



- *Introduction*

The BAE Systems Hawk is an agile aircraft which offers supreme handling, clean responsiveness to controls, and is by all accounts great fun to fly. It is capable of transonic speeds in a dive, and has long range and endurance. It is economical to operate and has an excellent safety record.

DSB Design brings you this excellent rendition of the Hawk T1 and Hawk T1A airframe.

The first in a line of Hawk Products from DSB Design, the Hawk T1/A package offers users of Microsoft Flight Simulator 2004 a chance to accurately fly the worlds premier light fighter trainer.

The Hawk has been designed with assistance from the aircraft manufacturer, BAE Systems, allowing for a visual model which is unsurpassed and a flight model which is modeled closely on real world specifications.

We at DSB Design hope you enjoy this aircraft and have many enjoyable hours flying it....I know we did!

If you have any requests or questions regarding the DSB Design Hawk, or other products available from DSB Design, please drop us an e-mail at support@dsbdesign.com

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- *Credits*

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Beta Testing _____	Dyl Roberts, Adam Preece, Del Payne, Neil Angus
Manual _____	David Brice
AI Voicepack Update _____	David Brice

Special Thanks to the members of RAF Virtual (<http://www.rafvirtual.org>) for the multiplayer compatibility testing and their unerring support over the last eight months since the Hawk product's commencement.

(By far the BEST RAF Virtual Air Force on the net!)

Further thanks go to Greg Goebel (<http://www.vectorsite.net>) who kindly allowed the use of his material on the Hawk for this manual.

- *BAE Systems Hawk History*

Origins

* In the early 1960s, the British Royal Air Force (RAF) was operating two jet trainer aircraft: the Hawker "Hunter T.7" two seat side-by-side trainer, and the Folland "Gnat T.1".

The Hunter trainer was well liked, but it was also expensive to operate; had limited endurance; and its side-by-side seating arrangement was increasingly seen as outdated. Side-by-side seating is well suited for primary training, since it gives the instructor a close view of what the student pilot is doing, but is poorly suited to advanced training, as it creates a cockpit environment that is dissimilar to that of the single-seat aircraft the student is presumably being trained to fly.

Although the Gnat T.1 was appreciated for its agility and good handling and achieved recognition as the mount for the RAF Red Arrows aerobatic display team, it suffered from high maintenance overhead; a cramped cockpit that could not accommodate tall pilots, and left the flight instructor straining to see forward through the back of the student's head; and no weapons training capability.

In 1964, the RAF released a draft requirement for a trainer to replace both the Hunter trainers and the Gnat T.1, with the designation "Air Staff Target (AST) 362". Transition to the new trainer was to begin in the mid-1970s. In step with the spirit of the times, the new trainer was to have a top speed of Mach 1.5. It hadn't been realized yet that the benefits of a supersonic trainer did not really outweigh the drawbacks of higher purchase and operation costs.

Then international politics intervened. The French were also interested in a new trainer to replace their Lockheed T-33 "T-birds" and Dassault Mystere IVs, and a round of typically complicated Anglo-French negotiations followed. These discussions led off in one direction to the Anglo-French SEPECAT Jaguar, which was originally conceived as a trainer and light strike aircraft. Ultimately, the Jaguar became very much a competent strike fighter, but was simply too much aircraft for flight instruction. Tandem seat Jaguars were built, but they were used for operational conversion, not flight instruction.

Another offshoot of this round of discussions was a series of proposals made to the RAF in 1968 by Hawker Siddeley Aircraft (HSA) for a jet trainer. By this time, the RAF's focus had shifted somewhat towards a replacement for the Huntington Jet Provost T.5 trainer, and HSA was also looking very seriously at the broader international market to replace aging trainers such as the Jet Provost, T-33, and Macchi MB.326. The estimated market for new jet trainers was estimated at thousands of aircraft, excluding the US, which rarely "bought foreign", and the Eastern Bloc, where political barriers ruled out the sale of Western aircraft.

HSA gave their studies the designation "HS.1182". The new trainer was to have armament capability so that it could be used for weapons training, as well as for light combat duties. Early concepts envisioned a single-engine, tandem-seat aircraft with straight, low-mounted wings, with some resemblance to the Macchi MB.326 trainer.

In 1969, the British Ministry of Defense gave the ball another push by issuing requirement "AST.397" for a tandem seat, single engine, subsonic jet trainer with weapons capability and an unprecedented 6,000 hour fatigue life. This specification was open to international competition and was by no means written around the HS.1182 specification, but gradually the competitors, in the form of aircraft such as the Dassault-Dornier Alpha Jet and proposals by British Aircraft Corporation (BAC), fell out, and in October 1971 the HSA proposal was accepted. This led to a production contract early the next year for 176 trainers, with the first to be delivered in late 1976.

With the beginning of full scale development, HSA assigned Gordon Hudson as chief designer, and confusingly assigned Gordon Hodson as the assistant chief designer. Both men were ex-Folland personnel. The design was given the name "Hawk", although traditionally trainers had, logically but a bit stuffily, been named after educational establishments. However, "Hawk" was a simple name, and easy to put in flight logbooks; the RAF Staff College emblem featured the Egyptian hawk god Horus; and apparently there were officials who thought that naming aircraft after universities was a bit stuffy, too, or at least wouldn't have much appeal for export sales.

The design that was finalized during development modified earlier concepts by providing a slightly swept wing, with the engine intakes mounted above the wing roots. Shoulder-mounted intakes had been considered earlier, but wind tunnel tests indicated some stability problems with that configuration. In any case, the design team had good reason to feel pleased with the machine, as it had clean and elegant lines.

The first "Hawk T.1", painted in snappy red and white colors, flew on 21 August 1974, with test pilot Duncan Simpson at the controls. A number of defects were discovered in flight test and corrected, but these were ordinary development and teething problems, as the Hawk's design was fundamentally sound.

Hawk T1/A

As mentioned, the Hawk is a tandem-seat trainer with a low-mounted, slightly swept wing, a single engine with inlets above the wing roots, and a conventional tail assembly. It has tricycle landing gear, with all gear assemblies featuring single wheels. The nose gear retracts forward, while the wide-track main gear hinges in the wings towards the fuselage. The aircraft is of conventional construction, built mostly of aluminum alloy, with some use of magnesium to save weight. Interestingly, the Hawk was the first British aircraft to be designed in metric instead of English units.

The wing features outboard ailerons and inboard double slotted flaps. The tailplane is all-moving, while the tailfin has a rudder. There are also twin fixed ventral fins under the tail; these were significantly shorter in early prototype machines. There is a single airbrake in the belly in front of the two ventral fins. A single airbrake cost less than twin airbrakes, but it cannot be extended on landing. Flight controls are powered by duplicate hydraulic systems.

The aircraft was designed to allow fit of five stores pylons, with one on the centerline and two on each wing, though RAF trainers never use more than one stores pylon on each wing. The extra attachment point on each wing was specified to permit flexibility for export sales. The inner attachment points are plumbed for drop tanks. For weapons training, the Hawk is fitted with a centerline gun pod, similar to those fitted to British Harriers, with a single 30 millimeter Aden Mark 4 cannon with 120 rounds, and a stores pylon under each wing for munitions. Pylon loads include practice bomb carriers and SNEB rocket pods, or a pair of 455 liter (120 US gallon) drop tanks. External load in practice is restricted to 680 kilograms (1,500 pounds).

Although the Rolls-Royce "Viper 632" turbojet was initially considered as the powerplant, the final choice was the Rolls-Royce / Turbomeca "Adour 151" non-afterburning turbofan with 23.15 kN (2,360 kgp / 5,200 lbf) thrust. The Adour had been developed for the Jaguar. Although the Adour cost much more than the Viper, the Adour was a more modern engine that had better fuel economy; had an estimated 95% parts commonality with the afterburning Adour 102s used in the Jaguar; and was regarded, correctly as it turned out, as offering more improvement potential than the mature Viper engine, while still having been proven in the Jaguar.

The Adour engine drops out of the Hawk's belly for service, and in principle can be replaced in one and a half hours. The Hawk was built with serviceability in mind, and almost a third of the aircraft's surface is covered by access panels. A Microturbo 047 Mark 2 Gas Turbine Starter / Auxiliary Power Unit (GTS/APU) is installed above the engine to permit self-starting and to assist in relights after an in-flight flameout. If the aircraft loses power in flight, a ram-air turbine automatically pops up in front of the tailfin to provide emergency electrical power.

The cockpit is very comfortable in comparison to the Gnat's, and the back seat is stepped up to give the flight instructor a clear view over the top of the student's head. There is a windscreen between the front and back seat to protect the back-seater from windblast in case of a bird strike or other front-canopy failure. The canopy is single-piece and hinges open to the right. The T.1's cockpit controls are analog and relatively simple, and include a Ferranti ISIS gunsight.

While HSA had wanted to use the new lightweight Folland-Saab "Mark 4GT" ejection seats, the RAF specified the bigger and heavier Martin-Baker "Mark 10B" rocket boosted zero-zero ejection seats to maintain commonality with other RAF aircraft. The larger Martin-Baker seats required a slight fuselage stretch from the original paper design to permit their accommodation. The canopy is taped with miniature detonation cord to shatter it before ejection.

** Only one pre-production Hawk was built. Five more were used for development, but they were later brought up to production standard and passed on as part of the RAF contract. HSA retained an early-production Hawk as a company demonstrator, with this aircraft undergoing a wide range of mutations over the years.*

The first Hawk T.1 to be formally accepted by the RAF was delivered in November 1976, with the last delivered in March 1982. As might be expected, some deficiencies were uncovered after the Hawk went into service. Some defects, such as a nose wheel that swiveled poorly, were corrected in later development; and some economy measures, such as low-cost radios, proved unacceptable in practice and had to be upgraded later. By the time of the last delivery, the Hawk was the "BAe Hawk", as HSA had been absorbed into the British Aerospace group in the spring of 1977.

The first user was the RAF flight instruction unit at RAF Valley on the island of Anglesey off the coast of Wales, followed by other RAF organizations such as the weapons training units at RAF Brawdy and Chivenor, and also units of the Royal Navy's Fleet Air Arm. Over time, defense consolidation has tended to accumulate the Hawk at RAF Valley, which is now the largest single British user of the Hawk.

In some cases the maneuverable Hawk is used in "aggressor" training, fitted with radar signature enhancement devices to simulate a larger aircraft. RAF Hawk trainers previously sported a lively blue-white-red color scheme, but now have a racy all-black color scheme.

The most prominent RAF unit flying the T.1 is the "Red Arrows" flight demonstration unit, which carries on a long tradition of exciting crowds at international air shows and public exhibitions flying formations with nine red-painted Hawks. Eleven Hawks were delivered to replace the Red Arrows' Gnat T.1 in 1980, and continue in service with the team. The Hawks of the Red Arrows have minor engine modifications to improve throttle response, and carry a 318 liter capacity (84 US gallon) smoke generator pod that stores diesel oil to generate white smoke, along with dyes to color the smoke red or blue. The smoke generator pod is derived from the Aden cannon pod.

Although the British Hawks are focused on the training mission, 88 of them were modified between 1983 and 1986 to possess a secondary air defense function through carriage of two US-built AIM-9L Sidewinder air-to-air missiles (AAMs). These Sidewinder-compatible Hawks are designated "T.1A" and include those flown by the Red Arrows. Apparently the Red Arrows fly T.1As on the rationale that if shooting were to suddenly break out, it might be wise for a group of some of the RAF's best pilots to be flying something they could fight with, though presumably not before their mounts got a quick new paint job to something less attention-getting than bright red. Other T.1As were painted in the standard RAF air defense light gray color scheme. For simplicity, this document will not further distinguish between the T.1 and the T.1A.

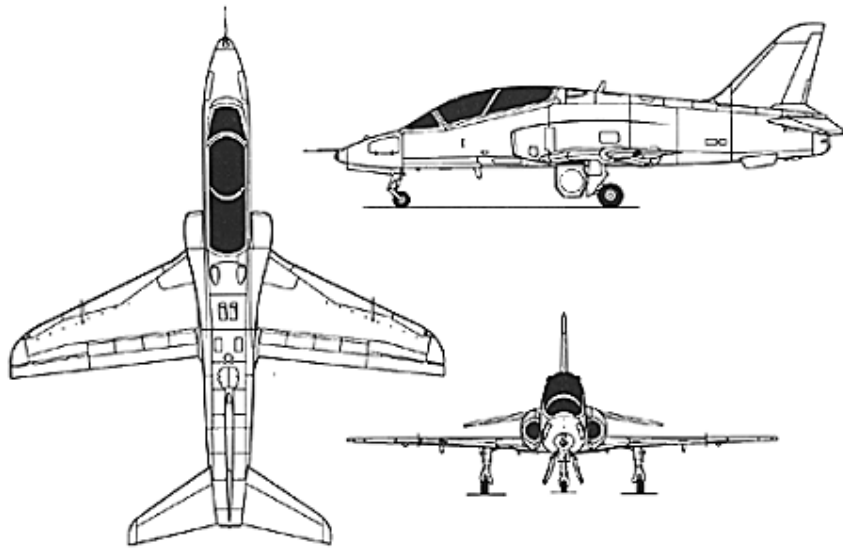
British Hawks have now been in service for over two decades, and unsurprisingly upgrades have been performed. In the mid-1980s, the Hawks were suffering from levels of mechanical strain and fatigue far greater than expected, leading to a re-winging program that began in 1988 and ended in 1995. The shortened fatigue life was apparently not due to any flaw in design, but changes in training practice that increased the stress on the aircraft. Another problem arose when a Hawk had a dispute over right-of-way with a duck that demonstrated the windscreen wasn't hard enough. In 1986, an upgrade program was begun to install thicker windscreens.

The RAF has had plans to upgrade 80 T.1s with new center and rear fuselages built to the export Hawk 60 standard, however, the RAF has now committed to buy a quantity of new-build Hawk Mk 128 trainers with modern "glass cockpits" and more powerful engines,

** Along with aircraft upgrades, the RAF has acquired simulator facilities to go along with their Hawks, opening the "Hawk Synthetic Training Facility" at RAF Valley in 2000. The facility is actually owned and operated by BAE Systems, with funding provided by the British government under a long-term contract arrangement.*

The facility includes a cockpit procedures trainer, a Hawk instrument flight simulator, and two full-dome flight simulators. The flight simulators include high resolution displays using a satellite imagery database, and can be linked with each other or with other compatible flight simulators. The simulator system reduces the amount of actual flight hours required in a training course, and also provides a safe environment for initial aircraft orientation preparatory to actual flight time. It is also used by the Red Arrows for procedures training.

- *Aircraft Specifications*



Crew: Two (Instructor - Rear cockpit, Trainee - Front cockpit)

Dimensions: Length 38 ft 11 in (11.86 m) incl. nose probe, 36 ft 7.75 in (11.17 m) excl. nose probe; Height 13 ft 1.24 in (3.99 m); Wing Span 30 ft 9.75 in (9.39 m); Wing Area 179.60 sq ft (16.69 sq m)

Engines: One Rolls-Royce/Turbomeca Adour Mk151-01 rated at 5,200 lb st (23.13 kN) dry

Weights: Empty Equipped 8,040 lb (3647 kg); Normal Take-off 11,100 lb (5035 kg); Maximum Take-off 12,566 lb (5700 kg)

Armament: Normal maximum external ordnance 1,500 lb (680 kg), Absolute maximum external ordnance 6,800 lb (3084 kg) on three hard points. Loads may comprise single 30-mm gun pod under the fuselage, and two AIM-9L Sidewinder air-to-air missiles or light bombs or [Export versions only] two underwing drop tanks of up to 190 Imp gal (228 US gal, 864 litres)

Performance: Maximum level speed 560 kt (645 mph, 1038 km/h) at 11,000 ft (3355 m); Maximum rate of climb at sea level 9,300 ft/min (2835 m/min); Service ceiling 45,500 ft (15240 m); Standard range 1310 nm (1509 miles, 2428 km); Ferry range 1670 nm (1923 miles, 3094 km)

- *System Specifications*

- Pentium II 500
 - 128 Mb RAM
 - 140 Mb of free available hard disk space
 - Sound Card
 - Microsoft Flight Simulator 2002 (Professional or Standard Version)
- OR*
- Microsoft Flight Simulator 2004
 - Microsoft Windows 98(SE), Windows ME, Windows 2000 or Windows XP
 - Adobe Acrobat Reader to view and print this manual*
 - Video Card with at least 32mb on board RAM

*Adobe Acrobat Reader is available for free from
<http://www.adobe.com/products/acrobat/readstep2.html>