Phoenix

Outlook

- Production concluded; system retired
- Last overseas operation for Phoenix UAVs was supporting British troops conducting combat operations in Iraq
- British deployment to Iraq is known as Operation Telic
- Some 23 Phoenix air vehicles have been lost during operations in Iraq
- Phoenix is being replaced by new Watchkeeper unmanned aircraft system

Orientation

Description. Unmanned air vehicle.

Sponsor. The United Kingdom Ministry of Defence.

Status. In service with the British military. Phoenix saw action in southern Iraq.

Total Produced. A total of 122 Phoenix air vehicles have been built. Some sources say 198 units were produced, while others say only 70 were built by June 1997.

Application. Remotely piloted vehicle for target acquisition and designation in any weather, out to 50 kilometers (26.99 nm).

Price Range. The estimated cost of a basic Phoenix air vehicle is $560,500 in FY94 dollars. That price may have increased to more than $700,000 in FY02 dollars.

Contractors

Prime

BAE Systems Military Air Solutions	http://www.baesystems.com, Woodford Aerodrome, Chester Rd, Woodford, Cheshire, SK7 1QR United Kingdom, Tel: + 44 161 439 5050, Fax: + 44 161 955 3008, Email: rjx.marketing@baesystems.com, Prime

NOTE(S): This program was formerly the responsibility of BAE Systems Avionics, Avionics Systems in Kent, which has since been sold to SELEX.

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Technical Data

Phoenix

	Metric Phoenix	**Metric** Frigate Bird	**U.S.** Phoenix	**U.S.** Frigate Bird
Dimensions				
Wing span	4.27 m	3.7 m	14 ft	12 ft
Launch weight (max)	160 kg	255 kg	353 lb	562 lb
Propeller diameter	N/A	2 m	N/A	6.7 ft
Max payload	40 kg	46 kg	88 lb	100 lb
Length	3.8 m	3.4 m	12.5 ft	11 ft
Performance				
Max speed	157 kmph	296 kmph	85 kt	160 kt
Cruise speed	100 kmph	152 kmph	53.99 kt	82 kt
Launching speed	130 kmph	N/A	70.15 kt	N/A
Combat radius	50-60 km	50-60 km	26.99-32.39 nm	26.99-32.39 nm
Altitude	2,744 m	2,744 m	9,000 ft	9,000 ft
Endurance	6 hr	4.5 hr	6 hr	4.5 hr

N/A = Not Available.

Propulsion. A single 18.6 kW (25 hp) Target Technology Ltd (now Meggitt) WAEL 342 two-stroke, air-cooled piston engine. BAE Systems offered to re-engine the Phoenix with a more powerful Wankel rotary propulsion system.

Control & Guidance. The Phoenix air vehicle can be remotely controlled, possibly even preprogrammed. The overall control system, called Machan, includes Ferranti (BAE Systems) FS60 and FDG60 vertical and directional gyroscopes. Thales supplies an HR3 magnetic sensor for heading reference. Command is via radio datalink. The ground control facility will interface with Marconi Command and Control Systems' BATES (Battlefield Artillery Target Engagement System) command and control system.

Launcher Mode. Phoenix is launched from a truck- or trailer-mounted catapult.

Recovery. Phoenix is recovered via a parachute deployed automatically or by command. The recovery system was provided by Flight Refuelling.

Warhead. No warhead or munitions deployment capability is planned for Phoenix. The air vehicle uses a stabilized thermal-imaging system with a zoom lens and a secure real-time datalink supplied by BAE Systems. A laser designation system is in the offing.

Phoenix

Source: U.K. Ministry of Defence

Variants/Upgrades

There are two models of the Phoenix: Model A and Model B. The Phoenix is said to need an upgrade, because the end of the Cold War has eventuated a change in its mission. The Phoenix was originally intended for target acquisition but is now being called upon to perform surveillance missions. Such missions would require the air vehicle to fly at higher altitudes and possibly at greater speeds. The cold- and hot-weather performance of Phoenix would also need to be enhanced, and a deicing system would likely be necessary.

The Phoenix unmanned air vehicle is also being re-engined, which could help to extend its service life to 2008. The Phoenix would receive a 50-horsepower Weslake 50 engine. That engine is being offered by Advanced Technologies Group, which is conducting trials under a contract from BAE Systems. Also offering an upgrade package is UAV Engines Ltd, but no details of that proposal have been released. The United Kingdom can re-engine all 198 Phoenix air vehicles for about $14.4 million.

BAE Systems is pursuing development of advanced features – including new payloads – for the Phoenix. The Phoenix could be outfitted with a lightweight thermal imager, dual infrared/television sensors, synthetic aperture radar, electronic warfare systems, and a GPS navigation unit. The ground station will also be improved, as will the air vehicle itself. The United Kingdom will upgrade its Phoenix UAV systems for use with Royal Air Force close air support aircraft.

BAE Systems has developed an electronic surveillance and countermeasures system designed to fit into the Phoenix payload pod. Known as the Monarch electronic warfare system, it is being developed as a private venture and could be configured to fit other UAVs. In addition, the U.K. Ministry of Defence operational requirements staff is considering using the Phoenix system to designate high-value targets by equipping the air vehicle with a laser designator.

Program Review

Background. In 1981 it was learned that the British Ministry of Defence was again studying a remotely piloted vehicle system to designate targets for artillery systems – especially the Multiple Launch Rocket System (MLRS). The program, called Phoenix, was to replace the old Supervisor program of Westland, which had been canceled. The 1982 Falklands War added urgency to the program. In June 1983, competitive development contracts were awarded to Marconi Avionics (now BAE Systems) and Ferranti. Each contractor teamed up with an airframe contractor to develop the air vehicle: BAE Systems with Flight Refuelling and Ferranti with Slingsby Aviation. Each engineering study contract was worth GBP1 million. In February 1985, BAE Systems and Flight Refuelling received a GBP80 million contract for full-scale development and production of Phoenix. However, in 1990 a decision was made to delay introduction into British service. The new schedule called for Phoenix to achieve Initial Operational Capability (IOC) by 1995-96. But difficulties persisted, and the program found itself facing a ministry-level review and possible cancellation. Given a final chance to overcome problems, the Phoenix entered service in late 1998.

New Requirements. The United Kingdom is examining the potential for wider use of unmanned air vehicles by its armed forces. Under its Watchkeeper program, the United Kingdom will acquire new UAV systems. The two contractors involved in the Watchkeeper competition were Northrop Grumman and Thales; Thales was selected as the winner. For more information, see separate "Watchkeeper" report in Tab B.

The U.K. Royal Navy has expressed an interest in acquiring a vertical takeoff and landing (VTOL) UAV. The United Kingdom may purchase a naval UAV in the future but has not announced specific plans for the deployment of such a system. The Royal Navy has shown interest in the Boeing ScanEagle and Northrop Grumman's RQ-8 FireScout.

U.K. to Expand UAV Fleet

The U.K. is also working on a cost-effective system designed to intercept UAVs. One concept under study is known as COUGAR (Counter UAV GBAD Additional Module Requirement). QinetiQ and Sula Systems Ltd are involved in that study. The COUGAR interceptor would be a turbojet-powered miniature monoplane, equipped with a low-cost, uncooled infrared seeker.

The interceptor would be vertically launched from a canister and collide with the UAV. The cost would be about GBP25,000 apiece.

	COUGAR
Length	1.2 m
Wingspan	1.1 m
Weight	Less than 14 kg

Future U.K. UAVs. Long-range, high-endurance UAVs are also being examined under the DERA-led Future Offensive Air Capability (FOAC) study.

The U.K. could use UAVs as part of an airborne early warning system, to resupply forward-deployed troops and naval task forces, as unmanned attack craft, and to designate targets for manned aircraft carrying long-range stand-off weapons.

The FOAC study is being conducted under a $59 million contract. (The FOAC was formerly known as Future Offensive Aircraft [FOA] and Future Offensive Air System [FOAS].) One of the study's objectives is to examine options for replacing the RAF's Tornado

GR.4 fighters. The Tornado was originally to have been replaced in about 2015, but the date has since slipped to 2018 and could be pushed back to 2020. The program's name was changed after the U.K. decided to add an unmanned option for meeting that requirement.

Options being studied include:

- An off-the-shelf variant of an existing aircraft, such as the Eurofighter Typhoon
- A new-design aircraft
- An unmanned aircraft
- A stand-off missile system, possibly launched from a transport aircraft

The purpose of the study is to examine the feasibility, cost, and operational effectiveness of the various solutions being proposed. Under the first phase, known as Initial Gate, the U.K. investigated the suitability of using variants of existing aircraft or all-new designs to meet FOAC requirements. That phase ended in 2001. In 2003, MBDA was awarded a three-year contract to study the potential use of a transport aircraft as a launch platform for cruise missiles.

The United Kingdom could cooperate with various allies in meeting its future strike needs and is already sharing information with France. Germany and Italy have also shown interest in participating in this program.

Meanwhile, BAE Systems is proposing the development of a new system, which includes an unmanned air vehicle, for air defense suppression. The conceptual system, using various types of unmanned air vehicles, would replace current anti-radiation missiles beyond 2015. To defeat mobile surface-to-air missiles (SAMs), BAE Systems is offering the Modular Interdiction Stand-Off Weapon (MISOW). The MISOW would combine a long-endurance UAV-carried surveillance system, a low-observable probe (drone-type system) for designation and target work in high-threat areas, a ground-based mission support station (MSS) for real-time analysis, and an air-launched stand-off missile system for attacking the target. The UAV would carry a sophisticated surveillance payload and have an eight-hour endurance.

The U.K. Royal Navy could use a UAV to meet its Future Organic Airborne Early Warning (AEW) requirement. The new platform would be deployed on the U.K.'s future aircraft carriers. Manned options are also being studied. The system could enter service by 2012.

U.K. Looking at Long-Range UAVs

The United Kingdom is also examining the feasibility of using an unmanned air vehicle as a surrogate satellite under the Extender project. That project will determine whether a long-endurance UAV could be used as a relay station for the Joint Tactical Information Distribution System (JTIDS). The U.K. wants to extend the reach of JTIDS, which currently uses a line-of-sight datalink, with a satellite link, but an alternative would be to use a high-altitude UAV. The UAV would be in a class with the Global Hawk, which is being developed by Northrop Grumman.

In 2005, reports claimed that QinetiQ was developing a high-altitude, long-endurance (HALE) unmanned air vehicle. QinetiQ had won a contract to design and build a HALE UAV. The solar-powered UAV would operate at an altitude of 60,000 feet and be able to stay aloft for weeks. The UAV would act as a satellite supplement.

The Belgian company Verhaert was involved in the project. The company has developed the Mercator 1, which weighs 27 kilograms and has a wingspan of 16 meters. VITO, the Flemish Institute for Technological Research, had given EUR11 million to Verhaert. The company is responsible for the system's ground station.

Expendable UAV. Roke Manor Research is working on an expendable UAV for the U.K. Royal Air Force. That UAV would perform reconnaissance and surveillance missions. Roke Manor used a small parafoil in its initial tests (which started in 2002). That UAV may be capable of being launched by hand or with a rocket, or it could be fired from mortars or artillery pieces. The U.K. wants to keep the price very low (in the area of GBP1,000). Other companies involved in the program include Blue Bear Systems Research and TASUMA.

Roke is also teamed with QinetiQ and Thales to study the development of future electronic warfare equipment for use by UAVs or manned aircraft from 2020.

Observer. Cransfield University is working on the Observer UAV system. Cransfield Aerospace, the commercial arm of Cransfield University, is working with QinetiQ to develop a UAV computer surveillance platform that allows the remote user to "pilot" the air vehicle with a few inputs of a touch-screen display.

Air Vehicle Models. The following provides a brief description of Phoenix air vehicle models, as well as a look at the new Frigate Bird vertical takeoff and landing UAV system.

Phoenix Model A. The BAE Systems/Flight Refuelling air vehicle is of twin-boom configuration, with the thermal imager housed in an under-fuselage pod. The

air vehicle is of modern composite construction, and components are supplied by Herman Smith Hitco Ltd.

Phoenix Model B. This model has undergone substantial changes from the Model A. The preproduction system features rounded fins and wingtips, probably in a bid to give the RPV a limited stealth capability against radar detection. The full-production version of the Phoenix is expected to be virtually identical to the preproduction model.

The redesigned air vehicle will be recovered by parachute – it will float to the ground inverted to protect mission sensors, which are attached to the system's belly. (The A model used a crushable blister to limit damage to the thermal imager, because the vehicle was recovered right-side up.)

Frigate Bird. This VTOL UAV system is designed for use aboard surface warships. The Royal Navy is very interested in using UAVs for overland reconnaissance and target designation (the latter in cooperation with a new stand-off missile system).

The Frigate Bird resulted from a series of in-house studies at BAE Systems and represents the first in a family of air vehicles weighing from 114 to 450 kilograms. Frigate Bird is a tail-sitter vehicle of canard configuration. Its design offers some advantages, such as compactness, over previous VTOL designs. The Frigate Bird must turn 90 degrees to shift from vertical to horizontal flight. The air vehicle is typically equipped with a 112-bhp Williams WTS 117 turboshaft engine (which provides a range capability of 815 km and an endurance of 4.5 hours). An optional 100-bhp Norton (now UEL) NR642 rotary engine can also provide substantially enhanced performance. Endurance and payload can be increased via a catapult or rocket-assisted conventional takeoff.

Naval UAV Being Considered by Royal Navy

Following launch, the vehicle transitions to conventional flight. Lift forces are provided by the canard and wing surfaces. During hover and slow forward flight, lift is provided by the counter-rotating propellers, and directional control is achieved with conventional control techniques. On recovery, Frigate Bird uses a harpoon mechanism to latch onto the deck and then utilizes the top-heavy characteristic of a tail-sitter to topple into a stable attitude on a normal undercarriage.

Although there was no formal requirement, the Frigate Bird was evaluated by the Royal Navy in 1990. The Royal Navy is continuing to follow the program's development studies. The air vehicle is compatible with a range of existing payload packages, including thermal imagers, radar systems, and electronic warfare equipment.

A team of Thales, Boeing, and QinetiQ has won a contract for the maritime segment of the Joint UAV Experimentation Program (JUEP). The team will fly a ScanEagle UAV in a maritime role to identify the joint service operational requirements for future maritime UAVs.

Related News

Phoenix UAV Retires from British Army Service – The Army's only tactical unmanned air vehicle (UAV) regiment, 32 Regiment Royal Artillery, said farewell to the Phoenix UAV surveillance aircraft at an Out of Service Parade held at Roberts Barracks, Larkhill, Wiltshire. During the ceremony, the UAVs were paraded past the soldiers who have had used them. The Phoenix UAVs were brought into service in 1999 as part of the NATO peacekeeping mission in Kosovo, and were most recently used for operations in Iraq.

The 22 (Gibraltar) Battery, part of 32 Regiment Royal Artillery, were the first and last Battery to operate Phoenix in Iraq. They were presented with their Iraq medals at the ceremony. The final operational flight of the Phoenix was conducted by Koehler's Troop in May 2006, at Camp Abu Naji, Al Amarah. The Battery is now training for possible future deployments to Iraq and Afghanistan.

The Phoenix officially went out of service on March 31, 2008, to be replaced by the Watchkeeper system in 2010. To fill the gap between retirement of the Phoenix and use of the Watchkeeper in 2010, the Lydian Hermes 450 System will be used and is currently operating in both Iraq and Afghanistan.

Lt. Col. Nick McRobb, the Commanding Officer of 32 Regiment Royal Artillery, said, "The Phoenix deployed on operations in Kosovo and Iraq, and paved the way for how we do operations today."

General Brims, General Officer Commanding 1 (U.K.) Armoured Division in Iraq in 2003, described the Phoenix as one of his key battle winners. "The Phoenix provided for the first time situational awareness commanders had not had access to before." He added, "We flew in front of the commandos before they went into attack and provided up-to-date, real-time information to commanders on the ground, enabling them to make key decisions before they

went into battle and during the battle itself. We had many years of great operational experience with Phoenix, and it has served us really well."

The 22 (Gibraltar) Battery RA also took the lead role in taking the Hermes 450 UAVs and the Desert Hawk 3 UAVs into operational service in Iraq last year. The Hermes operators provided new and invaluable support to 1 Mechanized Brigade, accumulating over 3,000 flying hours.

The Desert Hawk operators have deployed all over the British area of operations, including Basrah Palace, Maysaan Province, the Iranian border, and often operated with front-line infantry units using their own infantry skills to support these units on demanding operations. The detachments flew in excess of 1,000 operational Desert Hawk flights across southern Iraq.

57 (Bhurtpore) Battery RA deployed to Afghanistan in April 2007 with Desert Hawk, one Mini UAV, and Hermes 450, which provided a significant capability increase. Members of the Battery provided UAV imagery directly into the Brigade Headquarters and operated across the whole British area of operations. Members of the Battery also received medals during the ceremony.

The Phoenix UAV is an all-weather, day or night, real-time surveillance and target acquisition system. The Phoenix surveillance suite is datalinked to a ground station, which, in turn, transmits the gathered intelligence directly to artillery command posts. It is almost entirely made from Kevlar, glass fiber, carbon reinforced plastics and Nomex honeycomb, and is powered by a 25-horse-power, two stroke flat twin engine. The UAV can be launched within an hour of reaching the launch site. Up to two UAVs can be controlled from the same ground control station.

The concept behind the Phoenix system was to provide a battlefield surveillance and target acquisition capability to replace the Canadair Midge 501 Drone system, which had been in service with 94 Locating Regt RA in BAOR, and 22 Bty RA in the UK, since 1972. The drone system gathered data over pre-planned flight paths using "wet film" EO and IR sensors, resulting in data always being several hours old. Phoenix, however, transmitted live video to the ground control station, near real-time target acquisition data, and the ability to re-task in flight. (British MoD, 3/08)

Funding

No information has been released concerning annual funding for U.K. unmanned air vehicle programs. The Phoenix program's overall cost eventually increased to GBP303 million ($492 million). In 2004, the United Kingdom did slash its UAV budget due to the demands of operations in Iraq.

Contracts/Orders & Options

A fixed-price contract for the development of the Phoenix, worth GBP80 million, was originally awarded in 1985. Total program cost increased to GBP100.4 million by November 1990 because of inflation and design changes demanded by the U.K. Ministry of Defence.

Timetable

Month	Year	Major Development
Oct	1981	Phoenix program revealed
Jun	1983	Competitive contracts awarded
Feb	1985	Contract awarded
Early	1986	First flight of Phoenix air vehicle
	1990	Announcement that Phoenix IOC would be delayed
	1992	Frigate Bird announced
	1994/95	U.K. MoD review; cancellation under consideration
	1996	Flight Refuelling offers UAV for U.S. Tactical UAV competition
	1996/97	BAE Systems given one last chance to fix Phoenix problems or face cancellation

Month	Year	Major Development
Late	1998	Phoenix reaches Initial Operational Capability with the U.K. military
	2000	Invitation for Tenders issued for Spectator program
Mar	2003	Operation Iraqi Freedom launched
Apr	2003	Two Phoenix UAVs lost near Basra
	2008	Phoenix retires

Worldwide Distribution/Inventories

User Country. The only operator of the Phoenix unmanned air vehicle is the **United Kingdom**.

Forecast Rationale

After a final bow in Iraq, the Phoenix unmanned aircraft system (UAS) has exited the stage. The Phoenix unmanned air vehicle (UAV) officially retired from service with the British Army on March 31, 2008.

The Phoenix was the British Army's only tactical unmanned air vehicle and served with 22 (Gibraltar) Battery, 32 Regiment Royal Artillery. The Phoenix saw action during the NATO peacekeeping operation in Kosovo, and most recently in Iraq (Operation Telic), where it performed reconnaissance and targeting missions for British Army units.

During the drive to capture Baghdad, British forces lost 23 Phoenix UAVs, with another 13 damaged, from a total force of 89 air vehicles. British officials said most of the losses were due to technical problems related to working in the extreme climate of Iraq. The Phoenix UAV did not perform well in the high daytime temperatures in Iraq. Despite those losses and performance problems, the British military was pleased with the conduct of Phoenix during the war.

Although Operation Telic boosted demand for unmanned aircraft systems within the British military, it did not benefit the Phoenix UAV. The final operational flight of the Phoenix UAV took place in May 2006, at Camp Abu Naji, Al Amarah, in Iraq.

Retired from Service

Even before the war in Iraq, the British government had been moving to introduce new unmanned aircraft systems, but the fighting prompted London to consider a much wider deployment scope. Replacing the Phoenix will be the Watchkeeper system, which is to be operational in 2010. In the interim, the British Army will use the Hermes 450 system.

In addition to Phoenix, the United Kingdom has added large numbers of man-portable UAVs to its inventory, providing ground troops with a local area surveillance capability. In the future, the United Kingdom's UAS fleet is likely to include maritime and sophisticated high-altitude, long-endurance systems. The former will operate from Royal Navy surface warships, and the latter UAS will provide capabilities similar to the Northrop Grumman RQ-4 Global Hawk.

BAE Systems manufactured nearly 200 Phoenix UAVs for use by the British military.

Ten-Year Outlook

Production of the Phoenix UAS has concluded. No further production will take place.

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