

ARCHIVED REPORT

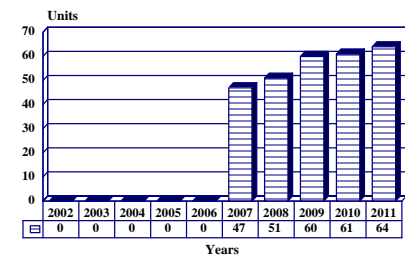
For data and forecasts on current programs please visit
www.forecastinternational.com or call +1 203.426.0800

MARTEL (AS.37/AJ.168)/Sea Eagle (P.3T/P.5T) - Archived 7/2003

Outlook

- Replacement missiles being examined
- Production of Sea Eagle and MARTEL has concluded
- London has yet to decide on a Sea Eagle replacement. Sea Eagle has been removed from service with the UK Royal Navy
- A new missile is expected to enter Royal Navy service around 2005-2006
- Italy and France will select their own replacements

10 Year Unit Production Forecast
2002 - 2011



Orientation

Description. Anti-ship missile.

Sponsor. UK and French ministries of defense through the Royal Air Force/Navy and the French Air Force/Navy, respectively. Executive management rests with British Aerospace for the AJ.168, P.3T, and P.5T; and with Matra for the AS.37 MARTEL.

Contractors. Developed and produced by Matra SA, Velizy-Villacoublay, France, and British Aerospace PLC Dynamics Group, Stevenage, Hertfordshire, England, United Kingdom. British Aerospace Dynamics (formerly Air Weapons Division) is prime contractor for the development/production of Sea Eagle, with further responsibility for integration of the missile components (including safety arming device) and of the missiles with various platforms. The ship-launched Sea Eagle variant has been funded and developed by the BAe Naval Weapons Division in Bristol, which has been a part of BAe Dynamics since January 1988.

Major Subcontractors. For the Sea Eagle, the subcontractors are as follows: Ames Industrial Ltd, Ferranti Computer Systems Ltd, Honeywell Learfield Ltd, IMI Ltd, Kulite Sensors Ltd, Marconi Defense

Systems Ltd, Plessey Radar Systems Ltd, Royal Armament Research and Development Establishment, and WES Limited.

Status. Production of MARTEL has ceased; Sea Eagle fabrication has also been completed. Production of a greatly enhanced MARTEL was resumed in France under the name ARMAT (see separate report in **Tab G**); this missile is operational with the French Armed Forces. A version of the Sea Eagle, designated Golden Eagle, had been offered to the United Kingdom to fulfill its CASOM requirement. A version of the Sea Eagle was also offered to meet the UK's SSGW need (see separate entry).

Total Produced. Approximately 523 Sea Eagles were completed or in production as of the end of 1992. A total of 3,172 AS.37 and 1,065 AS.168 MARTEL missiles were manufactured.

Application. Air-to-surface missiles for the destruction of ships and ground targets; MARTEL AS.37 is optimized for use against radar installations.

Price Range. The unit cost of Sea Eagle P.3T is put at \$638,000 in Fiscal 1992 dollars.

Technical Data

	<u>Metric</u> AS.37	<u>Metric</u> AJ.168	<u>Metric</u> P.3T	<u>US</u> AS.37	<u>US</u> AJ.168	<u>US</u> P.3T
Dimensions						
Missile Length ^(a)	420 cm	390 cm	450 cm	13.78 ft	12.80 ft	14.76 ft
Missile Diameter ^(a)	40/40/40 cm	40 cm	40 cm	15.75 in	15.75 in	15.75 in
Missile Weight ^(a)	530 kg	550 kg	830 kg	1,166 lb	1,210 lb	1,826 lb
Wingspan ^(a)	120 cm	120 cm	130 cm	3.94 ft	3.94 ft	4.27 ft
Performance						
Speed	963 kmph	963 kmph	1,129 kmph	520 kt	520 kt	610 kt
Range (effective) ^(a)	45 km	45 km	100 km	24.29 nm	24.29 nm	53.99 nm
Range (max) ^(a)	60 km	60 km	100 km	32.38 nm	32.36 nm	53.99 nm

^(a)Estimation applies only to the technical data referring to the P.3T.

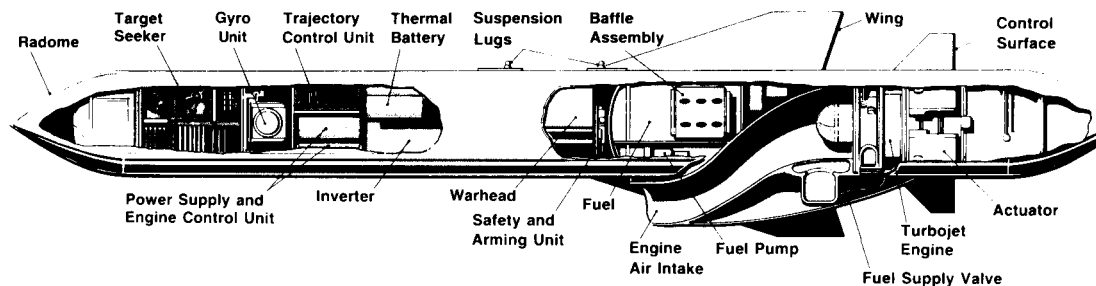
Propulsion. The MARTEL variants use a Basile solid propellant rocket motor for boost, produced by Hotchkiss-Brandt and Societe Nationale des Poudres et Explosifs. The sustainer in these missiles is the Cassandre solid fuel rocket, formerly produced by Societe Nationale des Poudres et Explosifs but now manufactured by Protac. Sea Eagle is powered by a Microturbo TRI 60 turbojet. This single-shaft turbojet with a three-stage transonic axial turbine develops 3.47 kN (772 lb) thrust. The engine weighs 47.27 kilograms (103.99 lb).

Control & Guidance. The AS.37 MARTEL is guided by the Electronique Serge Dassault AD37 passive radiation seeker. The AJ.168 MARTEL (electro-optic version) follows a preprogrammed flight plan upon launch but may be guided by pilot to correct an in-flight MARTEL to the target. Marconi Avionics Ltd developed the electro-optic camera control unit and the command radio data link system. Sea Eagle uses inertial navigation with active radar terminal homing. A new Marconi active radar homing head and strap-down inertial navigation system has been developed for the

Sea Eagle. This system incorporates an onboard computer for over-the-horizon capability against multiple targets.

Launcher Mode. Air-launched from pylons/racks from Buccaneer Mk II, Mirage III, and Atlantic aircraft. Sea Eagle is arming the UK Royal Air Force's Buccaneer, Sea Harrier, and Tornado aircraft. Sea Eagle has also been fitted to the Hawk and the A-36 Halcon variant of the CASA 101, and it is being integrated with the Sea King helicopter. A proposal has been made to integrate the Sea Eagle with the Harrier GR.7. The Sea Eagle is also being developed with a shipboard box launch system.

Warhead. The MARTEL uses a high-explosive warhead weighing 150 kilograms (330 lb) with a Thomson-SF proximity fuze. The Sea Eagle is said to initially employ the same warhead. A new high-explosive warhead is under development by the Royal Armament Research and Development Establishment for the Sea Eagle. It is also possible that a nuclear warhead could be integrated with this missile.



P.3T Sea Eagle

Source: Matra

Variants/Upgrades

The four main missiles mentioned within this report are the AS.37/AJ.168 MARTEL, P.3T Sea Eagle, and P.5T. The Golden Eagle, a development of the Sea Eagle, was offered to meet the United Kingdom's CASOM requirement.

The UK government contracted with Matra BAe Dynamics in 1996 to initiate a service life extension program for the Sea Eagle missile. The program will extend the Sea Eagle's service life by as much as 10 years past the current 15-year service life. Under the terms of this previously unannounced contract, Matra

BAe Dynamics is working on extending the life of the Sea Eagle's airframe. The company is artificially aging the missile by 10 years to confirm the new extended life. In 1997, the company won a £2.5 million contract to refurbish Sea Eagle gyroscopes as part of the overall service life extension program. The company may also refurbish the Sea Eagle's high-explosive warhead.

For additional information on these missile systems, please see the pertinent entries in the **Program Review** section.

Program Review

Background. The MARTEL program was conceived as a joint British/French effort in 1960. In September 1964, the United Kingdom and France entered into an agreement for the joint development and production of MARTEL. Two versions of the missile were developed: one was anti-radar, and the other was electro-optic. MARTEL is an acronym for Missile Anti-Radar and Television. Prototypes were completed in 1965-66. Production contracts were placed in both the United Kingdom (originally Hawker Siddeley Dynamics, now British Aerospace Dynamics) and France (Engins Matra) in December 1968. Initial operating capability for both variants was achieved in 1972.

Matra and Hawker Siddeley Dynamics developed and produced the air-to-surface MARTEL missile in two versions. Matra produced the AS.37 anti-radar MARTEL for French Mirage IIIE, Jaguar, and Atlantic aircraft, while British Aerospace manufactured the AJ.168 electro-optic guided version for Hawker Siddeley Buccaneers. Both versions share maximum structural and systems commonality.

Despite the fact that the Sea Eagle lost the 1984 competition for the UK Royal Navy's new anti-ship missile, British Aerospace is still actively developing and promoting the missile for this mission.

SSGW. Staff Target (Sea) 7021 calls for the acquisition of a new medium-range anti-ship missile for the Royal Navy's Future Frigates. A conceptual study phase is under way. The new missile, designated Surface-to-Surface Guided Weapon (SSGW), is to have a range of 150-300 kilometers. It will be introduced into service before 2010 and have an expected total in-service life of 35 years. The missile is to be capable of neutralizing or seriously damaging surface ships (of nominal displacement between 1,000 and 4,000 tonnes) fitted

with active and passive defenses. The weapon must also have a capability against fast patrol craft.

Competitors vying to meet the UK's SSGW requirement include Boeing's Harpoon, Saab Missiles' RBS15, Raytheon's modified BGM-109 Tomahawk, MBDA's Exocet, and Naval SCALP (see separate APACHE report in Tab B). The UK Ministry of Defense could select either a subsonic or supersonic solution, although some sources have indicated that the former may be preferred because of its lower cost.

Missile Models. British Aerospace and Matra have manufactured several missile systems that relate to this overall program. The following provides information on these various development/production efforts.

AS.37 Anti-Radar MARTEL. The anti-radar MARTEL uses a passive homing head for terminal guidance to the target. The MARTEL can be preprogrammed if the frequency of the enemy radar is known prior to aircraft launch. When turned on with the missile attached to the aircraft, the seeker sweeps in azimuth until it locates the radar. It locks on and the missile is fired. If the frequency changes en route to the target radar, MARTEL has the ability to continue homing as long as the emitting radar frequency remains within the preselected band. If the frequency of the radar is not known prior to aircraft launch, MARTEL is preprogrammed with an entire frequency band. When it is switched on in flight, it searches within the frequency band for a lock-on. Upon lock-on, it scans 90 degrees in azimuth for the target radar transmitter. The missile is fired when it locates the transmitter and homes to the target automatically. While the AS.37 can be fired at supersonic aircraft speeds, it maintains subsonic speeds to the target. It is versatile enough to be fired between 14.93 meters and 13,990.32 meters (49 ft to 45,900 ft) altitude. At low altitudes, it is able to avoid radar

detection before launch, giving it a considerable stand-off capability.

AJ.168 Electro-Optic MARTEL. This version is command-guided. An electro-optic screen in the aircraft cockpit displays the view seen by a camera in the missile's nose. The camera is panned by the operator for targets. When a target is selected, a graticule is placed over it to allow the television seeker in the missile to lock on. After lock-on, it is fired. The missile maintains altitude during cruise by means of a barometric altimeter. The operator transmits correction signals directly to the missile through a pylon-mounted pod. The pod also receives video signals from the missile and relays them to the operator's electro-optic display and control panel. This version is often called TV MARTEL.

When fired from a stand-off position over land, the electro-optic MARTEL is steered over landmarks until it is within view of the target area. The operator then resumes active control and directs the missile to the target. Electro-optic MARTEL keeps radar contact to an absolute minimum and therefore would most likely be launched at low altitude where the aircraft would be outside radar range detection.

Sea Eagle (P.3T). British Aerospace Dynamics Group announced in August 1979 that the UK Ministry of Defence (MoD) had awarded a contract to complete development and evaluation of a second-generation all-weather, air-launched, sea-skimming, anti-ship guided missile. Subsequently, the MoD committed funding for the full development and initial production of the P.3T, also called the Cruise MARTEL. The missile was formally designated Sea Eagle by British Aerospace in January 1980.

Sea Eagle is a fire-and-forget weapon. The active radar homing head and onboard computer, which were developed by Marconi Space & Defence Systems, enable the missile to be autonomous after launch. Sea Eagle is powered by a derivative of Microturbo's TRI 60 turbojet engine, which gives it a considerable operational range and a stand-off attack capability.

The potential market for Sea Eagle, in the short term, is for RAF Buccaneers, Sea Harriers, Harriers, and IDS Tornados. Estimated production requirement for the Royal Air Force and Royal Navy is 600 units. In January 1983, the MoD awarded a \$300 million contract for the final development and production of Sea Eagle. Shortly thereafter, the first salvo launch of Sea Eagle was successfully completed at the Aberporth range in the United Kingdom.

British Aerospace has made an unsolicited proposal to the UK Ministry of Defence to develop a cruise missile

version of Sea Eagle. This version would use the same engine as the standard Sea Eagle but would have a larger airframe, larger warhead, and greater fuel capacity. A UK-developed TERCOM guidance system would be employed along with new warheads and software.

British Aerospace has also announced that it is studying a supersonic version of Sea Eagle. In early 1987, it was learned that the United Kingdom and France were engaged in secret discussions regarding a nuclear-armed cruise missile; a development of the Sea Eagle was mentioned as one possible delivery system.

P.5T. British Aerospace has developed a ship-launched version of Sea Eagle designated P.5T. This missile can be fitted to most vessels down to 200 tons and can be placed on the same mountings used for the Sea Dart missile. (See separate entry in Tab H.) The missiles are placed in launch boxes in groups of one to six. These launch boxes contain the launching rails and provide maintenance-free environmental protection for the missiles. Two IMI Ltd solid fuel rockets provide the initial acceleration to cruise speed, at which point the Microturbo TRI 60 turbojet sustainer engine takes over. The missiles can be fired singly or in salvos to ensure target destruction. British Aerospace claims that the P.5T can destroy targets at very close ranges at considerable aim-off angles. The first successful launch was conducted in March 1987 at the Aberporth range.

The P.5T was in contention for a contract for the new British ship-launched anti-ship missile. The other contenders were the Exocet in the MM.40 version, OTOMAT, and the Harpoon in the RGM-84 version. Despite the fact that the P.5T Sea Eagle was heavily favored, in April 1984 the Ministry of Defence chose the Harpoon. However, an enhanced Sea Eagle could be offered up to the United Kingdom for its Surface-to-Surface Guided Weapon (SSGW) requirement. The new missile could provide a range of 150-300 kilometers and be introduced in the early 2000s. Potential competitors, other than an enhanced Sea Eagle, include the OTOMAT, RBS15, and a modified BGM-109 Tomahawk.

Golden Eagle. British Aerospace has proposed Golden Eagle for the United Kingdom's CASOM requirement. The Golden Eagle is an evolutionary stand-off weapon system alternative based on the Sea Eagle anti-ship missile. The system is equipped with a Hughes imaging infrared seeker and television datalink. The warhead would be composed of a large tandem charge or kinetic energy penetrator. The warhead size needed to kill hard targets means that other missile subsystems have less room. BAE would shrink avionics and guidance sections, leaving the missile's propulsion section an

off-the-shelf item. The Golden Eagle could eventually be fitted with a series of modular seeker heads including autonomous millimeter wave or synthetic aperture radar

designs. For more information on CASOM, please see separate "MANTIS" entry in Tab H.

Funding

Total program costs for Sea Eagle were estimated at £400 million (US\$495 million) in June 1987 (including £27 million for initial R&D in 1981). Funding figures for the MARTEL program are not available.

Recent Contracts

The latest available information pertains to 1990, when the British Ministry of Defence had ordered a further batch of British Aerospace Sea Eagle anti-ship missiles. The order was worth £37 million (US\$61 million). The total number of missiles being procured was not mentioned.

Timetable

<u>Year</u>	<u>Year</u>	<u>Major Development</u>
AS.37/AJ.168	Sea Eagle	
1960	1975	Concept definition begun
1964	1976	Research initiated
1964-67	1977	Engineering development begun
1967-69	1979-80	Flight testing begun
1969-71	1981	Operational evaluations under way
1972	1983	Initial serial production begun
1972	Late 1985	Initial operating capability
1978		Production limited
1981		Production terminated
	1988-92	Production continued
	1992	Golden Eagle unveiled
	1993	Production terminated
	Late 1996	Sea Eagle service life extension program launched
Late	2000s ^(a)	SSGW introduced

^(a)Estimated

Worldwide Distribution

User Country(s). The following countries have purchased these missiles: **Chile** (Sea Eagle), **France** (MARTEL), **India** (Sea Eagle), **Saudi Arabia** (Sea Eagle), and the **United Kingdom** (MARTEL/Sea Eagle).

Forecast Rationale

European navies are in the process of selecting new anti-ship missiles to arm their surface combatants. Unlike some previous efforts, a common solution to these needs is not being examined. Instead, France, Germany, Italy, and the United Kingdom will select new missiles based on the needs of their own national navies.

In the case of the United Kingdom, a new missile will initially be procured to meet the Surface-to-Surface

Guided Weapon (SSGW) requirements of the Royal Navy's Type 45 destroyers. Options for meeting the Royal Navy's needs include the Harpoon Block II, RBS15 Mk 3, Naval SCALP, OTOMAT, and Exocet.

The United Kingdom is looking for the most cost-effective solution to its need, but may favor those that offer both seaborne and land-attack capabilities. According to reports, the Harpoon Block II is the

preferred solution, but other sources claim that the RBS15 Mk 3 may be gaining favor.

A final decision on SSGW could be made in the near future. Introduction of the missiles will correspond with the service entry of the first Type 45 Daring class destroyer. Officially, the first Type 45 is to enter service in 2007, but the program is said to be behind schedule by as much as two years.

As for the Sea Eagle and MARTEL, production of these anti-ship missiles has long since ceased and will not be restarted. The Sea Eagle and MARTEL missiles are expected to slowly be retired from frontline service by their various operators around the world. The United Kingdom has withdrawn this missile from service with the Royal Navy and Air Force, and now India has announced that it is seeking a Sea Eagle replacement. Both missiles are expected to be superseded by newer systems between now and 2010.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Missile	(Engine)	thru 01	High Confidence Level				Good Confidence Level				Speculative		Total 02-11	
			02	03	04	05	06	07	08	09	10	11		
BRITISH AEROSPACE PLC/DYNAMICS														
AJ.168 MARTEL	CASSANDRE	1065	0	0	0	0	0	0	0	0	0	0	0	0
P.3T SEA EAGLE	TRI 60-1 MODEL 067	523	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal - BRITISH AEROSPACE PLC/DYNAMICS		1588	0	0	0	0	0	0	0	0	0	0	0	0
MATRA/THOMSON-BRANDT														
AS.37 MARTEL	CASSANDRE	3172	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal - MATRA/THOMSON-BRANDT		3172	0	0	0	0	0	0	0	0	0	0	0	0
NOT SELECTED														
UK SSGW	UNSPECIFIED	0	0	0	0	0	0	47	51	60	61	64	283	
Subtotal - NOT SELECTED		0	0	0	0	0	0	47	51	60	61	64	283	
Total Production		4760	0	0	0	0	0	47	51	60	61	64	283	