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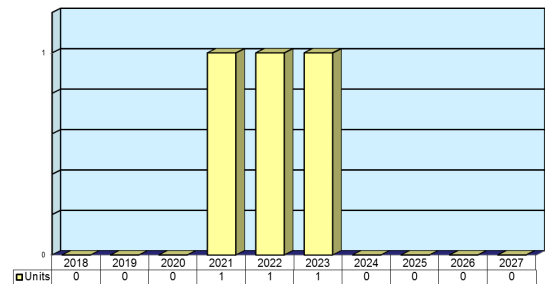
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Integrated Mast

Outlook

- The I-Mast order book is currently empty, and no further full mast systems are expected
- All production that is currently forecast is either for the IM400's SMILE/Sea Master 400 or SEASTAR / Sea Watcher 100 radars

Unit Production Forecast
2018-2027



Orientation

Description. The Thales Integrated Mast (I-Mast) is a family of various-size mast structures that accommodate all the major radars, sensors, and antennas of a naval vessel within an integrated structure.

Status. In production.

Total Produced. By February 2017, five IM400s had been built.

Application. The I-Mast is for naval vessels.

Platform. The I-Mast family consists of a series of different-sized masts that are each intended for a different class of naval vessels.

Price Range. Forecast International estimates the price of an I-Mast structure to range between \$15 million and \$33 million, depending on the variant and the quantity purchased. Other factors that affect pricing include software, training, spares, logistics support, and documentation.

In December 2007, Thales signed a EUR125 million (\$187 million) contract with the Netherlands Defense Materiel Organization (DMO) for the development and supply of four IM400 units. If 50 percent is allocated to development, then each IM400 would cost \$23 million.

Contractors

Prime

Thales Nederland BV

<http://www.thalesgroup.com>, Zuidelijke Havenweg 40, Hengelo, Netherlands,
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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Integrated Mast

Technical Data

	<u>Metric</u>	<u>U.S.</u>
IM 400		
Frequency band - Volume Search	E/F-band	
Maximum range	250 km	155 mi
Minimum range	300 m	984 ft
Elevation	70 deg	
Frequency band - Surface Search	I/J-band	
Maximum range	40 km	24.85 mi
Minimum range	80 m	262 ft
System weight (typical)	52 tons	
Footprint (typical) x Height (typical)	8 m x 8 m x 13 m	26 ft x 26 ft x 42.65 ft
IM 100		
Footprint (typical) x Height (typical) (a)	5.5 m x 5.5 m x 11 m	18 ft x 18 ft x 36 ft

(a) Data from *Naval Forces*, Issue IV, 2010.

Design Features. Each I-Mast housing is designed to accommodate a naval vessel's major radars, sensors, and antennas. Each I-Mast configuration replaces approximately 20-25 previously separate stand-alone radar and communication antennas, and integrates their combined functionalities into a single turnkey package.

The radars in the I-Mast are nonrotating, four-faced, active phased-array radars. The four faces operate simultaneously; therefore, the radars achieve four times more on-target time than would be achieved by a single rotating radar. The main components of the I-Mast 400 installation are the E/F-band volume search radar, the I/J-band surface search radar, the nonrotating Mode 5 / Mode S identification friend or foe (IFF) system, the electro-optical security system, the communications suite, the radar, and the communication electronic support measures (ESM). The following are two examples of I-Mast radars.

Sea Master 400. Sea Master 400 is a nonrotating, four-face phased-array volume search radar operating in the E/F-band. The Sea Master 400 is derived from the Thales SMART-L, SMART-S Mk 2, and APAR systems. The Sea Master 400 simultaneously provides the required air surveillance, helicopter control, surface surveillance, and weapon control functions. The system has been designed for defense against asymmetric threats. The radar system provides reliable target data at both short and long ranges. Sea Master 400 is the nomenclature for international contracts, and SMILE is the name used for domestic sales.

Sea Watcher 100. Sea Watcher 100 is a nonrotating I-band active phased-array radar for naval surface

surveillance. The system automatically detects and tracks asymmetric threats and very small objects such as swimmers and periscopes in all weather conditions. It operates in littoral, open ocean, and harbor environments. The Sea Watcher 100 can also be used for helicopter guidance. Sea Watcher 100 is the nomenclature for international sales, while the name Seastar is used for domestic contracts.

Typically, most sensors in an I-Mast installation are produced by Thales. However, it is possible to use third-party hardware in an I-Mast installation.

Operational Characteristics. All sensors, radars, and antennas in the I-Mast housing have a full 360-degree field of view. In addition, they are developed so as to operate simultaneously without interfering with each other.

I-Mast eliminates nearly all of the antennas and sensors found on most flat topside surfaces of a naval vessel. In addition, the I-Mast structure also houses all processing cabinets, leading to savings of below-deck space and the elimination of the cabling problems associated with a traditional topside design.

The I-Mast turnkey package arrives at the shipbuilding site as a complete unit, with all equipment installed, tested, and integrated.

Nonrotating radars require less maintenance, and the I-Mast design permits maintenance to be performed in the sheltered environment of the mast. Therefore, the crew is no longer required to wait until weather conditions are safe enough to perform maintenance.

Integrated Mast



IM400 Integrated Mast on a Royal Dutch Navy Holland Class Patrol Vessel

Source: Thales

Variants/Upgrades

IM50. This is the smallest Integrated Mast variant.

IM100. This configuration is designed for corvette-size vessels.

IM400. This was the first member of the Integrated Mast family and is designed for midsize vessels, such as ocean patrol vessels.

IM500. This configuration is designed for larger warships.

Sea Master 400 (SM400). Also known as the SMILE, this radar provides long-range air and surface surveillance service for the IM400 integrated mast. The radar is composed of four active phased array (AESA) panels operating in the E-/F-bands (S-band) that possess

a 250-km (135-NM) instrumented range with surface target capability out to 70 km (38 NM).

Apart from its inclusion in the IM400 package, the Sea Master 400 is also available separately.

Sea Watcher 100 (SW100). Also known as the SEASTAR, the Sea Watcher 100 provides automatic surface surveillance detection as part of the IM400 integrated package. The Sea Watcher 100 receives input from multiple active phased arrays (AESA) operating in the I-/J-bands (X-band). It is capable of detecting small, asymmetric targets, such as periscopes and mines in severe conditions or in littoral situations, as well as providing helicopter approach indication.

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Apart from its inclusion in the IM400 package, the Sea Watcher 100 is also available separately.

SEASTAR. SEASTAR is an alternative name for the Sea Watcher 100. For more information, please see above.

SMILE. SMILE is an alternative name for the Sea Master 400. For more information, please see above.

Program Review

First Contract - RNLN

In December 2007, Thales and the Netherlands Defence Materiel Organization (DMO) signed a EUR125 million contract for the development and supply of four Integrated Masts. The Integrated Masts will be installed on the four ocean patrol vessels that are being built for the Royal Netherlands Navy (RNLN).

The Integrated Mast concept has several advantages over more traditional design approaches. The central mast structure houses most sensors and saves deck space. The Thales package offers the sensors as a turnkey package, minimizing interference between the two radars and other equipment. Maintenance time is reduced because nonrotating radars are included, instead of a rotating design. In addition, the mast structure, the sensors (radars, EO), and the ship's body are built in parallel, reducing the overall project time.

The Integrated Mast for the RNLN's patrol vessels will contain the SMILE radar, Seastar radar, and Gatekeeper electro-optical system. SMILE is marketed as the Sea Master 400 for export applications, while Seastar is sold as the Seawatcher 100 for international customers.

In November 2010, the first IM400 housing arrived at the Thales plant in Hengelo. Thales reports that the housing was built by the Netherlands Navy in Den Helder and transported by barge. After arriving at Thales, it was hoisted on top of the test tower. In the following months, all the equipment (sensors, radars, antennas) was installed in the Integrated Mast structure and all test procedures were started.

Introducing the IM100

The I-Mast 100 (IM100), introduced in September 2009, is the second member of the I-Mast family. This system is designed for smaller, corvette-size vessels.

Second Order

In March 2010, the Netherlands DMO ordered the fifth IM400, for installation on the Karel Doorman joint logistic support ship (JSS). The IM400 will be built by

the Royal Netherlands Navy in Den Helder, and the subsystems will be built and tested by Thales. The mast and subsystems were scheduled to be delivered to the Damen Schelde shipyard in January 2014.

Successful FAT

In November 2011, Thales reported that the first IM400 had successfully passed its Factory Acceptance Test. Because the IM400 consists of various subsystems, the FAT included several tests. Following these tests, which were deemed successful, the contract partner accepted the first Integrated Mast.

The IM400 was then shipped to Damen Schelde Naval Shipbuilding and was successfully installed on the first new RNLN patrol vessel, *Holland*. The second IM400 was to be built by Thales in Hengelo. It was to be installed on the second RNLN patrol ship, *Zeeland*, in 2013.

Daewoo Proposes Integrated Mast Solution for the Thai Navy

In September 2012, the Thai government approved a program to procure two multipurpose frigates for the Thai Navy. The acquisition had been rumored for several years, but was pushed back because a number of other important programs were competing for defense funds.

In the preceding March, at the Bangkok Defense & Security 2012 Trade Show, the South Korean firm Daewoo Shipbuilding & Marine Engineering unveiled its DW 3000H frigate concept. At the time, DSME said that it would be bidding the DW 3000H for the long-rumored Thai Navy frigate requirement. Of special interest to Thales and the Integrated Mast program, the DW 3000H concept featured the IM500 variant of the I-Mast.

In April 2013, Thailand awarded Daewoo the frigate contract. However, in October 2013, Thailand awarded Saab a contract for the combat management system and some radar systems. The Thales I-Mast was not selected.

Integrated Mast

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (EUR millions)</u>	<u>Date/Description</u>
Thales	\$125	Dec 2007 – Contract from the Netherlands Ministry of Defense for development and supply of four Integrated Masts for the Royal Netherlands Navy's new patrol vessels.
Thales	Undisclosed	Mar 2010 – Contract from the Netherlands DMO for delivery and installation of a fifth Integrated Mast for the <i>Karel Doorman</i> joint logistic support ship.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Dec	2007	Thales introduces IM400, first member of Integrated Mast family
Dec	2007	Contract for development and production of four IM400s for Netherlands DMO
Sep	2009	Thales introduces IM100 variant for corvettes
Mar	2010	Contract for a fifth IM400, for the <i>Karel Doorman</i> JSS
Nov	2011	First IM400 passes FAT
Nov	2011	First IM400 installed on <i>Holland</i>
	2013	Second IM400 scheduled to be installed on <i>Zeeland</i>
Jan	2014	Mast and subsystems for JSS were to be delivered to shipyard
	2015	JSS becomes fully operational



The Active Phased Arrays of the IM400's SMILE/Sea Master 400 Long-Range Surveillance Radar

Source: Thales

Worldwide Distribution/Inventories

I-Mast is installed on the **Royal Netherlands Navy** Holland class patrol ships and the *Karel Doorman* JSS.

Integrated Mast

Forecast Rationale

The Thales I-Mast family provides several clear benefits over more traditional masts. In the build phase, the I-Mast requires a decreased installation time, as the sensor systems are pre-integrated into a monolithic mast structure, versus being attached and integrated separately. In the operational phase, the I-Mast has a low center of gravity. In addition, it allows faster transitions between individual sensor use, has a lower center of gravity, and facilitates easier maintenance.

After having fulfilled the requirements of the I-Mast's sole customer, the Dutch Navy, Thales still has the

potential to sell a few more units. However, the company seems to have stopped pursuing sales of the I-Mast line directly, and is instead focusing on the IM400's primary radars, the SMILE/Sea Master 400, and SEASTAR/Sea Watcher 100.

Going forward, no additional I-Mast sales are expected. An additional few sales of the Sea Master 400 or Sea Watcher 100 are possible; the I-Mast forecast includes these sales.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			
	Thru 2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Total
Thales Nederland BV												
Integrated Mast <> Worldwide - Sea Master 400/Sea Watcher 100												
	0	0	0	0	1	1	1	0	0	0	0	3
Total	0	0	0	0	1	1	1	0	0	0	0	3