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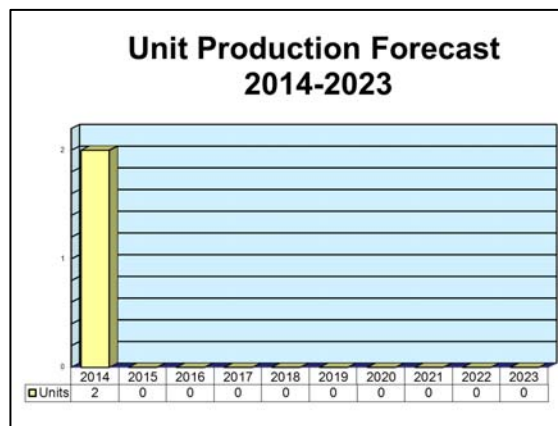
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Arabel

Outlook

- Arabel deliveries are expected to conclude in 2014
- The increased competition from newer rivals featuring more advanced capabilities has killed demand for the radar
- A slim chance remains for further sales, but this is unlikely. No additional orders are forecast



Orientation

Description. X-band, 3-D phased-array radar developed to provide target acquisition, tracking, and illumination for naval SAAMs (surface-to-air anti-missiles) and the ground-based SAMP (Surface-Air Moyenne Portee).

Sponsor

Delegation Generale pour l'Armement (DGA)
10/14 Rue St. Dominique
F-75997 Paris Armees
France

Licensee. No licenses are known to have been issued for the Arabel system.

Status. In production and service.

Application. Arabel provides 3-D general surveillance, target acquisition, target tracking, illumination, and missile guidance for the SAAM / SAMP missile systems. These are a modular air defense weapon system to be used by all three French services and the Italian Army along with the Aerospatiale ASTER missile. The weapons will be used to defend armored formations, shipping, air bases, and other valuable or high-profile targets from high-speed, saturation missile strikes in the severe electronic environment of the future.

Price Range. Based on the price of similar systems, the Arabel is thought to range in price from \$27 million to \$35 million.

Contractors

Prime

Thales Air Systems SA	http://www.thalesgroup.com , 7/9 Rue des Mathurins, Bagneux, 92221 France, Tel: + 33 1 40 84 40 00, Fax: + 33 1 40 84 33 81, Email: info.tad@fr.thalesgroup.com , Prime
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Arabel

Technical Data

Characteristics	<u>Metric</u>	<u>U.S.</u>
Frequency	X-band	
Range (aircraft)	70 km	37.7 nm
Range (missiles)	20 km	10.7 nm
Rotation rate	60 rpm	
Guidance channels	16	
Targets traceable	50	
Elevation coverage	-10 to +75 degrees	

Design Features. Arabel is a multifunctional, 3-D, X-band radar featuring a phased-array antenna mechanically scanned in azimuth. The beam is 2° wide and can scan up to 70° in elevation. The transmitter can hop frequencies over 10 percent of the frequency range. Power output, signal format, and other, higher functions are controlled by software.

Operational Characteristics. Arabel's omnidirectional coverage will enable all-round defense against saturation attacks. The radar can locate and accurately track more than 50 targets. The Arabel utilized in both SAAM and SAMP deployments will share similar processors, displays, and interfaces. Software is customizable as an option, and the Arabel SAAM/SAMP combinations are capable of integration with a range of communication and identification friend or foe (IFF) systems.



Arabel Radar as Seen as Part of the SAMP/T System

Source: Eurosam

Variants/Upgrades

Naval Arabel. The naval SAAM system uses the Arabel radar to direct ASTER 15 missiles, and is intended for point defense against sea-skimming anti-ship missiles coming from several directions at speeds of up to Mach 2.5 and maneuvering at up to 15g. Missiles on diving trajectories are also able to be intercepted, and the system has an additional anti-aircraft capability. The radar antenna is mounted at least 25 meters above the water line. Maximum range of the ASTER 15 is 15 kilometers, compared to the 20 to 30 kilometers of the ASTER 30. Thales says the system is suitable for deployment on vessels down to 2,000 tons.

Land Arabel. The land-based Arabel variant is adapted to match the increased performance of the ASTER 30 missile over the ASTER 15 missile. Thales states that the radar has improved electronics compared to the naval version.

Used in the SAMP/T missile defense battery, Arabel is mounted on a cross-country vehicle, usually a Renault TRM10000 6x6-type truck. The SAMP/T system is intended as an area defense weapon able to deal with saturation attacks by aircraft in conditions of heavy electronic countermeasures. The ASTER 30 is utilized as an anti-tactical ballistic missile system to intercept low-altitude standoff dispenser systems and other air-to-surface missiles, including those with anti-radar capability.

The SAMP/T and its Arabel radar are air transportable (C-130, Transall, etc.) and are able to deploy within 45 minutes of unloading. A typical firing unit carries six to eight rounds (launch and reload rounds) and is supplemented by the Arabel radar vehicle. The vehicle will control four fire units and have dual-redundant circuitry. The Arabel's antenna is retractable into the vehicle-mounted radar shelter.

Program Review

Background. The Arabel radar arose out of a feasibility study conducted by the U.K., France, and Germany under the defunct designations SA-90 and SAN-90. Following program failure, France continued alone. Primarily envisioned as an air defense system, SAAM/SAMP is based on the MBDA ASTER missile, which has applications for ground and naval air defense.

Arabel Selected by French Navy

By 1988, Arabel had been selected as the prime air defense system sensor for the French aircraft carrier *Charles de Gaulle*. It was also announced that Arabel would be installed on La Fayette class frigates.

Italy Wants Its Fair Share

In 1989, Aerospatiale, Thomson-CSF (now Thales), and Selenia created the Eurosam consortium, which took overall responsibility for the development of the Family of Anti-Air Missile Systems (FAAMS). Italy and France decided to merge the ASTER 15 and IDRA missile development programs under an effort called ASTIDRA, although this did not include the FAAMS project. The main obstacle to this merger was Italy's desire for a 50-50 work split. The French were reluctant to agree to this over concerns that it would entail unacceptable delays.

The French proposed the ASTER 15 for both nations' requirements, with minimum Italian participation. However, time was running out for the inclusion of new ASTER partners, since a 1995 deadline would not allow much time for disagreements. Furthermore, the program was rapidly approaching the point after which it would be impossible to incorporate new ideas. Eventually, Aerospatiale and Thomson-CSF signed an agreement with Italy's Selenia on FAAMS development, and the Italian forces used the EMPAR radar in their SAAM systems (SAAM is the operational name of the system derived from the FAAMS program).

London and Madrid Calling

After some delay, the U.K. and then Spain joined the FAAMS program instead of the U.S.-sponsored NATO Anti-Air Warfare System (NAAWS) effort. The ASTER 30 missile would fulfill the U.K.'s and Spain's Local Area Missile System (LAMS) requirement and arm the Royal Navy's new Air Defense Frigates. Eurosam was to commence a LAMS project definition study, with the U.K. expected to fund 70 percent of the \$45 million cost. Spain would fund the remaining 30 percent. In return, the two countries would receive compensatory work on Eurosam's FAAMS. Subsequently, Spain withdrew from this agreement because its workshare was deemed inadequate.

Arabel

Arabel/ASTER Score a Direct Hit

Prototype trials took place between 1989 and 1994. Site testing of the first production-standard Arabel fire control radar started in 1993. Launches using a complete prototype ASTER naval system took place as planned in 1995. Firing trials of the naval ASTER 30 occurred in 1996-1997.

The first Arabel production model was delivered in 1997 for installation on the *Charles de Gaulle*. Sea trials were conducted by the French Navy's *Ile d'Oléron* testbed vessel starting in 1997 and were completed by 1999. In 1999, the Arabel/ASTER missile firing system achieved a milestone when it successfully intercepted a C22 drone maneuvering and flying at nearly Mach 1, approximately 50 meters above sea level.

First Export Customer: Saudi Arabia

In 1994, France and Saudi Arabia signed the Sawari II (La Fayette class) contract for F3000S frigates. In mid-1997, Thomson-CSF received its first export order for the Arabel/ASTER 15 missile combination from Saudi Arabia. The Saudis ordered a third F3000S frigate and requested that the Arabel be installed on its earlier two F3000S frigates. The first-in-class, *Al Riyadh*, was presented to the Royal Saudi Navy in July 2002.

Arabel's ability to acquire and track a target was proven when the Eurosam missile systems aboard the three Saudi Sawari II frigates were tested. Three tests performed in 2004 scored direct hits on the incoming targets. In April 2004, Thales presented the second-in-class, HMS *Makkah*, to the Royal Saudi Navy.

Operational/Dual Configuration

France and Italy ordered the first two SAMP/T systems in 1998 as part of the HAWK replacement program. The Arabel radar for the SAMP/FR is positioned on top of its control center, which is mounted on a heavy-duty truck frame.

OCCAR (Organisation Conjointe de Cooperation en Matiere d'Armement), the European procurement agency, issued a EUR3 billion (\$3.5 billion) contract in November 2003 for SAMP/T ASTER air defense systems. The order covered the production of 18 SAMP/T ASTER Block 1 missile batteries for the French Air Force and Army (12) and Italian Army (six). Unlike the SAMP/FR and SAMP/IT, both France and Italy use the Arabel radar with their SAMP/T land-based systems.

In July 2005, the first qualification firing of the ASTER 30 SAMP/T system took place at the Landes

test range, which belongs to the French DGA's CELM (Centre d'Essais de Lancement de Missiles) missile testing facility. This marked the first combined use of all the SAMP/T's system elements: the target engagement module, the Arabel radar and target identification module, the vertical launcher, and the ASTER 30 munition. The firing scenario demonstrated the SAMP/T system's ability to intercept a threat posed by a combat aircraft, in this case simulated by a C22 target flying at 7,000 meters. The target was intercepted at a range of 26 kilometers and an altitude of 7,000 meters. The ASTER 30 made a direct hit.

A second SAMP/T trial took place in December 2005. Arabel acquired and tracked the target, with the final interception taking place at an altitude of 500 meters and a distance of 10 kilometers from the launcher. The ASTER 30 registered a direct hit on the target. A third successful test firing took place in November 2006. This test strove to be representative of a medium-range interception of a self-screening jamming aircraft.

Thales started Arabel deliveries for the SAMP/T program in 2007. In May 2008, the Italian Army performed two successful ASTER 30 firings at the PISQ (Poligono Interforze Salto di Quirra) test range in Sardinia. In July 2008, the French Air Force (FAF) carried out an ASTER 30 firing trial that was configured to represent a long-range interception of a subsonic aircraft flying at high altitude. The SAMP/T operated in an integrated mode with the French Air Defense System. In December 2008, Eurosam fired the SAMP/T system at the CELM test range in Les Landes. This firing tested the new Arabel software version that took into account the results of the year-long technical-operational evaluation program. This December firing preceded the delivery of the first serial SAMP/T system to the FAF.

Possibility in the Middle East

In August 2004, a defense white paper released by the government of Brunei outlined the need to upgrade its medium- and long-range air defense capabilities. The Eurosam SAMP/T system is capable of fulfilling this requirement. If SAMP/T were to be selected, then either Arabel or the Finmeccanica EMPAR could be chosen for the radar portion. Brunei currently operates 12 aging Rapier fire units and Mistral MANPADS. Nothing further has been reported regarding this sale.

Arabel Losses

In December 2006, Denmark selected the Thales Nederland anti-air warfare (AAW) suite for its new offshore patrol vessels. The AAW suite consists of one SMART-L radar, one active phased-array radar system, and one fire control cluster.

Arabel

In other activity, the U.K. Ministry of Defence reported in August 2008 that its two new Royal Navy aircraft carriers would sail with the BAE Systems ARTISAN radar. Thales reported in February 2009 that the company's S1850M radar would also be installed on the new aircraft carriers.

Military Procurement International reported in May 2009 that Finland would replace 18 SAM systems with Kongsberg's Norwegian Advanced Surface-to-Air Missile System (NASAMS). NASAMS was selected over the Eurosam SAMP/T.

Thales Introduces Global MultiShield

The June 2007 issue of *Defense Technology International* reported that Thales was promoting a multilayer concept known as Global MultiShield. Global MultiShield uses Eurosam's SAMP/T as the outer and upper layer against threats such as theater ballistic missiles (TBMs). SAMP/T, with its Arabel radar, is integrated with a second system based on the new SHIKRA radar. The third innermost layer of the MultiShield concept includes the new Gerfly radar.

Integrating SAMP/T with Other Radars

In June 2009, *Defense News* reported that Thales had offered an extensive technology transfer package to South Korea in order to beat Israel Aerospace Industries' subsidiary, Elta Systems, in a ground-based radar competition. According to *Defense News*, Thales will transfer "G-1000" radar information; the report says that the G-1000 is the radar being supplied to the SAMP/T system being delivered to the French and Italian armies. Thales added that the GS1000 (Ground Smarter 1000) radar can also be deployed in association with the SAMP/T weapon system.

Earlier, in March 2009, *Defense News* had reported that Europe was interested in an improved SAMP/T ASTER system. The first stage would be a Block 1 NT (new technology) standard, and a Block 2 version would follow. The improved performance would partially result from the use of a new radar to tackle smaller, faster, and longer-range ballistic missiles. A spokesperson for the Delegation Generale pour l'Armement (DGA) said that France's contribution to NATO's layered missile defense will be the SAMP/T battery, the air defense command-and-control system, and the Thales M3R radar.

At the 2009 Paris Air Show, Thales announced that the company was pursuing development of the Ground Smarter 1000 mentioned above, a new radar incorporating M3R active antenna technology. The combination of the GS1000 and the SAMP/T missile system will provide an autonomous advanced TBM capability.

Arabel and SAMP/T Deliveries

In May 2009, the DGA delivered the first Arabel-equipped SAMP/T systems to the French Air Force. The SAMP/T was christened MAMBA by the FAF. Eurosam reported that the fourth SAMP/T system was delivered in November 2010. In May 2011, the DGA delivered the fifth MAMBA to the FAF, and by November 2011, the FAF owned seven. The final unit, the 11th was delivered in January 2014.

In October 2010, Eurosam performed a system firing at the DGA test range in Biscarrosse; the target was representative of a medium-range ballistic missile, and was intercepted at the intended range. The SAMP/T system (MAMBA) combines the Arabel radar, a real-time engagement module, and the ASTER 30 missile.

Funding

For the period up to 1988, funding of \$247 million (FRF1.5 million) was provided about equally by the three parties involved in the SAAM/SAMP program (Thomson-CSF, Aerospatiale, and DGA), the initial agreement for which can be traced back to 1982-1983.

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (EUR billions)</u>	<u>Date/Description</u>
Eurosam	3.0	Nov 2003 – Contract from OCCAR for series production of the SAMP/T ASTER air defense system. The order covers the production of 18 SAMP/T ASTER Block 1 missile batteries for the Italian Army, the French Army, and the French Air Force. All 12 units for the French Air Force will be equipped with the Arabel radar system.

Arabel

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Apr	1988	Arabel development contract announced; Franco-Italian joint development agreement
Oct	1989	FAAMS selected for U.K. Royal Navy
	1992	Arabel split into two radars
	1998	French and Italian armies order first two ground-based Arabel radars
Jan	1999	Arabel/ASTER missile-firing system intercepts C22 drone maneuvering and flying at nearly Mach 1 approximately 50 meters above sea level
	1999	Arabel enters service on French aircraft carrier
	1999	Ground-based Arabel enters service
Nov	2003	Eurosam receives order for 18 SAMP/T batteries. Twelve to be equipped with Arabel
Spring	2007	Start of year-long technical-operational evaluation
	2007	Thales delivers first Arabel radar for SAMP/T
Summer	2008	End of year-long technical-operational evaluation
May	2009	First SAMP/T delivered to French Air Force
	2009	SAMP/T enters operational service
Jan	2014	Deliveries to French Air Force to conclude
	2014	Possible end of Arabel radar production

Worldwide Distribution/Inventories

Arabel is used by the **French armed forces** on the SAMP/T and has been installed on the La Fayette class frigates and the *Charles de Gaulle* aircraft carrier. The **Italian Army** uses the Arabel on its SAMP/Ts. The **Saudi Arabian Navy** has fitted Arabel on its three Al Riyadh class frigates.

Forecast Rationale

In 2014 – nearly three decades after program development began – production of the Arabel radar is expected to conclude. As of January 2014, France had received its 11th and final Arabel-equipped MAMBA (SAMP/T) system. Meanwhile, Italy is also expected to receive its final SAMP/T system sometime in 2014.

There is a slight chance that the Arabel could be produced going forward. The SAMP/T missile defense system has been announced as a shortlist candidate for Poland's AMD (advanced missile defense) requirement. If the aging system can win the contract over rivals like

MEADS, it would mean a few more years of production.

The chances of the SAMP/T being selected along with the Arabel radar are slim, though. A recent SAMP/T contract from Singapore specified Thales' Ground Master 200 instead of the Arabel. Because of the radar's older architecture and its inherent reduced capabilities versus modern systems, any future SAMP/T sales are not likely to include the Arabel.

Due to these circumstances, no Arabel production is forecast beyond 2014.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence					Good Confidence			Speculative		
	Thru 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Thales Air Systems SA												
Arabel <> France <> Air Force <> MAMBA												
	10	1	0	0	0	0	0	0	0	0	0	1
Arabel <> Italy <> Army <> SAMP/T												
	5	1	0	0	0	0	0	0	0	0	0	1
Subtotal	15	2	0	0	0	0	0	0	0	0	0	2
Total	15	2	0	0	0	0	0	0	0	0	0	2