

The French-Italian FREMM is available in a number of variants, including ASW, ASuW/AAW and GP.
(Photo: Fabius)



Dr Alix Valenti

Jack-of-All-Trades

Understanding Multi-Mission Warships

Although not a category yet recognised in its own right, the 'multi-mission warship', is steadily emerging as a requirements from navies the world over, for a warship that could serve in a wide variety of threat scenarios and operational environments.

"A Jack of all trades is a master of none." Everyone has heard or read somewhere this expression that, according to the Cambridge Dictionary, is "said about someone who is able to do many things, but is not an expert in any." It is usually used with a negative connotation; it is also usually used wrong. The original saying allegedly went: "A Jack of all trades is a master of none, but oftentimes better than a master of one." It is hard to imagine a more fitting expression to characterise the emergence of the multi-mission warship, and the

debate that has been surrounding its evolution.

Its emergence has progressively eroded distinctions between ship categories, to the benefit of a platform flexible enough to not only respond to current fleet organisational and operational challenges, but to also, why not, leave room to adapt to what may lie ahead. Some see this multi-mission warship as a panacea, a 'Jack of all trades' for fleets around the world; others have questioned whether it might turn out to be a 'master of none'. The answer lies in what is in a name.

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What Is in a Name?

“In the past, navies began by defining the size of the platform they needed, and then determined the equipment and the weapons that could fit onto that platform according to its size,” Karsten Moeller, Member of the Executive Group Operating Unit Surface Vessels at thyssenKrupp Marine Systems, told *Naval Forces*. Whether this would then turn out to be called a corvette, a frigate, a destroyer or a cruiser was more the result of a classification originally made by the US Navy (USN) to organise its carrier battle groups; for instance, cruisers and destroyers would protect the aircraft carrier whereas frigates would have more specific roles, such as anti-submarines warfare (ASW), anti-surface warfare (ASuW) or anti-air warfare (AAW).

This distinction, widely used by Western countries for most of the 20th century and based essentially on ship displacement and armament, has progressively lost its significance at the beginning of the 21st century; at least from the standpoint of naval architecture. “The thinking today is completely different,” continued Mr Moeller. Indeed, as noted by Gianfranco Abbrescia, Vice President Naval Marketing at Leonardo, when speaking to *Naval Forces*: “All new ships need to fill an operational gap identified by the navy in relation to the operational theatres in which they are deploying and, therefore, the threats they are likely to face and the missions they are likely to embark.”

Whether the ships emerging out of the requirements will then be called corvettes, frigates or destroyers has now become a political decision based on what image the navy is trying to convey. For instance, it is

going to be much more difficult today for a politician to justify spending billions of taxpayers’ money on what can be understood as a battleship; rather, budgets earmarked for shipbuilding will have to be justified for ships meant to defend rather than attack. “Admittedly, the difference between a ship typology and another is very thin and quite flexible, closely linked to the use of key words that may or may not facilitate obtaining funds from those who allocate budgets,” Angelo Fusco, Senior Executive Vice President of Fincantieri Naval Vessel Business Unit, told *Naval Forces*. “The word ‘frigate’ is undoubtedly much more viable at political level than the word ‘destroyer’.”

Ultimately, today what is in a name matters less at naval construction level than the imperative of doing more with less. According to Mr Abbrescia, “navies are trying to extend ships’ capacity while also reducing their numbers; as such, we are now creating ships that are bigger than they used to be in the past to allow room for additional capabilities if necessary, for example adding mission modules.”

Mission Modules – Panacea?

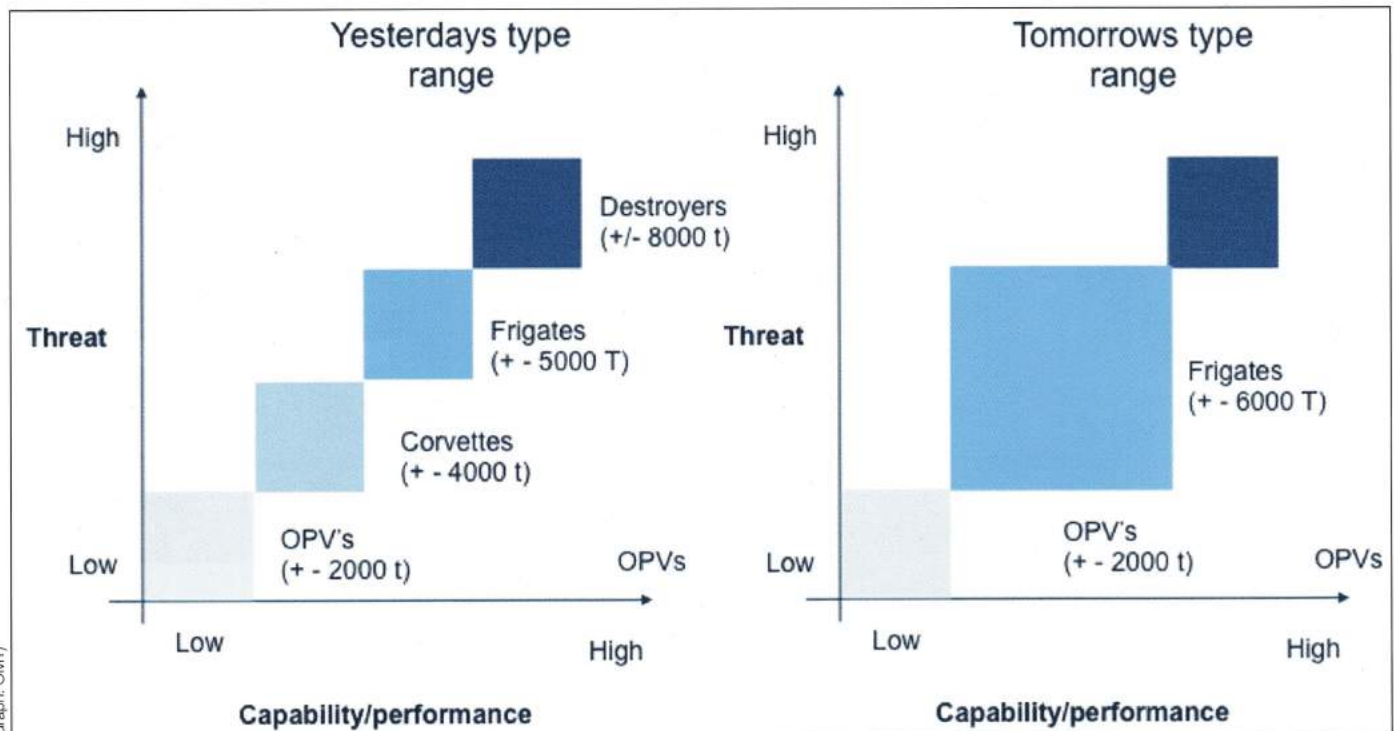
When discussing modularity in the context of shipbuilding, perhaps one of the first ships that comes to mind is the Danish STANFLEX concept, that was developed 25 years ago and is today at the heart of the ‘Iver Huitfeldt’, ‘Absalon’ and ‘Knud Rasmussen’ classes of ships of the Royal Danish Navy (RDN).

The FLEX concept involves over a dozen different systems (e.g. weapons, sensors, cranes, RHIBs, floating booms, etc) being containerised in more than 100 FLEX containers. Each container has two connector areas, which

connect to the combat management system (CMS), power supply, cooling, fire alarms, etc, allowing navy crews to bolt them into specific spaces on the ship and switch them around according to mission needs. Talking to *Naval Forces*, Rear Admiral Nils Wang, Director of Naval Team Denmark and Commandant at the Royal Danish Defence College, noted: “The tactical flexibility enables switching containers within hours for repair reasons; the operational flexibility enables a ship to be fitted for the mission within days or weeks; and, the strategic flexibility enables the transfer of continuously updated weapon-containers to new ship-classes when the old ones are de-commissioned.”

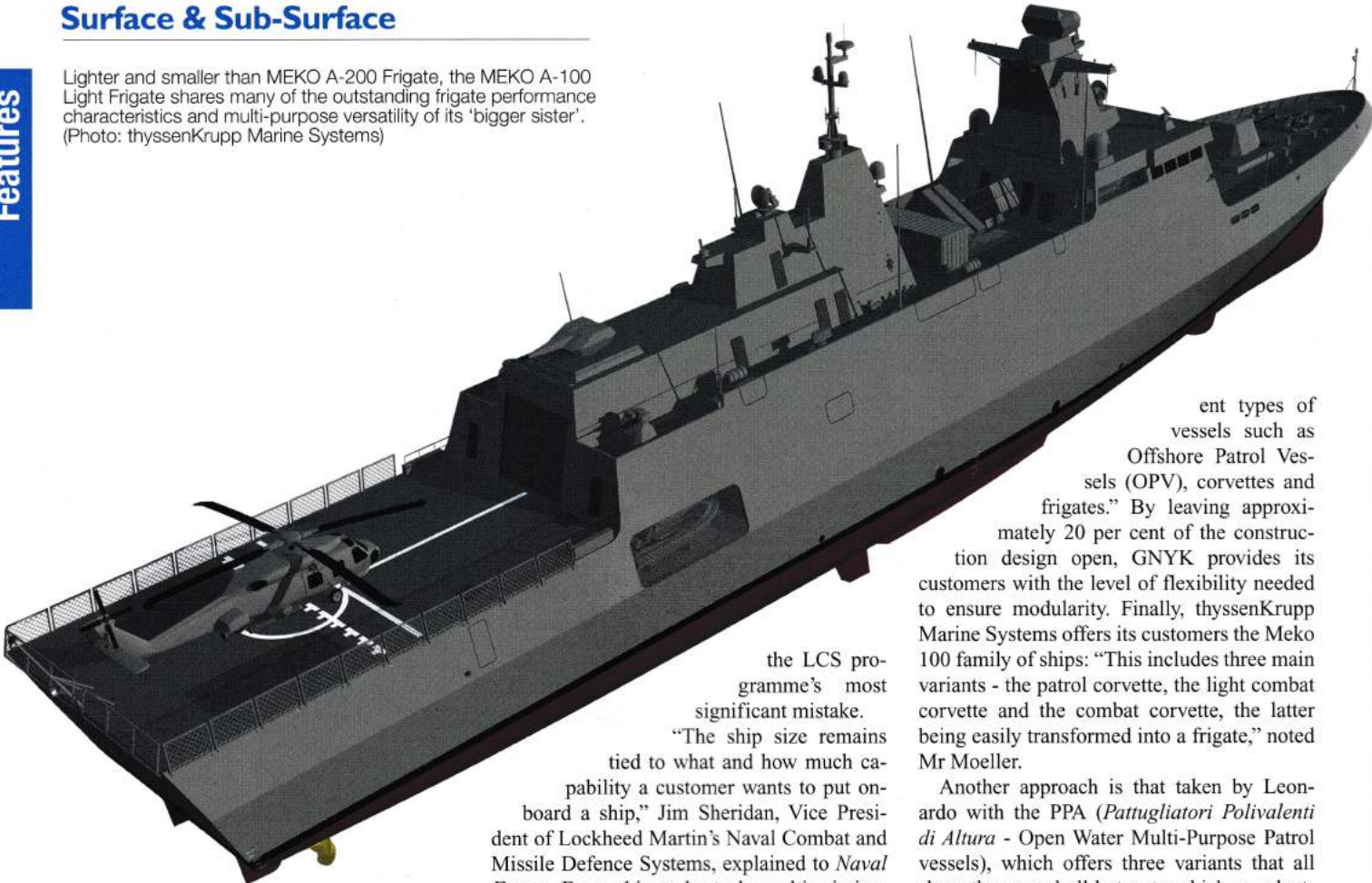
While very *avant-garde* 25 years ago, the concept of containerised modules has however shown the limitations of its application when it was chosen as a key element of the design for the USN Littoral Combat Ship (LCS). The LCS programme was defined in the late 1990s/early 2000s, when the USN had no peer competitors; its intended primary roles were presence missions and mine counter measures (MCM), and as such was not meant to be heavily armed. The size of the ship and its systems structure were designed on this basis. However, as the programme progressed through a decade of fast changing threats, new missions were progressively added to the requirements of the ship on the premise that it would merely be a matter of adding new containers. The series of setbacks the programme has been experiencing since demonstrated that it could not be that simple.

According to Dr Steven Wills, PhD Naval Historian currently working as Research Analyst at CNA in Washington, the key mistake was that the rapid, and quite varied,



(Graph: OMT)

Lighter and smaller than MEKO A-200 Frigate, the MEKO A-100 Light Frigate shares many of the outstanding frigate performance characteristics and multi-purpose versatility of its 'bigger sister'. (Photo: thyssenKrupp Marine Systems)



evolution of the mission modules was not taken into consideration when the platform was designed. Speaking to *Naval Forces*, Dr Wills shared his personal opinion that, “unfortunately with the MCM module, two of the key systems haven’t worked out: one of them was the H-60 helicopter, which was going to tow a sled for mine clearance, and the other the remote mine-hunting vehicle (RMMV).” Similarly, the ASW module turned out to be too heavy for the ship - although recent news from the US Naval Institute (USNI) indicate that the new ASW module has now met two test milestones. “The Navy attempted a great leap forward with the LCS,” notes Dr Wills: “Most times when the navy builds a new class of ships there are only a few changes from class to class; LCS has over a dozen new elements (new rotational crew system, forward deployed element, modules, new hull forms, new weapons) that have to be supported.” The result has been a programme where each new ship being built corrects the issues of the previous ones. “Effectively you have six different types of LCS now,” concluded Dr Wills.

Families of Ship

“The concept of mission modules is still very much in its infancy,” Mr Abbrescia told *Naval Forces*. “Unless the ship was designed to receive the mission modules whose integration has already been engineered, these cannot be integrated on the fly.” Effectively this was

the LCS programme’s most significant mistake. “The ship size remains tied to what and how much capability a customer wants to put on-board a ship,” Jim Sheridan, Vice President of Lockheed Martin’s Naval Combat and Missile Defence Systems, explained to *Naval Forces*. For a ship to be truly multi-mission, shipbuilders need to take into consideration the types of missions the ship will be carrying out as well as bear in mind that these ships, which will be in service for decades, will need to evolve at the same pace as the threats they will be facing. Consequently, the power of the radar, the number of sensors, the types of weapons that will be mounted in the short-, medium- and long-term have to be anticipated as much as possible because “it all comes with power and cooling demands that drive a lot of the space and weight requirements on-board the ship,” continued Mr Sheridan.

There are two approaches to building multi-mission warships in this sense. A number of shipbuilders have developed designs that are akin to that of a family of ships. Naval Group and Fincantieri, for instance, have developed the FREMM (*Frégate Multi-Mission - Multi-Mission Frigate*), which displace approximately 6,000t and can be configured either as ASW, AAW or general purpose (GP) variants. “On-board these ships there are 15 multi-mission consoles that can be configured to carry out a variety of task simultaneously,” Hervé Boy, Surface Ship Marketing Manager at Naval Group told *Naval Forces*. Similarly, Jörg Brechtfeld, Director Naval Sales at German Naval Yards Kiel (GNYK), told *Naval Forces* that as they see customer requirements becoming increasingly specific and moving away from given categories, they need “a flexible design in the drawer that is able, with small modifications, to accommodate differ-

ent types of vessels such as Offshore Patrol Vessels (OPV), corvettes and frigates.” By leaving approximately 20 per cent of the construction design open, GNYK provides its customers with the level of flexibility needed to ensure modularity. Finally, thyssenKrupp Marine Systems offers its customers the Meko 100 family of ships: “This includes three main variants - the patrol corvette, the light combat corvette and the combat corvette, the latter being easily transformed into a frigate,” noted Mr Moeller.

Another approach is that taken by Leonardo with the PPA (*Pattugliatori Polivalenti di Altura - Open Water Multi-Purpose Patrol vessels*), which offers three variants that all share the same hull but onto which an adaptable number of modules can be added. “These modules have all been designed for integration in the PPAs specifically,” added Mr Abbrescia. This means that the most basic of the three variants is fitted with a limited number of combat systems, but also for a potential upgrade to a more powerful ship should the navy need it in a few years time. Similarly, BAE Systems’ Type 26 ship, on which Australia’s future ‘Hunter’ class frigate is based, was designed with a large mission bay capable of accommodating a wide variety of mission modules that can be easily integrated into the ship thanks to the shared infrastructure of the ship. “If there is an ability for your vessel to flex its environment and capabilities, then you effectively do have something that is able to deliver more than the sum of its parts, because you can effectively change parts,” Robin Pollet, Combat Systems Chief Engineer at BAE Systems Australia, told *Naval Forces*.

The success of these different approaches lies, as noted by Mr Brechtfeld, “in having a reliable integrator as partner that devises the integration plan.”

Plug & Play ... or Not

“It is the integration of a warship that, I believe, will determine the effectiveness of the multi-mission warship,” said Mr Boy. The notion that one could have different mission modules and merely ‘Plug & Play’ with them can only apply if the mission modules are

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specifically designed for a particular ship, such as the PPAs or the Type 26; other than that, it is a primarily commercial notion according to Mr Fusco. Two reasons explain this.

“While different naval radars, communications and electronic warfare (EW) systems may transmit using different levels of amplification and different frequencies, care is always taken to ensure that systems do not interfere with one another as far as possible to avoid causing interference or degrading the performance of their RF counterparts,” Thomas Withington, EW, radar and military expert told *Naval Forces*. These challenges are generally overcome by virtue of being a priority from the outset during a ship design phase; it would however be significantly more difficult to take this into account if some of those sensors were added later as ‘Plug & Play’ modules.

As far as mission modules are concerned, their successful integration in a ship, and the ability of the warship to be future proof by allowing enough modularity to integrate new mission modules, hinges upon the CMS.

Thales’ TACTICOS CMS, for instance, is designed for growth, Joris Janssen Lok, Strategy and Marketing Manager at Thales Netherlands, told *Naval Forces*. “This means that both TACTICOS and our sensors are designed from the start to be able to accept new capabilities during the years in which they are in service on the ship.” To this end, Thales has product evolution roadmaps for TACTICOS and for sensors such as NS100/200 that defines which new functionalities will be added when to the CMS or the sensors; typically new functionalities will be added every six months. “If a customer wants to add a new capability, they can just purchase the relevant module from our catalogue, or discuss with Thales for integration in the roadmap if the functionality does not yet exist,” concluded Mr Janssen Lok.

Similarly, for its Aegis CMS, Lockheed Martin has built a common source library: a repository for all of its source codes, which currently contains over 14 million source lines of code. “The code is applicable to multiple ships and multiple platforms,” Mr Sheridan pointed out, “and if a customer wishes to add functionality to a particular class of ships, once the new source code is in the CSL, then it is available for use on other ship classes or platforms should that customer desire it.”

Leonardo’s CMS “is based on a service oriented architecture, that is, to its framework can be inserted modules for the control of on-board sensors and weapon systems, as well as for adaptability to the different types of missions the ship will be required to deploy on,” Mr Abbrescia noted.

Oftentimes Better Than Master of One

Ultimately, two key elements contribute to defining a multi-mission warship: the flexibility of the hull design, which leaves navies the room to determine what sensors and effectors it wants to include on-board; and, a scalable CMS that not only facilitates the integration of different missions modules, leaving room for growth, but also enables a ship crew to carry out multiple missions simultaneously by simplifying the high data flow received from all sensors.

A third element is also progressively gaining traction in the industry: off-board assets. “Networking is a reality now,” Mr Sheridan indicated. Lockheed Martin has developed the ‘launch on remote’ capability that allows its Aegis CMS to use data from off-board assets to launch a missile toward a target; it is also working on ‘engage on remote’, a capability that enables ship’s missiles to rely entirely on off-board assets data. “We take the benefit of above-the-platform integration to use multiple ships in a particular scenario to close the fire and control loop.” Similarly, Mr Pollet noted: “We recognise that as time goes on and technology improves, ASW will be done by off-board assets.”

Finally, although mission modules are still in their infancy, technological developments will also continue to increase the ease with which they will be integrated. “On-going trends in electronics miniaturisation could result in progressively smaller sensors and missiles which could enable highly effective capabilities to be packaged in smaller combatants over the coming years,” concluded Dr Withington.

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