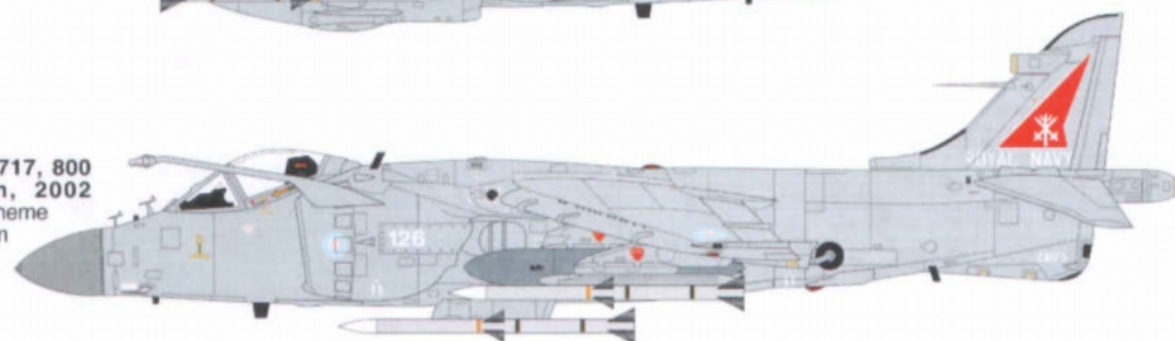
Sea Harrier FRS.2 ZA195, BAe Dunsfold, 1994
Aircraft updated to production standard and repainted in the medium sea grey scheme with pale red/blue roundels and camera reference markings.



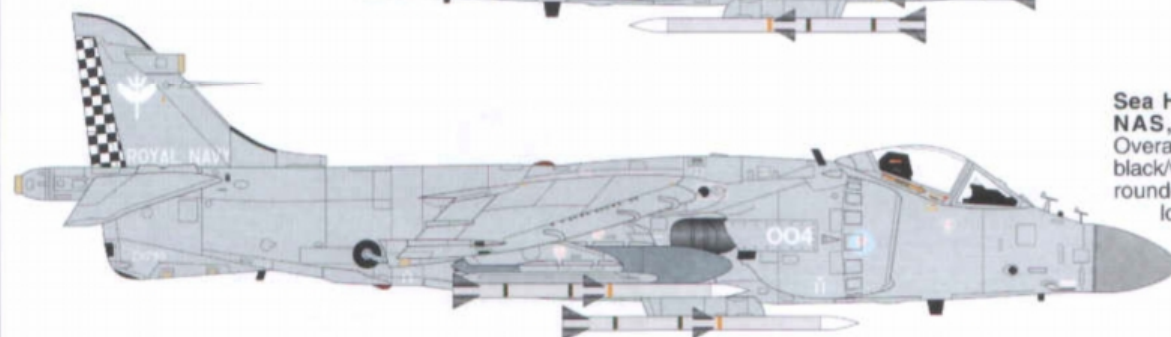
Sea Harrier FA.2 ZH800/124, 800 NAS, RNAS Yeovilton, 1998
Overall Medium Sea Grey scheme with 800 fin emblem in white.



Sea Harrier FA.2 ZA175/717, 800 NAS, RNAS Yeovilton, 2002
Overall Medium Sea Grey scheme with current 800 fin emblem in red and white.



Sea Harrier FA.2 ZH799/004, 801 NAS, RNAS Yeovilton, 1999
Overall Medium Sea Grey finish with black/white chequers on rudder. Wing roundels carried on upper (port) and lower (starboard) positions only.



Sea Harrier FA.2 ZD613/002, 801 NAS, RNAS Yeovilton, 1999
Overall Medium Sea Grey finish. Wing roundels carried on upper (port) and lower (starboard) positions only.



Sea Harrier FA.2 ZE696/712½, Operational Evaluation Unit, 899 NAS, RNAS Yeovilton, 1994

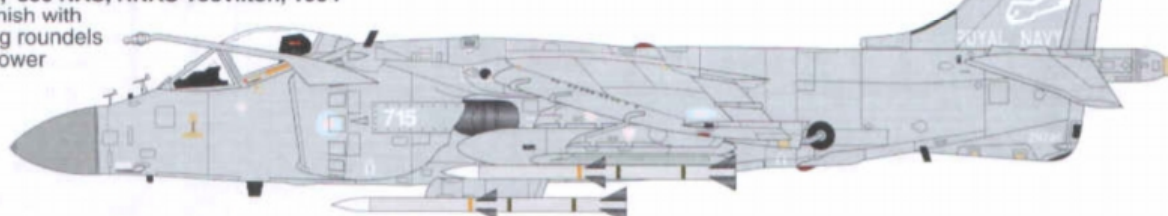
Overall Medium Sea Grey scheme. Following the loss of two aircraft coded 713, the OEU did away with the number and placed 712½ between 712 and 714.



Sea Harrier FA.2 XZ457/714, 899 NAS, HMS Invincible, 1995.
Overall Medium Sea grey. Aircraft flown by Lt-Cdr Tim Eastaugh during deck landing trials and specially marked "The Sharp End" for the Neil Mercer book.

Sea Harrier FA.2 ZH796/715, 899 NAS, RNAS Yeovilton, 1994

Overall Medium Sea Grey finish with emblem on tail in white. Wing roundels carried on upper (port) and lower (starboard) positions only.



Sea Harrier FA.2 ZD615./723, Operational Evaluation Unit, 899 NAS, RNAS Yeovilton, 1997
Overall Medium Sea Grey finish with emblem on tail in pale grey.

Sea Harrier FA.2 ZD612/719, 899 NAS, RNAS Yeovilton. 1998

Overall Medium Sea Grey finish with variation of unit emblem on tail in dark grey.

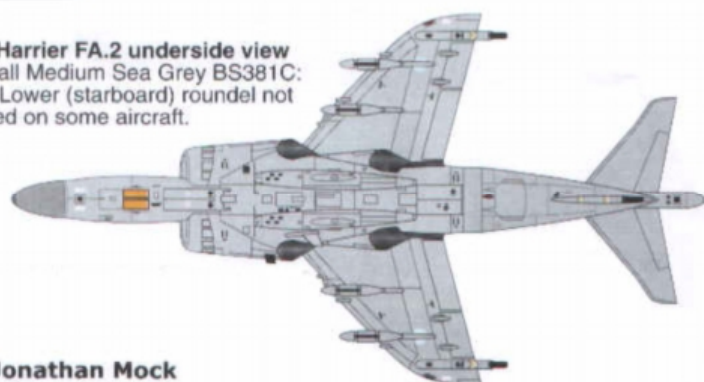


Sea Harrier FA.2 serial number unknown/124 899 NAS, 1997
Overall Medium Sea Grey finish with unit emblem appearing to be outlined in dark grey, possibly showing through after overpainting of fin in Medium Sea Grey.

Sea Harrier FA.2 plan view
Overall Medium Sea Grey BS381C: 637. Upper (port) roundel not carried on some aircraft.



Sea Harrier FA.2 underside view
Overall Medium Sea Grey BS381C: 637. Lower (starboard) roundel not carried on some aircraft.



Sea Harrier FA.2 details



Top: Blue Vixen radar nose radome. Note the additional air scoop.
 Above: F.95 oblique camera port - note teardrop shape.
 Below: Air vents below the tail and dielectric panel on fin strake.
 Above right: Forward 'cold' nozzle and fire access detail
 Right: Nosewheel gear details
 Bottom right: Upper nose blade aerial and yaw vanes
 (All photos Andy Evans)

