



MILGEM (Jinnah-Class) Corvette/Frigate

Pakistan's Next-Generation Warship.

By Bilal Khan

On 05 July 2018, the Pakistan Ministry of Defence Production (MoDP) signed a deal with Turkey's Military Factory and Shipyard Corporation (ASFAT A.Ş.) for four MILGEM corvettes and frigates for the Pakistan Navy (PN).[1]

The PN is currently scheduled to receive all four ships by 2024, with the first scheduled for 2023. Turkey will build two of the ships, while Pakistan will construct the rest under a transfer-of-technology (ToT) agreement.

The contract has a reported value of \$1 billion to \$1.5 billion[2]. It is a high-cost program compared to the PN's other programs, but it contains both ships and a proprietary frigate design.

In terms of the latter, ASFAT A.Ş. will assist its Pakistani counterparts – i.e., Maritime Technologies Complex (MTC), Karachi Shipyards & Engineering Works (KSEW) and Navy Research and Development Institute (NRDI) – in designing a frigate for the PN. The PN will also own the intellectual property (IP) rights of the frigate.[3][4]

The fourth MILGEM will be the lead ship of the joint-frigate design. Given that the PN is also buying the IP rights of this ship, it is likely that the fourth ship will form the basis of the PN's next-generation frigates. For the PN, ownership over its own frigate design would allow it to construct additional ships at will. Thus, the in-house frigate it is designing with ASFAT A.Ş.' could be its mainstay surface combatant in the future.

[1] Press Release. "Pakistan Navy Signed Contract for Acquisition of 4x MILGEM class warships with Turkey." Press Information Department. Ministry of Information. Government of Pakistan. 05 July 2018. URL: http://pid.gov.pk/site/press_detail/8782

[2] İbrahim Sünnetçi. "“Together for Peace” AMAN-19 Multinational Naval Exercise & Pakistan – Turkey Defence Cooperation." Defence Turkey. Volume 13. Issue 91. URL: <https://www.defenceturkey.com/en/content/together-for-peace-aman-19-multinational-naval-exercise-pakistan-turkey-defence-cooperation-3454>

[3] Ibid.

[4] Press Release. "Pakistan Navy Signed Contract for Acquisition of 4x MILGEM class warships with Turkey." Press Information Department. Ministry of Information. Government of Pakistan. 05 July 2018.

Based on disclosures thus far, it seems that the PN opted to configure its MILGEM ships as high-tech and integrated systems. From situational awareness to electronic warfare (EW) to a wide array of weapon systems, the MILGEM and **Type 054A/P** will set the standard for the PN's surface warships.

Subsystems

Most of the PN MILGEM's subsystems will come from Turkey. In fact, Aselsan secured a \$191 million US contract in November 2019 to supply subsystems for the PN MILGEM program[5].

For the PN, the reason for this selection is likely a mix of factors, the foremost being Turkey's willingness to extend a loan for the program. That loan likely covers Turkish origin products and services, so financing is easier for the PN. Turkey also already integrated those systems, so integration costs are lower as well.

However, these systems are also designed for a NATO end-user (Turkey), so there could be a measure of quality or performance involved as well. In a way, Turkey has become Pakistan's intermediary for Western and NATO-grade technologies it is unable to acquire (at least affordably) from Europe.

Finally, Turkey showed a willingness to open or modify its subsystems so that the PN can integrate its own weapons, data links, and other systems to those solutions.

[5] Zeynep Kahveci. "176.9m-euro contract from ASELSAN." Anadolu Agency. 15 November 2019. URL: <https://www.aa.com.tr/tr/ekonomi/aselsandan-176-9-milyon-avroluk-sozlesme/1646148>

Aselsan SMART-S Mk2

The PN MILGEM's main search and targeting radar will be the SMART-S Mk2. The design belongs to Thales Group (Thales Nederland), but Aselsan manufactures the radar under license. [6] However, in the years since it took on the program, the company succeeded in sourcing many critical radar components domestically. In fact, Thales is sourcing the transmitter/receiver modules (TRM) of these radars from Aselsan.[7]

The Aselsan SMART-S Mk2 is an active phased array radar offering an instrumented range of 250 km. The radar can detect and track up to 500 airborne and surface targets. Based on Thales Nederland's catalogue, the radar can track missiles at 50 km, and maritime patrol aircraft (MPA) at 200 km.[8]

The radar is marketed with dedicated electronic counter-countermeasures (ECCM) capability, suggesting a measure of defensibility against radar jamming/spoofing.

Aselsan ARES-2NC

The Aselsan ARES-2NC is a variant of the electronic support measures (ESM) suite the PN selected for use from the **Agosta 90B submarine (ARES-2N)**. The ESM suite will allow the MILGEMs to passively monitor as well as categorize and record enemy radar and communication signals.

[6] İbrahim Sünnetci, "A Look at Latest Status of the PN MILGEM Project." Defence Turkey. Volume 14. Issue 97. 2019.

[7] İbrahim Sünnetci, "A Look at Latest Status of the PN MILGEM Project." Defence Turkey. Volume 14. Issue 97. 2019: URL: <https://www.defenceturkey.com/en/content/a-look-at-latest-status-of-the-pn-milgem-project-3824>

[8] "Thales Group to Use Aselsan Modules for Radars." Defence Turkey. Volume 9. Issue 55. 2014: <https://www.defenceturkey.com/en/content/thales-group-to-use-aselsan-modules-for-radars-1717>

In turn, the MILGEMs will add the signals to a threat library in which electronic attack (EA) assets can use to spoof/jam enemy emitters.[9]

However, the ARES-2NC offers an additional capability: the ability to engage in EA through a directional radar-frequency (RF) jamming system. The ARES-2NC uses digital radio frequency memory (DRFM) for its EA role, covering a frequency range of 7.5-18 GHz. It is also equipped with a radar warning receiver (RWR), so it will alert the crew of enemy radar targeting against the ship.

Thus, in addition to electronic intelligence (ELINT), the PN MILGEM will also have the capability to engage in EA through its ESM suite. Not only will these ships employ these capabilities to defend themselves, but they can offer area-wide coverage, thus placing other (and lesser equipped) assets under an umbrella.

Finally, the PN is evidently using the same base ESM suite in multiple platform, i.e., with the MILGEM and Agosta 90B, and potentially the **Yarmouk-class corvette** (which may get the same suite as it too will have ELINT capabilities).

This will streamline training and give personnel familiarity with multiple ship types.

Havelsan ADVENT

The Havelsan ADVENT will be the PN MILGEM's combat management system (CMS). Havelsan introduced the ADVENT in 2019 as a successor to its GENESIS CMS, which it supplied to Turkey for its FFG-7 frigates.

[9] İbrahim Sünnetçi, "A Look at Latest Status of the PN MILGEM Project." Defence Turkey. Volume 14. Issue 97. 2019.

The ADVENT was developed for a network-enabled environment, so one of its key features is the ability to fully integrate multiple data links. Practically, this enables the MILGEM to communicate with and share data with different types of platforms, such as surface warships, maritime patrol aircraft (MPA), unmanned aerial vehicles (UAV), and others.

MilSOFT Naval Information Exchange System (NIXS)

The PN developed its network-enabled/network-centric warfare environment with support from a Turkish company, MilSOFT. The solution is based on MilSOFT's Naval Information Exchange System (NIXS).

Using data links (e.g., Link Green, Link-17, Link-11, etc) and an IP communications infrastructure called "RedLine", the NIXS enables a wide variety of naval vessels and aircraft to view a 'tactical' image using connected sensors onboard and outside of the ship. NIXS also offers a 'regional' image sent from a central command and control source (e.g., headquarters). The regional image is a fusion of different feeds, be it from surface ships, aircraft, drones, satellite and others.

NIXS is accessible from an interface as small as a laptop, so, the PN could enable even its smallest platforms – such as the MRTP-15 fast patrol boat– to gain tactical and regional situational awareness. NIXS is also the way ships lacking long-range sensors, like the Azmat-class fast attack craft (FAC), can track, identify, and engage distant targets. The NIXS is basically why these ships are threats when they carry weapons such as the **Harbah dual-anti-ship cruising missile (ASCM) and land-attack cruise missile (LACM).**

However, NIXS can also serve as a means of early warning and threat awareness. So, for example, the FAC(M)s can use that awareness to relocate away from potential threats, while maintaining their attack credibility.

The PN MILGEM will factor into this equation by both providing long-range situational awareness through its radar (as well as sonar, RWR, etc), and draw on the feeds of other assets, such as drones, MPAs and/or the airborne early warning and control (AEW&C) aircraft of the Pakistan Air Force (PAF).

Meteksan Yakamos

The Meteksan Yakamos hull-mounted sonar will be the PN MILGEM's main method of monitoring for sub-surface threats and managing its anti-submarine warfare (ASW) capabilities. It can operate in both active and passive modes, and offers a range of up to 30 km.[10][11]

Aselsan HIZIR

The PN MILGEM will also incorporate the Aselsan HIZIR torpedo countermeasure system. The HIZIR is a comprehensive suite consisting of torpedo detection capabilities (via an array) and towed decoys. It offers an automated response as Aselsan says that the HIZIR "detects, classifies and localizes the threat torpedoes and advises the appropriate countermeasure tactics to escape from the threat torpedoes." [12]

[10] Ibid.

[11] Product Catalogue. Yakamos. Meteksan. URL: <https://www.defenceindustries.com/products/meteksan-savunma-sanayii/yakamos-hull-mounted-sonar>

[12] Product Catalogue. HIZIR. Aselsan. URL: <https://www.aselsan.com.tr/en/capabilities/naval-systems/torpedo-and-torpedo-countermeasure-systems/hizir-torpedo-countermeasure-system-for-surface-ships>

The HIZIR consists of multiple subsystems, including its standard equipment – such as detection array, on-board operator consoles, etc, and add-ons. These add-ons include the HIZIR-LFAS (Low Frequency Towed Active Sonar) and ZOKA acoustic jamming and expendable decoys.

The ZOKA decoy can operate as a jammer of sorts by emitting a wideband acoustic signal that mimics the host ship, forcing the torpedo away from its intended target.[13]

In its tests, Aselsan claims that the ZOKA stopped a training version of Atlas-Elektronik's DM2A4 torpedo.[14]

Weapon Systems

The actual weapon system configuration of the PN's MILGEMs are not certain. The PN will certainly get a modified version of the Ada-class corvette with vertical launch system (VLS) cells. However, it is unclear if this version will constitute all four ships, or only the fourth ship (i.e., the original frigate).

The steel-cutting ceremony of the first MILGEM shows a design with the VLS cells, so it is possible that the modifications apply to all ships. However, that outcome also implies that the fourth ship will see additional changes since it will be an original design of MTC with ASFAT A.Ş.' assistance.

In any case, the original frigate will certainly incorporate VLS, so that feature will exist in the design of the PN's next-generation frigates. With VLS in place, the PN will construct fully capable multi-mission ships.

[13] Ibid.

[14] "HIZIR Countermeasures System Success Against DM2A4 Torpedo." Mönch Publishing Group. 2018. URL: <https://www.monch.com/mpg/news/ew-c4i-channel/4195-tr2409.html>

Anti-Ship Warfare

Though the PN MILGEMs will use the Thales SMART-S Mk2, Aselsan will enable the PN to integrate the C-802 and/or Harbah ASCM/LACM to the ship.[15] Thus, the MILGEMs will be able to engage enemy ships and land-based targets. The ships can independently target ships or, as noted above, leverage other PN assets through NIXS – such as the **ATR-72 MPA**– to track targets at longer ranges.

The C-802A offers a range of up to 190 km, making it an analogous solution to the Boeing RGM-84 Harpoon and MBDA Exocet. Pakistan did not disclose the range of the Harbah, but if it is based on Babur-series of LACM, it could have a range of 450 km (i.e., Babur III) to 700 km (i.e., Babur Version 2). In either case, the PN will deploy its ASCM/LACM through slant launchers, which it will place at the ship's mid-section.

Anti-Submarine Warfare

The anti-submarine warfare (ASW) capabilities of the PN MILGEM will likely be standard fare, i.e., deploy two triple-cell launchers for lightweight ASW torpedoes. The PN did not yet disclose where it will acquire these torpedoes, though any one of China, Turkey or Europe is plausible.

Anti-Air Warfare

Currently, the PN is intending to arm the VLS-equipped MILGEMs with the Chinese LY-80, which it will also equip the PN's forthcoming Type 054A/P frigates.[16]

[15] İbrahim Sünnetci, "A Look at Latest Status of the PN MILGEM Project." Defence Turkey. Volume 14. Issue 97. 2019.

[16] Ibid.

The baseline version of the LY-80 offers a range of 40 km, but a newer version with a range of 70 km is also available for export.

The PN MILGEM will also use the Aselsan Gökdeniz close-in-weapon-system (CIWS). The Gökdeniz will take the place of the RIM-116B (Block 1A) Rolling Airframe Missile (RAM), which it was unlikely to acquire due to the need for approval from the United States. The Gökdeniz uses twin 35 mm gun barrels that can fire 1,100 rounds-per-minute, and can use both airburst and high-explosive incendiary ammunition.[17]

The Frigate Will Be a Complete Platform

In 2018, an official said that the fourth ship would be “the first Jinnah-class frigate,” but later reports from the Turkish media indicated that all four ships will be of the ‘Jinnah-class’ line (citing the PN CNS).[18][19] But the official statement regarding the contract and the PN official’s statement in 2018 suggests that the last ship – i.e., the frigate – will be different from the preceding three.

Currently, it seems that the first three ships in the PN’s order will be a modified variant of the Ada-class with VLS (as the steel-cutting ceremony showed an image of the VLS-equipped model). Thus, it is possible that the fourth ship/frigate will be a further modification. The ‘MILGEM’ family spawned multiple designs, including the 3,000-ton I-Class frigate and 3,500-ton **CF3500 frigate**. Thus, the joint-ASFAT A.Ş. and MTC/NRDI/KSEW design could be a variant of the other MILGEM designs, such as the 3,000-ton I-Class. The latter would make sense as it is a production-ready design, modifying it would not involve as much design and testing work as a clean-sheet ship.

[17] Ibid.

[18] Qoumi Awaz News: <https://www.youtube.com/watch?v=Tdy5Vh9EW6w&feature=youtu.be&t=66>

[19] İbrahim Sünnetci, “A Look at Latest Status of the PN MILGEM Project.” Defence Turkey.

Volume 14. Issue 97. 2019.

Since Pakistan will own the IP rights of the fourth ship, it is likely that this design will form the basis of the PN's next-generation frigates, which it will construct locally. Based on the MILGEM's configuration above, these frigates will have AShW, ASW, AAW and EW/ELINT capabilities integrated into one system.

Be it through new ships or retrofit of existing ships, the above will form the baseline standard of any ship the PN terms as a 'frigate.' In other words, any 'frigate' the PN builds after the culmination of the MILGEM program will be a fully multi-mission and network-enabled warship.

In turn, the PN can build its mainstay frigate fleet around this high-tech and high-capability ship, which it can evolve and construct at-will.

This program speaks to the PN's goal of building a credible deterrence posture, namely via the following:

Gaining Flexibility to Add New Naval Capabilities

First, the PN will now control a platform/design that it can upgrade with new weapon systems when they become available.

Leading the pipeline of these new weapons will be a supersonic-cruising ASCM (i.e., something similar to India's BrahMos).

In its yearbook for 2017-2018, the Ministry of Defence Production (MoDP) revealed the development of a supersonic missile for the PN.[20]

[20] Year Book (sic) 2017-2018. Ministry of Defence Production. Government of Pakistan. 05 September 2019. URL: <http://www.modp.gov.pk/frmDetails.aspx>

Second, by building in-house design capacity, the PN can tailor its next-generation frigates to leverage any new technology trends or accessible off-the-market subsystems and weapons.

The bottleneck in this case will be the supplier of the weapon/input. So, if a long-range SAM becomes available to the PN, it will need access to that specific input, but otherwise, it can manage the design, integration and testing process.

Thus, not only will the PN be able to save money when acquiring new ships, but it will also be in a position to deliver new naval capabilities as they become available.

Boosting the Threat Value of Simpler, Low-Cost Assets

With its area-wide AAW (via VLS) and longer-ranged sensors, the fourth ship/frigate will also enhance the capabilities of the PN's less-equipped fast attack crafts (FAC) and corvettes.

The FACs and corvettes could use the frigate's sensors (via NIXS) to guide their C-802A and Harbah ASCM/LACMs. Likewise, the frigates will also offset the lower-end assets' vulnerability to aerial threats with AAW coverage.

With each new frigate the PN builds, it can also leverage the advantage of constructing stripped-down FACs at lower cost and in greater numbers. In fact, the PN is already working towards this with its Azmat-class fast attack craft or FAC(M)

MTC took ownership of designing the fourth ship of the line, enabling Karachi Shipyards and Engineering Works (KSEW) to construct FAC(M)-4 "without seeking foreign expertise." [21]

[21] Ibid.

In other words, KSEW is not relying on prefabricated kits-of-materials (KoM) for the FAC(M)-4, but is working off MTC's design and engaging with input (e.g., steel) suppliers directly.

With the in-house frigate program, MTC will continue developing experience in ship design, while KSEW will build expertise in construction and integration without KoMs.

In time, the two entities could develop an improved version of the FAC(M), but with an emphasis on lowering costs and, potentially, simplifying and accelerating the construction process.

Even if they lack radars, as long as they have access to NIXS as well as an ASCM/LACM load, they are credible anti-ship and land-attack threats. With the PN's frigates in place, neutralizing these FACs would not be trivial as they will benefit from AAW and ASW support.

If the PN can achieve a low enough price point for such FACs, and construct them quickly enough, then it could build a sizable fleet of attack assets. Not only does a large fleet offer many attack vectors from which the PN can undertake long-range strikes, but a large fleet can sustain more losses without losing capability.

Building a Force of New, High-Tech Assets

The PN officially has an in-house frigate program, and its **own long-range maritime patrol aircraft (LRMPA) project**.

Granted, both will draw on overseas suppliers, especially for critical inputs such as propulsion or steel (or the aircraft in the case of the LRMPA). However, it reflects to the PN's intention to acquire high-capability assets with some measure of local input, if only at the design, integration and testing levels.

The PN currently has two programs for surface applications – i.e., the frigate and FAC(M) – and one for its aviation needs in the LRMPA. It is also **interested in acquiring an unmanned combat aerial vehicle (UCAV)**, so there is potential for it to collaborate on an in-house program with the PAF. The latter is developing its own medium-altitude long-endurance (MALE) UAV.

The only traditional naval dimension left for the PN to internally develop is that of submarines. However, with an in-house midget submarine program listed in the MoDP's 2016-2017 yearbook, the PN may be on its way to that outcome as well.[22]

Turkey's Savunma Teknolojileri Mühendislik ve Ticaret A.Ş. (STM) invited Pakistan to jointly design a submarine to replace the PN's aging 119-ton Cosmos MG119 miniature diesel electric submarines (SSK) in 2016.[23] If this program succeeds, the PN may expand its focus towards an in-house shallow-water attack (SWAT) submarine with AShW and ASW capabilities.

Ship Design Does Not Mean Indigenization

Throughout this report, the term 'in-house design' was used frequently. It is important to understand that 'in-house design' does not necessarily mean indigenization.

Pakistan will not indigenize the critical inputs – e.g., propulsion, steel, electronics, etc – of its 'in-house' frigate. It is unrealistic to expect it, though the national discourse may use sweeping statements, such as "indigenous," in a loose manner.

[22] Year Book (sic) 2016-2017. Ministry of Defence Production. Government of Pakistan. 12 November 2018. URL: <http://modp.gov.pk/frmDetails.aspx>

[23] "STM Strengthens Position in Pakistan." MSI Turkish Defence Review. January 2017. Issue: 34

Rather, the PN wants to control the design of its frigates and, in turn, decide for itself the suppliers it will work with for core inputs. So, when the PN ordered the Agosta 90B from DCNS or Naval Group, it had to buy inputs from the OEM (via KoM), which in turn worked with its choice of suppliers.

Thus, the PN had little-to-no-control over the inputs – or pricing. Moreover, it did not own the design, so when the PN's ties with the OEM broke down, it could not manufacture additional Agosta 90B submarines.

With the 'in-house frigate,' the PN will own the design and, in turn, will choose its suppliers based on cost, access to sensitive technology, and other factors.

Though it is far from a local turnkey solution, the PN can at least exert more control over pricing, configuration, and other key areas. So, to lower costs, the PN can acquire steel from China or South Korea instead of Germany or the UK. It can also experiment with diesel and/or gas propulsion by studying Ukraine's solutions instead of strictly buying from China or Germany.

In some cases, the PN can request turnkey transfer-of-technology from the input suppliers, but only if Pakistan can absorb it and use it across enough applications. For example, Pakistan might want to acquire composites technology because it can apply it to ships, aircraft and missiles. Likewise, the 'design' process itself is vastly layered as one can 'design' sensors and other electronics as well, but still acquire the critical technologies (e.g., transmit/receive modules for radars) from overseas.

In terms of shipbuilding, the 'design and integration' model will result in a minimal domestic input. But it does not mean there is no economic value. If Pakistan can export ships of its own designs, it can channel the construction, integration and testing work to Karachi and Gwadar. It could generate employment and at least some foreign currency gains (though the least since most of the inputs will come from abroad).

It is not ideal, but only handful of countries can claim to comprehensively construct a ship from their own resources alone, i.e., the United States, China, and to an extent, France and Russia. Others generally work with overseas suppliers at some level, or set-up collaborative joint-ventures or consortiums (which is the case between the United Kingdom, Germany, Spain and Italy). Sweden's Saab AB operates along a similar track to what the PN is working towards, e.g., Saab designed the Swordfish LRMPA suite, but it relied on Canada, Britain, Italy and the United States for every single input except for the weapons.

The PN is moving towards a similar model to Saab. In fact, one could argue that is the threshold both the PN and the PAF are looking to achieve with their respective programs. They both understand that Pakistan cannot develop every input of a complex weapon system alone, but it can design the overall system and rely on willing input suppliers to fill in the gaps.

Ideally, Pakistan will evolve its indigenous R&D so that it can collaborate with other countries and, in turn, set-up consortiums where others depend on Pakistan in some areas while Pakistan relies on them in others. However, this is not a near-term endeavour.