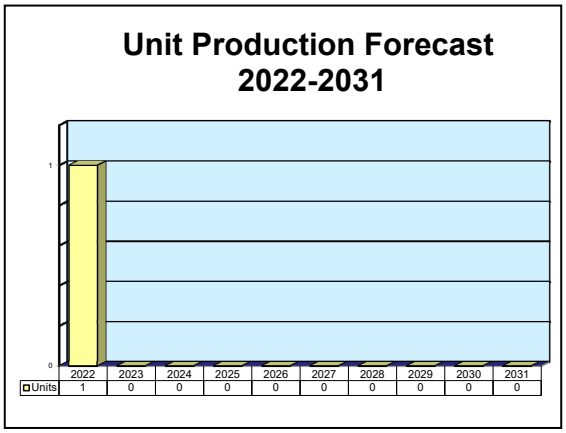
Herakles

Outlook

- Aquitaine class, French-variant FREMM vessels carry the Herakles radar as standard equipment
- Production will end in 2022 with delivery of the final French air defense FREMM
- No further sales are expected



Orientation

Description. The Herakles is an E/F-band (S-band), 3D active phased-array radar intended to provide surveillance and local air defense coverage.

Sponsor

Delegation Générale pour l'Armement
10/14 Rue St. Dominique
F-75997 Paris Armées
France

Status. In production and service.

Application. The Herakles provides long-range air and surface surveillance, wide-area protection, and deployment of air defense and anti-surface weapons. It performs detection, acquisition, and tracking of all target profiles, including stealth missiles and anti-radiation missiles (ARMs). The Herakles can control all types of active or semi-active surface-to-air missiles and is fully compatible with MBDA ASTER 15 and ASTER 30 missile systems. The Herakles is designed to be used as the sole radar on board vessels of frigate size. The Herakles also functions as the main radar in conjunction with long-range radar for specialized applications.

Price Range. Forecast International estimates it costs between $22.5 million and $32.5 million to outfit a ship with the Herakles radar.

Contractors

Prime

Thales Air Systems SA	http://www.thalesgroup.com, 3 Avenue Charles Lindbergh, Rungis, France, Tel: + 33 1 79 61 40 00, Email: info.tad@fr.thalesgroup.com, Prime

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

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Technical Data

	Metric	U.S.
Characteristics		
Antenna type	Active phased array, two-axis monopulse	
Frequency	E-/F-band	S-band
Range (3D air domain)	250 km	135.0 nm
Range (surface domain)	80 km	43.2 nm
Coverage		
Range	0 km - 250 km	0 mi - 135.0 nm
Azimuth	360°	
Elevation	0° - 70°	
Rotation rate	60 rpm	
Track capacity	>400	

Design Features. The Herakles is a multifunctional, 3D, E/F-band radar equipped with a two-axis electronically scanned antenna. Its 60-rpm rotation speed provides accurate tracking of highly maneuverable targets. It has all-solid-state technology and redundant architecture to provide graceful degradation in order to maintain full operational performance during critical mission phases. The Herakles has an integrated uplink for missile guidance and, as an option, can be equipped with identification friend or foe (IFF) systems. Integrated IFF with Mode S and Mode 5 is available for NATO countries, or with another National Secure Mode for non-NATO countries.

The system consists of an antenna, a local console, and two cabinets. One cabinet is the direct drive amplifier, while the other contains the radar signal generator, the high-dynamic reception unit, and the radar processor.

Operational Characteristics. The Herakles provides all-weather 3D coverage, and it can locate and accurately track more than 500 targets simultaneously. Thales states that the Herakles has excellent performance in brown and blue water operations and is designed to be the sole radar on multimission corvettes or frigate-size vessels. The Herakles can also be used in conjunction with long-range radar for specialized applications, such as on anti-aircraft warfare (AAW) vessels.

The French FREMM Aquitaine class frigates carry the Herakles radar.

Source: U.S. Navy, Mass Communication Specialist 3rd Class Molly Greendeer

Variants/Upgrades

Herakles. The standard Herakles was installed on all but the final two French Navy FREMM (Frégate Européene Multi-Mission) vessels. The configuration on the final two French Navy FREMMs is also known as the FREDA, and is optimized for an anti-air role.

"Augmented" / "Boosted" / "Improved" Herakles. The final two Herakles radars, which will operate on board the air defense variant of the French Navy's FREMMs (known as FREDA or FREMM DA ships), have alternatively been called the "Augmented," "Boosted," or "Improved" Herakles. For these units, Thales increased the number of transmit/receive modules, added new algorithms/waveforms, and added a volume search/watch mode. Additionally, the shipbuilders have reduced the mast's diameter to minimize blind spots in the radar's arc.

Program Review

Background. Thales engineers began development of Herakles in early 2000 to fill the need for an S-band multifunction radar that was fully compatible with MBDA's ASTER missiles. Thales already produced the Arabel fire control radar, optimized for surface-to-air anti-missile (SAAM) missiles. The first Herakles prototype was tested in mid-2003 at a Thales facility, and then later at a French Armament Procurement Agency (DGA) missile test range facility.

Asian Win: Singapore's Formidable Class

By early 2000, Thales had received an order for six Herakles systems. In January 2004, France's DCN Shipyard launched the first new 3,200-ton-displacement stealth frigate for the Royal Singapore Navy under Project Delta. The first Herakles radar was delivered in 2004, and the first Herakles sea trials took place aboard a Singaporean frigate in November 2005.

The RSS *Formidable* was delivered to Singapore in July 2005. The remaining five vessels were built locally by Singapore Technologies Marine (ST Marine). The last-in-class RSS *Supreme* was launched in May 2006. Thales earlier reported that five of the six radars had been delivered. The sixth radar was likely delivered in mid-2007, and French shipbuilder DCNS (now Naval Group) delivered the sixth and last Formidable class frigate to the Singapore Navy in August 2008. In January 2009, RSS *Stalwart* and RSS *Supreme* entered service with the Singapore Navy.

European Win: FREMM

In November 2002, Italy and France signed a cooperative agreement to construct multimission frigates. Then, at Euronaval 2004, the French and Italian defense ministers signed a Declaration of Intent to develop and construct 27 FREMM frigates. Also in 2004, the French Navy selected the Herakles for its FREMM frigates. The Italian frigates were to sail with the Italian SELEX Sistemi Integrati EMPAR (European Multifunction Phased Array Radar). Deliveries for the FREMM program were expected to commence circa 2011 (France) and end in 2015.

Thales representatives stated at the time that the first radar was to be delivered by mid-2008. But the Italian government faced funding difficulties, and there is some doubt as to whether all 27 FREMM frigates were built. While France found funding easier to obtain, its spending priorities changed, leading to a smaller FREMM class size.

First International FREMM – Morocco

In April 2008, DCNS confirmed that the FREMM contract with the Royal Moroccan Navy had been finalized. The "first cut" ceremony for Morocco's FREMM was held in December 2008. Morocco received one frigate with a simplified weapons and electronics fit; however, it was equipped with the Herakles radar.

Algeria May Buy Italian

In early 2008, France and Algeria were in talks regarding Algeria's purchase of four to six FREMM frigates. But in September 2009, news surfaced that Algeria was then looking to Italy for its frigates. Notably, Italian FREMM frigates were equipped with EMPAR. The deal with Algeria may also involve Leonardo helicopters. *Defense News* (August 2009) reported that Italy was offering two Maestrale 2000 frigates. The Maestrale 2000 was a new design that drew from the Maestrale class and FREMM frigates.

Greece Wants FREMMs

The Defense Ministry in Athens announced in January 2009 that it wanted up to six French DCNS FREMM frigates, to be built at Elefsis Shipyards in Greece. In April 2008, DCNS opened its first Greek office, in Athens. DCNS and Elefsis Shipyards signed a cooperation agreement in 2006.

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Military Procurement International listed the losing bidders for the Hellenic Navy competition as Germany's ThyssenKrupp Marine Systems (teamed with its subsidiary Hellenic Shipyards), the Netherlands' Schelde Naval Shipbuilding, Denmark's Odense Shipyard, Russia's Rosoboronexport, and Spain's Navantia.

Defense News disclosed in April 2009 that Greece was the first country to be cleared by France for the potential purchase of the naval version of the SCALP cruise missile for its planned buy of FREMM frigates. The statement came from MBDA Group Director for Exports Jean-Luc Lamothe at the Latin America Aerospace & Defense Conference and Exhibition (LAAD 2009).

Defense News reported in September 2010 that French industry executives were hoping the Hellenic Navy would sign a contract for FREMM warships in 2012. Discussions on industrial cooperation are critical, and Greece expected to complete much of the work in local shipyards. Talks have centered on an order for four ships and options for two additional frigates.

Will France Fund a New Aircraft Carrier?

France has considered financing a new aircraft carrier – the Porte-Avions 2 (PA2) – as the country currently has only one, the nuclear-powered *Charles de Gaulle*. The PA2 project was awarded to the MO-PA2 consortium of DCNS (now Naval Group) and Thales. DCNS has displayed a PA2 model with the Herakles long-range radar and the SMART-S medium-range radar, both produced by Thales.

However, the status of the PA2 project has become uncertain. In November 2008, *Defense News* quoted DCNS CEO/Chairman Jean-Marie Poimboeuf as saying that the PA2 had not been canceled, just postponed until 2011-2012. Since that time, no further conclusive statements have been made.

France views itself as a naval power; consequently, it is unlikely the country would allow itself to lack an operational aircraft carrier. On the other hand, defense funds are limited. If the PA2 is built, the Herakles is apt to make the equipment list.

Three More FREMMs for France

In October 2009, a contract was awarded for three additional FREMM vessels, bringing France's total order to 11, scheduled for delivery from 2012 to 2022. Then, in April 2010, Thales signed a contract to equip these additional three FREMMs with radar, IR search-and-track (IRST), sonar, and communications systems.

Thales reported in May 2010 that its hardware was on board the first-in-class FREMM *Aquitaine* as it was put in the water in preparation for testing. Thales systems on board the *Aquitaine* include a bow and towed array sonar suite, the Herakles, and the Artemis IRST system, as well as electronic warfare and communications systems.

Saudi Arabia Has a Shopping List

MPI reported that the Royal Saudi Navy was looking to procure four to six Franco-Italian FREMM frigates for EUR3 billion ($3.78 billion) to replace its older Medina class (Sawari 1) frigates. In addition, the Saudi Navy was looking to DCNS for replacements for four Badr class corvettes and nine Al Siddiq class patrol boats, while also considering the introduction of about six DCNS Marlin submarines.

In September 2009, *Defense News* quoted a defense executive as saying that the French were in discussions with Saudi Arabia regarding the Saudis' procurement of three FREMM frigates.

Although news has been scant since then, Forecast International believes that there is still a possibility for FREMM (and Herakles) sales to Saudi Arabia.

Morocco Will Be Sailing a FREMM

Morocco's single FREMM frigate received a simplified weapons and electronics fit, but was also equipped with the Herakles radar.

Egypt Buys the FREMM

In February 2015, reports emerged that Egypt was purchasing a FREMM vessel. The ship would be equipped to French specifications, and would thereby include the Herakles radar.

In order to expedite delivery – with approval from France – DCNS rerouted the previously France-destined D-651 *Normandie* to Egypt. For Egyptian service, the ship became FFG-1001 *Tahya Misr*; after some modification, it was delivered to Egypt in June 2015.

FREMM ER

Revealed in 2012, the reimagined FREMM ER variant, in contrast to the FREMM, features a more modern, integrated mast concept. This means that the ship's sensors are contained within a single, monolithic structure. In this configuration, the rotating Herakles radar has been replaced by a non-rotating, four-plate array radar known as the Sea Fire 500.

As of October 2016, the updated ship's design was finalized, and it was being actively marketed. Since that time, little has been heard of the project; indeed, it seems as if Naval Group has shifted its sales focus to a new, slightly smaller vessel, the 4,000-ton Belh@rra, also known as the FTI.

If the FREMM ER design succeeds in gaining customers, the Herakles will experience significantly reduced demand. Realistically, if the FREMM ER were to launch, it could mean the end of Herakles orders.

Contracts/Orders & Options

Contractor	Award ($ millions)	Date/Description
Armaris & Orizzonte Sistemi Navali (a)	4,000	Dec 2005 – OCCAR issued a contract for eight FREMM ships to be built for the French Navy. Of the eight ships, six were to be configured for anti-submarine warfare and two for land attack. Deliveries were to begin in 2011 and be completed in 2015.
DCNS	Not disclosed	Apr 2008 – A contract from the Royal Moroccan Navy for one multimission frigate based on the FREMM design. Terms, value, and delivery date were not disclosed.
DCNS	Not disclosed	Oct 2009 – An order for an additional three new vessels under the European FREMM program. This brought France's total order to 11 vessels, scheduled for delivery between 2012 and 2022.
Thales	Not disclosed	Apr 2010 – Contract to equip France's additional three FREMM frigates with radar, IR search/track, sonar, and communications systems.

(a) Armaris shareholders are DCN (now Naval Group) and Thales. *Military Procurement International* reported that DCN would receive 55 percent of the contract value ($2.2 billion) and Thales 20 percent ($800 million).

Worldwide Distribution/Inventories

The **Singapore Royal Navy** has fitted the Herakles on its six Formidable (Project Delta) frigates. FREMM frigates of the **Egyptian Navy**, **French Navy**, and **Royal Moroccan Navy** are equipped with the Herakles.

Note: *Italian FREMM frigates sail with the EMPAR or MFRA (Kronos MFRA), not the Herakles.* ***Egypt*** *has purchased one FREMM with the Herakles and two with the MFRA.*

Forecast Rationale

The Herakles radar equips all French-spec FREMM frigates – for which Egypt, France, and Morocco have placed orders. Given their performance and popularity, FREMM vessels could garner additional sales, but with France moving forward with the purchase of a new frigate type, continued production is not expected.

Algeria and Saudi Arabia were rumored to be interested in the FREMM (and its Herakles radar). Saudi Arabia was said to be particularly interested, with a deal near completion, but this has since fallen through. Italy renewed the push to sell the FREMM to Saudi Arabia, with a vessel visiting the kingdom in 2019, but if any deal emerges as a result of these efforts, it will mean a sale of the EMPAR or MFRA and not the Herakles.

Herakles sales are also impacted by development of the FTI/FDI (also known as the Belh@rra). The Belh@rra, in the 4,000-ton class, is smaller than the FREMM and features an alternative radar, Thales' Sea Fire. This combination could prove interesting to naval forces that do not require a vessel as large or expensive as the FREMM. In France, the vessel has been selected as the basis of the Admiral Ronarc'h class, whose acquisition has replaced the planned procurement of the final three FREMM vessels.

Although no new sales of the FREMM have materialized in the past few years, the ship and its radar are very capable and have the potential to win procurement contests. While a deal with Saudi Arabia now seems unlikely, there is still a slight chance that

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other customers will emerge. For some time, though, no country has surfaced as a serious buyer of the French FREMM, and this bodes poorly for future sales of the Herakles.

At press time, Forecast International does not foresee any additional customers for the French-spec FREMM and its Herakles radar, although a small chance for new orders remains.

Note: *The production forecast indicates the year of commissioning of the Herakles' platform.*

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
Thales Air Systems SA												
Herakles <> France <> Navy <> FREMM Note: Schedule is Based on Ship's Commissioning Date												
	7	1	0	0	0	0	0	0	0	0	0	1
Total	7	1	0	0	0	0	0	0	0	0	0	1