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Happy INDEPENDENCE Day!

▷ EXCLUSIVE SECRETARY DDR&D & CHAIRMAN DRDO

PHOTOGRAPH: PIB

True to its name, DRDO is spearheading research and development efforts across a wide spectrum of next-gen defence capabilities. In an Exclusive interaction, **Samir V. Kamat, Secretary DDR&D and Chairman DRDO**, speaks with **Manish Kumar Jha** on the full and comprehensive range of military technology development, some of them futuristic and ground-breaking for India.

"DRDO developed AIP is going into the P-75. The land-based prototype of this AIP was proven on the ground last year."

Manish Kumar Jha (Manish Jha): The DRDO recently broke new ground by conducting test of a scramjet engine, which will enable critical hypersonic weapon technology for India. How complex and indigenous is the scramjet engine development, and how will it be a game changer for DRDO's next generation missile advancement?

Samir V. Kamat (Kamat): Hypersonic Cruise Missile is a class of weapons that can travel more than 5 times the speed of sound (> 6100 Kmph) for long duration and is powered by scramjet i.e., Air breathing engine. Air breathing propulsion systems, having supersonic combustion, plays a critical role for long-duration cruise conditions.

DRDO achieved a significant milestone in the field of Hypersonic Weapon Technology, when it conducted long-duration Active Cooled Scramjet Subscale Combustor ground testing. The development of this scramjet engine is fully indigenous. It will be a game changer as the hypersonic missiles are very difficult to track and intercept. It gives you an assured retaliation capability, even if the other country has good air defence. The missile is difficult to detect and even if detected, it is difficult to intercept them.

We are working on two types of hypersonic missiles, hypersonic glide missile and hypersonic cruise missile. We have finished one development trial of Hypersonic glide missiles and in next 2-3 years we should be able to complete its development and will offer it to the Users.

For development of Hypersonic Cruise missiles, which is based on scramjet, we are currently proving the scramjet on the ground, and then we have to prove it in flight. Then there are other challenges in respect to the cruise missiles, and, I hope that in next five years it will get converted into weapon system. Hypersonic missiles are being flown by select few countries in the world, but they are not the hypersonic cruise missile. They are flying hypersonic glide missiles only.

Manish Jha: What is next after Akash, especially when it worked and proved, showing the efficacy, testing and credibility in real real-time situation?

EDITORIAL

SP's Naval Forces wishes the Indian Navy a very Happy Independence Day 2025!

In an exclusive interaction with Manish Kumar Jha, Dr Samir V. Kamat, Secretary DDR&D and Chairman DRDO, outlines DRDO's advances in next-generation naval capabilities, most notably the indigenously developed Air-Independent Propulsion (AIP) system set for integration into P-75 submarines, with the land-based prototype already proven. The AIP energy module is expected to be ready by December, to be inserted into a submarine hull for trials during refit. He details work on quantum sensing for submarine detection using picotesla-level magnetometers deployable on UAVs or aircraft, aiming for operational readiness in 2–3 years, and highlights coastal defence systems including shore-based BrahMos and Guided Pinaka. Beyond naval focus, he discusses scramjet-powered hypersonic cruise missiles, the Akash NG, Uttam AESA radar for Tejas, high-thrust engine co-development, AMCA stealth and IP ownership strategies, and quantum secure communications — all with an emphasis on self-reliance.

We also have a report on India's Submarine Capability and Roadmap by Manish Kumar Jha in this issue with an in-depth assessment of India's undersea modernisation across three categories: diesel-electric (SSK), nuclear-powered ballistic missile (SSBN), and nuclear-powered attack (SSN) submarines. Against the backdrop of China's and Pakistan's expanding submarine fleets, the plan combines indigenous propulsion, missile integration, stealth advances, and industrial partnerships to secure credible sea-based nuclear deterrence and maintain control of the Indian Ocean well into the 2030s.

The piece on Navantia's Naval Prowess, spotlights Navantia's blend of tradition and innovation, with technological USPs like the CATIZ and SCOMBA combat systems and an indigenous fuel-cell-based AIP used in S-80 Plus submarines. The company's embrace of Industry 4.0 shipbuilding and sustainable propulsion research positions it at the forefront of future maritime defence solutions.

In another article, Lt General P.C. Katoch (Retd) reports on the ongoing capability enhancement in the Indian Navy which recently marked a twin boost with the commissioning of Russian-built INS Tamal and the delivery of indigenous stealth frigate INS Udaygiri. Also, defence approvals worth ₹1.05 lakh crore include mine countermeasure vessels, moored mines, super rapid gun mounts, and unmanned undersea platforms add to the modernisation of the Navy. Strategic focus is also on nuclear-powered attack submarines under Project-77, with two boats cleared for development and future integration of BrahMos and hypersonic systems. These inductions and upgrades aim to bolster India's ability to secure critical sea lanes, counter advanced threats, and project power across the Indian Ocean.

Wishing all discerning readers happy reading!

JAYANT BARANWAL
Publisher & Editor-in-Chief

Kamat: Our indigenously developed Akash missile system demonstrated its capabilities effectively in the recent conflict. Currently User trials of Akash NG are going on, that would be the next generation, Akash.

India became first country to demonstrate the capability of engagement of 04 aerial targets simultaneously at 25 km ranges by command guidance using single firing unit by Akash Weapon System. We are also working on Akash with longer range capability. Then there is Quick Reaction Surface-to-Air Missile (QRSAM), which is going to be inducted soon.

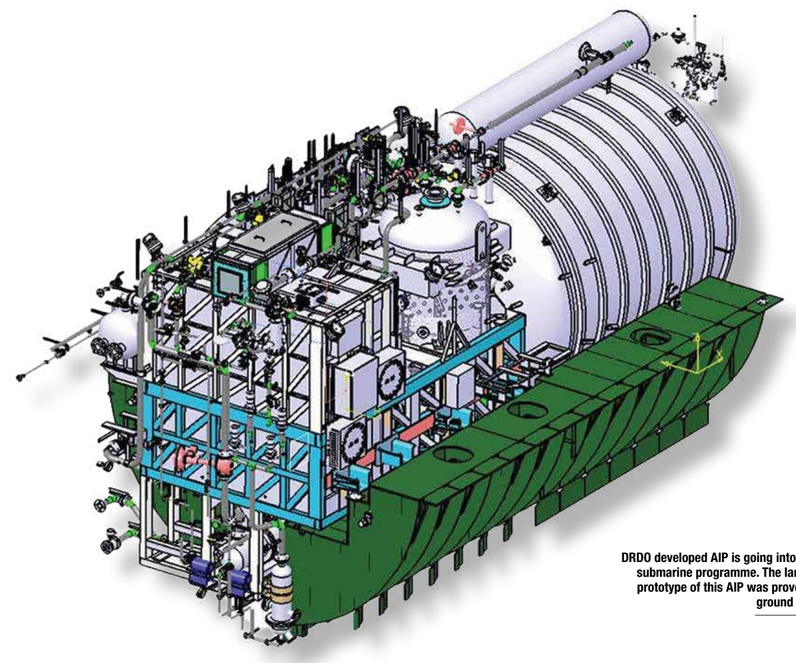
Manish Jha: What are the features that lead to the new fighter jets being harder to detect by the enemy radars, and does the DRDO plan on upgrading the Indian radar system to detect such jets that would perhaps be used by foreign military forces?

Kamat: Stealth fighter jets are designed to minimise radar detection through a combination of features including radar-absorbent materials, specialised shaping, and electronic warfare capabilities. The DRDO is actively working on upgrading India's radar systems, including the development of advanced radars. Designed for air superiority, ground strikes, suppression of enemy air defences, and electronic warfare, the AMCA features advanced systems tailored for modern combat. Its stealth profile incorporates a low radar cross-section, achieved through radar-absorbent materials and internal weapons bays, enabling it to evade enemy detection.

In the field of Radar, we are self-sufficient now. Our radars are of world class. We have airborne radars, ship-based radars, cloud-based radars. We are having long range radars meant for tracking ballistic missiles as well as space situational awareness. We have short range battlefield radar as well as land-based radars for surveillance capability. Today we are having the capability to develop any type of radar.

"Our energy module is getting ready hopefully by December this year and then module will be put in a submarine hull, that may take a year or so"

PHOTOGRAPH: DRDO_India/ X



DRDO developed AIP is going into the P-75 submarine programme. The land-based prototype of this AIP was proven on the ground last year.

DRDO is actively working on upgrading India's radar systems, including the development of advanced radars.

Manish Jha: What about DRDO's AESA Radar development progress?

Kamat: AESA radar is now ready for our airborne platforms. DRDO's LRDE has designed and developed Uttam AESA Radar for LCA (Tejas) aircraft of the Indian Air Force (IAF). Production clearance was obtained after completion of developmental flight trials. Licensing Agreement for Transfer of Technology (LAToT) was signed between DRDO and HAL, Hyderabad for Limited Series Production of Uttam Radar for LCA Mk-1A. The combined flight trials with Indigenous EW Suite of DRDO is in progress on Tejas. Production Order on Industry Partner is awaited, so as to make Radar available for the 41st Aircraft onwards being produced by HAL for IAF.

Manish Jha: How close is DRDO to operationalising quantum tech against advanced submarine threats, and is this a near-term or decade-long capability?

Kamat: There is quantum computing, quantum sensing and Quantum Communications. Detection of submarines is quantum sensing, where you have quantum interference, where very small changes in the magnetic field is detected.

So, when a submarine passes, because it is made up of steel, it has some magnetic effect i.e., it disturbs the earth magnetic field. So, the small changes in the earth magnetic field can be detected by this magnetic sensor, which can be flying on a UAV or an aircraft. That way you can detect submarines up to a depth of 100-200 meters. It is a very useful technology.

We are working on various types of magnetometers, which can detect picotesla (pT) level changes in the magnetic field. With that we hope that we will be able to detect submarines in the ocean. It is not very futuristic; we hope that we should have this indigenous capability in next 2-3 years.

Quantum Communication through optical fibres, we have demonstrated upto 100 kms. Now, recently we have done free space quantum secure communication using quantum entanglement over a distance of more than one km via a free-space optical link established on the IIT Delhi campus. Free-space Quantum Key Distribution (QKD) eliminates the need to lay optical fibres, which can be both disruptive and expensive, especially in challenging terrains and dense urban environments. With this, India entered into a new quantum era of secure communication which will be a game changer in future warfare.

Manish Jha: What steps has DRDO taken in the process of developing a higher thrust class engine? And how do you

PHOTOGRAPHS: PIB, SpokespersonMoD / X, DPI, DRDO

(Top Left) DRDO's first-of-its-kind Naval Anti-Ship missile; (Top Right) DRDO's Extended Range Anti-Submarine Rocket (ERASR);
(Above Left) Indigenously-developed Vertically-Launched Short-Range Surface-to-Air Missile (VLSRSAM);
(Above Right) Manish Kumar Jha, Consulting & Contributing Editor for ***SP's Naval Forces*** in an exclusive interaction with Dr Samir V. Kamat, Secretary DDR&D and Chairman DRDO.

look at the possible collaboration to partner with, the co-development cost and time?
Kamat: We are looking at the co-development of higher thrust class engine and this could be a national mission, where there will be GTRE, there will be the Indian industry and of course there will be a foreign OEM. We will also involve academia and other startups to work with us because this is a capability which the country needs. Lot of discussions has happened but final decision in this regard will be taken by our government. This is one area where we have to become Atmanirbhar.

The GTRE has developed Kaveri dry engine, which will go into our unmanned platforms. For a manned platform, we need higher thrust weight class engine, which we hope to do. The Kaveri engine final high-altitude trials as well as flying test bed trials are underway and once that is done, we are ready to integrate it with our Unmanned Platforms.

"We are working on various types of magnetometers, which can detect picotesla level changes in the magnetic field. With that we hope that we will be able to detect submarines in the ocean. It is not very futuristic; we hope that we should have this indigenous capability in next 2-3 years."

Manish Jha: Beyond the concept of "Make in India", how has the DRDO worked to ensure core intellectual property ownership in next-gen systems like AMCA and hypersonic to further prevent tech dependencies?
Kamat: DRDO is actively involved in designing and developing critical technologies for advanced systems like the AMCA (Advanced Medium Combat Aircraft) and hypersonic missiles. This includes focusing on key areas like stealth technology, AI-assisted electronic piloting and advanced avionics. DRDO's work on hypersonic technology, including the successful ground testing of a scramjet engine, demonstrates India's progress in this cutting-edge field.

We are generating our own intellectual property. We are doing the design and development on our own. The IP belongs to us. Even when we do co-development of an engine, one of the conditions is that entire IP should belong to India. DRDO is working to ensure core intellectual property (IP) ownership in next-gen systems like the AMCA and hypersonic by prioritising indigenous design and development, fostering collaboration with private players, and leveraging transfer of technology (ToT) agreements strategically.

This approach aims to reduce reliance on foreign technology and build a self-reliant defence industrial base. DRDO is increasingly engaging with private sector companies and MSMEs in defence R&D and manufacturing. This collaboration is crucial for scaling up production, accelerating technology transfer, and building a robust domestic defence ecosystem.

The 'Make in India' initiative is a key driver in this process, encouraging private companies to invest in defence production and contribute to self-reliance. The ToT process is carefully managed to ensure that India retains control over the core IP and can adapt the technology to its specific needs. DRDO also releases updated compendiums like "DRDO Products for Export," showcasing India's defence capabilities to friendly nations and potentially paving the way for further collaborations and ToT opportunities.

Manish Jha: DRDO has developed crucial AIP technology in the shortest time. How would you talk about the DRDO AIP systems induction timeline for the P-75 submarine?
Kamat: DRDO developed AIP is going into the P-75. Our energy module is getting ready hopefully by December this year and then module will be put in a submarine hull, that may take a year or so. After that when the submarine come for refit, this hull containing the AIP i.e., energy module will be joint to the submarine and then it will go through the testing.

The land-based prototype of this AIP was proven on the ground last year.

"Then Guided Pinaka is also very accurate, which can be used against ships which are coming close to our coast"

Manish Jha: What measures can be taken to ensure the security of the Indian coastline?
Kamat: For Coastline security, you can have variety of defence systems like Radars, Electro Optic systems etc to detect any threats coming in. Then you can have a coastal battery of guns, missiles like surface-to-surface, surface-to-air etc. An entire network can be built if required. It need not be ship based only, it may also be ground based or shore based. BrahMos is also a good weapon, it can be fired from the shore. Then Guided Pinaka is also very accurate, which can be used against ships which are coming close to our coast.

India's Submarine Capability and Roadmap: Track for 2035

Indian Navy's submarine modernisation plan is multi-pronged and spans across diesel-electric (SSK), nuclear-powered ballistic missile (SSBN), and nuclear-powered attack (SSN) submarines. The navy's modernisation plan has multiple strategic and rational elements for India's maritime doctrine of sea denial, sea control, and credible minimum deterrence. The plan also takes into account China's expanding naval footprint in the Indian Ocean and the People's Liberation Army Navy's rapid submarine buildup.

PHOTOGRAPHS: ThyssenKrupp Marine Systems, DPR Defence

Indian Navy's submarine modernisation plan includes the need for a credible sea-based deterrent (Left) HDW Class Dolphin AIP Submarine (Right) INS Arihant SSBN

■ MANISH KUMAR JHA

INDIA'S SUBMARINE MODERNISATION IS a strategic national security initiative aimed at deterring regional threats, ensuring maritime dominance in the Indian Ocean, and bolstering the country's second-strike nuclear capability. The plan is multi-pronged and spans across diesel-electric (SSK), nuclear-powered ballistic missile (SSBN), and nuclear-powered attack (SSN) submarines.

The navy's modernisation plan has multiple strategic and rational elements, which include China's expanding naval footprint in the Indian Ocean and the People's Liberation Army Navy (PLAN) rapid submarine buildup. PLAN is expected to grow its submarine force to 65 boats by 2025 and 80 by 2030, according to United States government reports. This expansion includes both nuclear-powered attack submarines (SSNs) and ballistic missile submarines (SSBNs), as well as a robust diesel-electric submarine (SSK) fleet.

At the same time, Pakistan's modernisation of its submarine fleet (Agosta-90B upgrades, Hangor-class under construction) poses challenges on the back of China's overt support.

However, the depletion of Indian conventional sub strength is also factored from 21 in the 1980s to 15 (2024), while many are ageing.

The submarine modernisation plan includes the need for a credible sea-based nuclear deterrent as part of India's nuclear triad.

India's submarine modernisation programmes have been categorised broadly in Projects like Project 75 (P-75), P-75(I), SSBN, SSN, and associated upgrade plans. How is it unfolding?

Project 75 (P-75) – Kalvari-Class Diesel-Electric Submarines

Six Scorpene-design submarines were built at Mazagon Dock Ltd (MDL) with Naval Group (France), as part of the original P-75 programme.

In the series, the lead boat, INS Kalvari, was commissioned in December 2017. INS Vagir (5th boat) was commissioned in January 2023 and the final boat, INS Vagsheer, launched in April 2022, was officially commissioned into the Indian Navy on 15 January 2025.

These subs feature modern stealth features and missions from anti-submarine warfare (ASW) to mine-laying. They have faced delays and weapons (Black Shark torpedo) delivery issues due to vendor issues and blocklisting policies.

Moreover, the planned additional three Scorpène boats (P-75 Additional) are under final negotiation for construction at MDL to boost fleet numbers.

Project-75 (India) – Next-Generation Diesel-Electric Subs with AIP

The next phase of the Indian Navy submarine plan is categorised as P-75(I). Approved for six stealth diesel-electric submarines, to be built under "Make-in-India" collaboration between MDL and TKMS (Germany), bid passed technical evaluation in early 2025.

TKMS-MDL bid was the sole compliant offer. It incorporates the AIP, which is likely German fuel-cell-based, vertical-launch capability for cruise missiles, high indigenous content, and extended submerged endurance. The first boat is expected in the mid-2030s (seven-seven-year build timeline for the lead hull). It is expected that the entire class will be delivered by the mid-thirties.

Continued on page 6...

India's Submarine Capability...

continued from page 5

At the same time, the life-extension of ageing Shishumar (HDW Type 209) class: INS Shishumar and INS Shankush mid-life upgrades are underway at MDL, extending service by 10–15 years, finishing around 2026.

Nuclear Ballistic Missile Submarines (SSBNs – Arihant/Arighat/Aridhaman/S5)

India's first SSBN, INS Arihant, was launched in July 2009 and commissioned in August 2016. It was operationalised in 2018. INS Arihant is a 6,000-tonne class sub with 4× K-15 SLBMs (750 km range).

Second SSBN, INS Arighaat (S3) was commissioned in 2024, boosting indigenisation as estimated at around 70 per cent. Arighaat is the same 6,000-tonne with CLWR reactor, carries up to 4× K-4 SLBMs (3,500 km range) or more K-15s mixed load.

The third Arihant-class submarine, INS Aridhaman (S4) of about 7,000-tonnes, is undergoing sea trials. Aridhaman is expected to be inducted in 2025. It has 8 missile tubes and can carry up to 8 K-4 or longer-range K-5 SLBMs (~6,000 km).

The fourth unit, codenamed S5 (loosely referred to) is also under construction at Visakhapatnam, with an upgraded reactor and expanded SLBM capacity.

S5-class SSBNs: Larger advanced next-gen SSBNs have an estimated 13,500-tonne, to begin production by 2027. The SSBN is powered by a 190 MW reactor from BARC. In terms of its capability, it is reported that the S5-Class could carry up to 12–16 K-5/K-6 SLBMs with MIRV capability.

Building further on this, the construction of up to six S5 boats in phases is planned to bolster credible nuclear deterrence.

Nuclear Attack Submarines (SSNs/'Hunter-Killers')

India's lease of Akula-class SSN (INS Chakra III) ended in 2021. A new lease from Russia is expected to start in 2025/2026 while domestic SSNs develop.

The Cabinet Committee approved the first two indigenous SSNs in late 2024/early 2025 at the estimated cost of ₹45,000 crore ≈ $5.4 billion).

Navy Chief announced the first SSN to be ready by 2036, the second within two years thereafter. As per the re-opted plan, the Navy has marked its target of six SSNs over the next decade or so.

These SSNs are envisioned to be faster, quieter, longer-endurance platforms equipped with torpedoes, anti-ship and land-attack missiles, and potentially autonomous drones.

Strategic Context & Challenges

India's submarine fleet modernisation is essential against the backdrop of expanding Chinese & Pakistani naval presence in the Indo-Pacific and Indian Ocean region.

However, in the crucial thread, the delays in P-75(I) stem from ambitious technical demands (e.g. stealth + AIP + vertical launch, etc.) in addition to strict liability and technology transfer clauses, and an unwillingness from many OEMs to meet the full suite of NSQRs. It was only in early 2025 that the government gave the green light to the MDL–TKMS bid, as the only compliant offer.

Filling shortfalls in diesel-electric numbers is also being managed via upgrades to Shishumar-class boats via mid-life refits to extend operational life through the 2030s.

Despite the foreign collaboration, indigenisation remains a core policy goal. SSBN/SSN/AIP subs aim for high local content as part of "Make-in-India," though component sourcing and readiness timing pose perennial challenges. India is executing a multi-pronged, multi-decade submarine modernisation plan. The P-75 Programme is complete, with six diesel-electric Scorpènes already inducted.

India's Submarine Capability

Programme	Type	Boats	Key Features/Status
P-75 (Kalvari)	Conventional (SSK)	6 Scorpènes	Last Inducted in 2025; advanced stealth; facing weapons delivery delays
P-75(I)	Conventional (SSK + AIP)	6 planned	German TKMS design; AIP; vertical missiles; indigenisation; delays
Arihant-class	SSBN	Arihant, Arighat, Aridhaman, S4(4 total)	Nuclear deterrent force; SLBMs K-15, K-4, upcoming K-5
S5-class	Advanced SSBN	Up to 6 planned	13,500t; 190 MW reactor; 12–16 K-5/K-6 MIRV missiles; from ~2027
SSN programme	Nuclear attack (hunter-killer)	6 planned	2 approved so far; first ready by 2036; leased Akula until then

AIP: Air Independent Propulsion system

P-75(I) holds promise for a leap forward with AIP-equipped SSKs, but is delayed and now firmly anchored to the TKMS–MDL pathway.

The SSBN fleet continues to grow with Arighat and Aridhaman entering service soon. INS Aridhaman, India's third Arihant-class submarine, is expected to be commissioned into the Indian Navy by the end of 2025. Currently, Aridhaman is undergoing sea trials. Further, the next-generation S5 class will deliver expanded SLBM payloads and longer endurance.

The long-term goal is to field a fleet of six indigenous SSNs, with the first boat targeted for 2036 to support hunter-killer operations. Interim leasing of Russia's Akula-class will bridge capability gaps. This programme is ambitious, strategic, and essential. The modernisation plans to combine legacy upgrades, foreign collaboration, and growing indigenous industrial capabilities to ensure credible undersea deterrence and strategic depth through the 2035s.

India aims to possess a triad-capable SSBN fleet and field advanced SSNs to counter Chinese and Pakistani submarines.

Additionally, it is geared to modernise and expand its diesel-electric fleet with AIP and missile capabilities and develop self-reliant technologies like AIP, nuclear propulsion, and SLBMs.

This effort is central to India's maritime doctrine of sea denial, sea control, and credible minimum deterrence in an evolving Indo-Pacific security environment.

Operation-Proven Defense: IAI's Edge for India's Security


Credit: IAI

In today's fast-evolving threat landscape, defense superiority demands **speed, precision, and seamless coordination.**

During Operation Rising Lion, Israel faced the largest coordinated missile and UAV assault in its history - hundreds of ballistic and cruise missiles, **drone swarms**, and high-volume rocket attacks. The response was swift and decisive, powered by IAI's game-changing technological solutions.

Combat-Proven Performance

IAI's **multi-layered defense** architecture protected critical assets and civilian centers, enabling real-time decision-making under extreme operational pressure - and **keeping the nation safe.**

- **Barak** shielded airspace and naval zones from cruise missiles and UAVs.
- Advanced **MMR** and Green Pine radars provided early detection and guided interceptors with pinpoint accuracy.
- **Heron** UAVs maintained persistent ISR over vast theaters, feeding real-time intelligence into the command chain.
- **AI-enabled satellite communications** ensured uninterrupted coordination across land, sea, air, and space.

IAI's systems also played a critical role in enabling deep strikes and achieving **air superiority** during the operation.

Meeting Contemporary Defense Challenges

The modern defense environment is defined by multi-axis missile threats, UAV proliferation, and the strategic need for maritime domain superiority. With its vast and diverse borders, India requires persistent surveillance, resilient connectivity, and rapid-response capabilities.

IAI's combat-proven solutions meet these challenges head-on.

- The trusted Heron UAV family delivers **enduring surveillance** across high-altitude frontiers and deep-sea patrols.
- The scalable Barak system provides **layered air and missile defense**, ensuring strategic stability in high-threat environments.

Connectivity That Saves Lives

IAI's systems are integrated into a unified, AI-powered network, creating **360° situational awareness** that empowers commanders to make fast, informed decision - critical for countering high-volume, multi-vector attacks.

A Trusted Partner for the Future

With four decades of close cooperation, IAI proudly supports India's vision of a self-reliant, next-generation defense ecosystem. In the toughest battles, technology and readiness make all the difference. IAI's vision is to expand local production and development capabilities - to manufacture in India, for India, and for export to the world.

IAI is proud to stand with India - to protect, to partner, and to innovate together.

Empowering a State of Readiness

True security lies in the ability to anticipate, adapt, and respond at a moment's notice. IAI's integrated systems - designed to detect threats early, connect decision-makers seamlessly, and enable rapid, coordinated action - empower nations to maintain **a state of constant operational readiness.**

This readiness ensures that when challenges arise, the response is decisive - **safeguarding sovereignty, stability, and peace.**


Credit: IAI

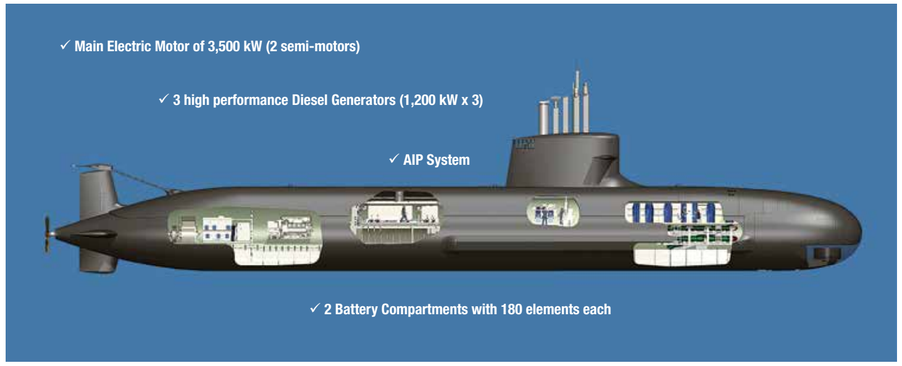
Credit: IAI

Navantia's Naval Prowess

Powering the Future of Global Maritime Defence

■ SP'S SPECIAL CORRESPONDENT

PHOTOGRAPHS: Navantia



(Top Left-Right) Navantia completes the fitting of the Hydrogen Propulsion System AIP into a S-80 Class Submarine; Navantia's BEST (Bio-Ethanol Stealth Technology) AIP (Air-Independent Propulsion) system during operational test; (Above) Navantia's S-80 Class Submarine.

FROM CUTTING-EDGE SUBMARINE TECHNOLOGY and Air-Independent Propulsion (AIP) systems to strong partnerships with the Spanish Navy and expanding global deliveries, Navantia is redefining shipbuilding for 21st-century maritime security.

Navantia, Spain's leading naval shipbuilder, has established itself as a cornerstone of maritime defence innovation in Europe and beyond. With a heritage rooted in centuries of naval construction, the company today is renowned for its advanced submarines, surface vessels, and integrated combat systems. Working closely with the Spanish Navy, while expanding its international footprint—from Australia to India—Navantia exemplifies the blend of tradition, technological sophistication, and strategic agility. As global navies modernise their fleets, Navantia's role has become increasingly critical in the evolving landscape of maritime power.

Historical Legacy and Technological USPs

Navantia was formed in 2005 following the restructuring of Spain's state-owned shipbuilding industry, but its shipyards in Cartagena, Ferrol, and San Fernando trace their roots back several hundred years. It operates as a subsidiary of SEPI (Sociedad Estatal de Participaciones Industriales), reflecting its strategic importance to Spain's industrial and defence policy.

Navantia's mission is clear: to be a global leader in naval construction, system integration, and life-cycle support. Its business verticals span the full spectrum of maritime defence needs—surface combatants, submarines, auxiliary vessels, and advanced digital solutions for ship management.

One of Navantia's standout technological capabilities lies in its expertise in integrated combat systems. The company's CATIZ Combat System and SCOMBA, a scalable command-and-control architecture developed with the Spanish Navy, provide interoperability and real-time tactical awareness—key differentiators in modern maritime warfare.

Another major USP is its development of Air-Independent Propulsion (AIP) for submarines. The AIP system, based on fuel-cell technology, significantly extends submerged endurance, making submarines quieter and more difficult to detect. This technology features prominently in the S-80 Plus class submarine, making Navantia one of only a few shipbuilders globally to design and build submarines with indigenous AIP technology.

S-80 Plus: The Flagship Submarine Programme

Navantia's flagship submarine initiative, the S-80 Plus, is a critical leap in autonomous underwater operations. Designed entirely in Spain, the S-80 series is built at Navantia's Cartagena shipyard and represents the most ambitious naval programme undertaken in the country.

Navantia specializes in the construction of all types of surface military ships and submarines, as well as in engine manufacturing incorporating advanced technologies

These submarines feature advanced combat systems, an extended range with the AIP module, reduced acoustic signatures, and significant payload capacity. The first in class, Isaac Peral (S-81), underwent sea trials and is scheduled to be commissioned by the Spanish Navy in 2025, followed by Narciso Monturiol (S-82) and two others.

Navantia's strategic alignment with the Spanish Navy continues to be a cornerstone of its business. The S-80 Plus submarines, F-110 frigates (under construction), and auxiliary ships like the BAC Cantabria highlight a strong home-market foundation. This long-standing collaboration allows Navantia to validate, test, and evolve technologies before deploying them in export markets.

The F-110 frigates, in particular, are set to integrate next-generation radar systems, cyber-defence infrastructure, and artificial intelligence for autonomous operations—demonstrating Navantia's vision for multi-domain naval warfare.

Global Footprint: Exports and Collaborations

Navantia's export capabilities are significant. The company has delivered advanced platforms to a wide array of navies:

- **Australia:** Navantia collaborated on the Hobart-class Air Warfare Destroyers and Canberra-class Landing Helicopter Docks, delivering both platforms and design expertise. The Royal Australian Navy is also sourcing auxiliary ships from Navantia under the SEA 1654 programme.
- **Saudi Arabia:** Navantia partnered with Saudi Arabian Military Industries (SAMI) to build Avante 2200 corvettes for the Royal Saudi Naval Forces. The first ship, Al Jubail, was delivered in 2022, and the programme includes extensive technology transfer.
- **Turkey:** The design of Turkey's flagship amphibious assault ship, TCG Anadolu, is based on Navantia's Juan Carlos I, showing the company's role in transferring complex warship design and know-how.
- **Norway and India:** Navantia has participated in technology bids and partnerships in these regions, positioning itself as a capable design collaborator in submarine and surface vessel procurement.

Navantia in India: A Growing Interest

While not yet a major supplier, Navantia has shown growing interest in India's expanding defence market. Most notably, it was among the contenders in the Indian Navy's P-75(I) submarine programme, offering the S-80 Plus design with AIP capability. Navantia had tied up with Larsen & Toubro (L&T) to bid for this project. Navantia's willingness to engage in technology transfer and co-production aligns with India's 'Make in India' and strategic partnership models.

Navantia has also explored collaboration with Indian shipyards for surface combatant programmes, potentially positioning itself as a long-term partner for naval design and system integration.

Shaping the Naval Future

Navantia is also investing heavily in Industry 4.0 technologies. Through its 'Navantia 4.0' programme, the company is implementing digital twins, automated welding, augmented reality, and smart logistics in shipyards to improve precision and reduce build times. This effort supports not just product delivery but also after-sales life-cycle support and fleet readiness.

Its commitment to sustainability is evident in green propulsion research and modular designs that allow for future upgrades, hybrid systems, and emission compliance—an increasingly important metric for international naval operators.

Navantia has successfully transitioned from a state-owned shipbuilder focused on its domestic navy to a world-class naval enterprise. Through AIP submarines, next-gen combat systems, robust partnerships, and forward-looking digitalisation, the company now stands at the cutting edge of naval capability. As strategic tensions shift from the Atlantic to Indo-Pacific, Navantia's growing global presence and technological agility suggest a larger role in shaping maritime power in the decades to come. ■

New Ships, Subs, MCMVs for Navy

Indian Navy has achieved a significant twin power upgrade with the commissioning of the Russian-built INS Tamal and the delivery of the indigenous stealth frigate INS Udaygiri, marking a major enhancement in its maritime capabilities

■ LT GENERAL P.C. KATOCH (RETD)

PHOTOGRAPH: PIB

Project 17A indigenous stealth frigate Udaygiri delivered to Indian Navy

INS 'TAMAL' WAS COMMISSIONED into the Indian Navy on July 1, 2025, at the Yantar Shipyard in Kaliningrad, Russia, in presence of senior Indian and Russian naval officials. The 3,900-tonne, 125-meter-long INS 'Tamal' is the eighth frigate in the Krivak (Project 1135.6) class and the second of the upgraded Tushil class, following INS Tushil' commissioned in December 2024. The frigate features a blend of Indian and Russian technologies, including BrahMos supersonic cruise missiles, advanced air defence systems, a 100mm main gun, Close-In Weapon Systems, anti-submarine rockets, and heavyweight torpedoes. It is designed for blue water operations across all dimensions of naval warfare (air, surface, underwater, and electromagnetic) and is equipped with sophisticated electronic warfare systems and robust defences against nuclear, biological, and chemical (NBC) threats.

With a crew of about 26 officers and 250 sailors, INS Tamal is set for its home-port in Karwar, Karnataka, and is expected to play a crucial role in safeguarding India's maritime interests in the Indian Ocean Region (IOR). Notably, INS Tamal is the last foreign-made warship to be inducted into the Indian Navy, reflecting India's shift towards self-reliance in defence manufacturing.

Concurrently, also on July 1, 2025, the Indian Navy received INS 'Udaygiri', the second ship of the indigenous Project 17A stealth frigate class, built by Mazagon Dock Shipbuilders Ltd (MDL) in Mumbai. Udaygiri is a follow-on to the Shivalik-class frigates, featuring a 4.54 per cent larger hull, improved stealth, and next-generation weapons and sensors. The frigate is powered by a Combined Diesel or Gas propulsion system and managed by an Integrated Platform Management System, enabling operations in blue water environments and the ability to counter both conventional and non-conventional threats.

Udaygiri boasts state-of-the-art sensors and weaponry, including supersonic surface-to-surface missiles, a medium-range surface-to-air missile system, a 76mm main gun, and advanced close-in weapon systems. With 75 per cent indigenous content, Udaygiri exemplifies India's progress in indigenous warship design and the push for self-reliance in defence manufacturing. It is the second of seven Project 17A frigates under construction, with the remaining five to be delivered by the end of 2026.

The Indian Navy has achieved a significant twin power upgrade with the commissioning of the Russian-built INS Tamal and the delivery of the indigenous stealth frigate INS Udaygiri, marking a major enhancement in its maritime capabilities; strengthening its ability to safeguard national maritime interests and maintain security across vital sea lanes in the IOR.

India is also accelerating its nuclear-powered attack submarine (SSN) programme under Project-77, with two submarines now officially cleared for development

The Ministry of defence (MoD) recently cleared projects worth ₹1.05 lakh crore, including quick-range surface-to-air missiles (QRSAM), mine countermeasure vessels (MCMVs), electronic warfare (EW) systems, armoured recovery vehicles, naval moored mines and a tri-services logistics platforms, according to news reports of July 3, 2025. The Indian Navy received a significant portion of these approvals, including Mine Countermeasure Vessels (MCMVs) which are specialised ships designed to detect and neutralise sea mines, ensuring safe navigation for both military and commercial vessels.

To further counter such threats, moored mines or underwater explosives anchored to the seabed to block enemy access to critical maritime areas, were also cleared for the Navy. The Defence Research and Development Organisation (DRDO) has developed a Processor Based Moored Mine (PBMM) which is capable of detecting and destroying surface and subsurface threats by the acoustic/pressure influence anomaly generated by targets passing in proximity. Also cleared for the Navy was the Super Rapid Gun Mount: a naval artillery system that can target both aerial and surface threats. In addition, Submersible Autonomous Vessels (unmanned platforms) were also approved, which conduct undersea surveillance, mine detection, and anti-submarine operations with minimal risk to personnel.

India is also accelerating its nuclear-powered attack submarine (SSN) programme under Project-77, with two submarines now officially cleared for development. According to news reports of July 8, 2025, India has cleared the development of two nuclear-powered attack submarines under Project-77, with Larsen and Toubro (L&T) playing a central role; in collaboration with the DRDO and the Shipbuilding Centre at Visakhapatnam. These next-gen submarines will be armed with BrahMos and upcoming hypersonic missile systems, enhancing India's maritime strike capabilities.

India eventually plans to build a fleet of six nuclear-powered attack submarines under Project-77. Powered by nuclear reactors, these submarines can operate underwater for extended durations and travel at higher speeds than conventional ones. They are expected to carry an evolved version of the BrahMos missile and future hypersonic systems currently under development by DRDO. These advanced weapons could offer strike ranges between 1,500 and 2,000 kilometres, allowing submarines to hit high-value targets from safe stand-off distances. This extended reach will enable the Indian Navy to conduct deep-strike missions while remaining beyond the detection range of enemy air defence and anti-submarine systems.

In addition to the above, Russia is to supply India with an upgraded Akula-class submarine armed with 1,500-km range 'Kalibr' missiles by 2028 albeit its delivery was earlier scheduled in 2025, according to news reports of July 2, 2025. The submarine, part of a $3 billion deal between India and Russia in 2019, will bolster India's underwater warfare capabilities in the Indo-Pacific region. To compensate for the three-year delay in delivering the Akula-class submarine, Russia has offered to equip the diesel submarine (already leased to India) with an advanced variant of the Kalibr missile – 3M14K (SS-N-30A) cruise missile having a range of 1,500-2,000 km. ■

Russia Hand Over to India
Eighth 11356 Frigate INS Tamal

INS Tamal is an impressive blend of Indian and Russian cutting-edge technologies and best practices in warship construction. It also exemplifies collaborative strength of the India-Russia partnership.

PHOTOGRAPHS: ROSOBORONEXPORT

INS Tamal is a model of technology cooperation between Russia and India. It incorporates more than 20 Indian-made ship systems.

ROSOBORONEXPORT (PART OF ROSTEC State Corporation) on July 1, 2025 in Kaliningrad handed over another Project 11356 frigate, built by United Shipbuilding Corporation, to the Indian Navy. The eighth Project 11356 frigate, built in Russia for the Indian Navy, was christened Tamal.

"The successful completion of construction, testing and delivery of the frigate Tamal to India demonstrates Rosoboronexport's readiness to effectively fulfill any naval contracts, taking into account current global market trends. The eighth Project 11356 frigate is a model of technology cooperation. It incorporates more than 20 Indian-made ship systems, including the BrahMos supersonic missile system, an automated communications system, a surface search and target acquisition radar, and a sonar station," - said Alexander Mikheev, Director General of Rosoboronexport. "Today the Company is actively developing partnerships with Indian public and private enterprises to jointly develop and manufacture military products on the partner's territory. We are discussing 50+ projects for all services of the armed forces and are already working on a number of them".

According to the Russian special exporter, Tamal is a frigate that meets all the current requirements of the global naval shipbuilding market. Its radars are capable of timely detecting all types of air attack weapons, including advanced low-flying anti-ship missiles. The ship has a reliable air defence system based on the Shtil-1 vertical-launch SAM system developed and manufactured by Almaz-Antey Air and Space Defence Corporation.

INS Tamal hand over ceremony at Kaliningrad, Russia

The ship's armament is sufficient to counter current and emerging threats. Its artillery armament, consisting of 100mm and 30mm artillery systems, together with an EW system, can repel UAV attacks and effectively counter unmanned surface vehicles. The ship has a reinforced helipad, enabling it to operate a Ka-31 long-range early warning helicopter. The delivered frigate Tamal has excellent seaworthiness: it is able to travel 4,850 miles without refueling and stay at sea for 30 days without resupply.

Currently India is already operating 7 Project 11356 frigates. In December 2024 a commissioning ceremony for frigate Tushil took place in Kaliningrad. In addition, India's Goa Shipyard Limited launched the ninth and tenth frigates of this project, which are being built by Indian shipbuilders with the Russian assistance.

As Alexander Mikheev said during Aero India 2025, today, Rosoboronexport and the Indian side are working to expand bilateral technological cooperation within the framework of the 'Make in India' programme. "We offer our partners large-scale projects to develop and produce military aircraft, helicopters, air defence equipment, armoured vehicles and ammunition. We are also ready to discuss the possibility to jointly promote these products in third countries," said Rosoboronexport's CEO.

The Project 11356 ships are designed to conduct operations on the high seas against enemy surface ships and submarines, as well as repel air attacks, both independently and as an escort ship of a task force. Their seaworthiness allows the ships to carry out combat missions in any area of the world's oceans in conditions of long separation from supply bases.

TRIALS OF EXTENDED RANGE ANTI-SUBMARINE ROCKET SUCCESSFULLY CARRIED OUT

User trials of Extended Range Anti-Submarine Rocket (ERASR) were successfully carried out from INS Kavaratti. DRDO's Armament Research & Development Establishment (ARDE), Pune, in association with High Energy Materials Research Laboratory and Naval Science & Technological Laboratory, has designed and developed ERASR for indigenous rocket launcher (IRL) of Indian Naval Ships.

ERASR is a totally indigenous anti-submarine rocket used to combat submarine and fired from onboard IRL of Indian Naval Ships. It has twin-rocket motor configuration to meet a wide spectrum of range requirements with high accuracy and consistency. The ERASR uses an indigenously developed Electronic Time Fuze. A total of 17 ERASRs were successfully test evaluated at different ranges. All the specified objectives of the trials such as Range performance, Electronic Time Fuze functioning and Warhead functioning were successfully demonstrated.

ICG INDUCTS 'ADAMYA' FPV

'Adamya' the first Fast Patrol Vessel (FPV) under the eight FPV Project at Goa Shipyard Limited (GSL) was inducted in the Indian Coast Guard (ICG) on June 26, 2025, in Goa. The FPV is the first ship in its class within the ICG fleet to feature Controllable Pitch Propellers (CPPs) and indigenously developed gearboxes, offering superior manoeuvrability, operational flexibility, and enhanced performance at sea. The vessel is equipped with state-of-the-art technology, including a 30mm CRN-91 gun, two 12.7mm stabilized remote-control guns with fire control systems, an Integrated Bridge System (IBS), an Integrated Platform Management System (IPMS), and an Automated Power Management System (APMS). These advanced systems will empower the ICG to perform its charter of duties with increased precision, efficiency, and responsiveness across India's extensive maritime domain.

GOA SHIPYARD LAUNCHES ICGS ATAL FPV

Goa Shipyard Limited (GSL) launched ICGS ATAL (Yard 1275) Fast Patrol Vessel (FPV) for the Indian Coast Guard (ICG) in a ceremony held at Vasco-da-Gama, Goa on July 29, 2025. It is the sixth in a series of eight state-of-the-art indigenously designed FPVs being constructed for ICG by GSL.

The FPVs, designed in-house at GSL, are 52 metres in length, with an 8-metre beam and 320-tonne displacement. These high-speed boats are equipped to conduct coastal patrols, island security missions, and offshore asset protection, significantly augmenting India's maritime domain awareness and national security. The vessel shall also perform anti-smuggling, anti-piracy and search & rescue operations.

FLAG APPOINTMENTS

Vice Admiral Sanjay Vatsayan, assumes charge as the 47th Vice Chief of the Naval Staff

Vice Admiral Sanjay Vatsayan assumed charge as the 47th Vice Chief of the Naval Staff (VCNS) on August 1, 2025. He was commissioned into the Indian Navy on January 1, 1988. A specialist in Gunnery and Missile Systems, he has held a wide range of command, operational and staff assignments over his distinguished naval career spanning more than three decades. Prior to taking over as the VCNS, he served as Deputy Chief of the Integrated Defence Staff (DCIDS) - Operations and thereafter as DCIDS (Policy, Plans and Force Development) at HQ IDS.

Vice Admiral Krishna Swaminathan, takes over as the Flag Officer Commanding-In-Chief, Western Naval Command

Vice Admiral Krishna Swaminathan assumed charge as the Flag Officer Commanding-in-Chief, Western Naval Command on July 31, 2025. The Flag Officer was commissioned into the Indian Navy on July 1, 1987 and is a specialist in Communication and Electronic Warfare. The Flag Officer has held several key operational, staff and training appointments in his naval career. On promotion to the rank of Vice Admiral, the Flag Officer discharged the responsibilities of Chief of Staff of the Western Naval Command in Mumbai and Controller of Personnel Services and Chief of Personnel at the Naval Headquarters. Prior to his current assignment as FOCINC West, he served as the Vice Chief of the Naval Staff at NHQ.

Vice Admiral C.R. Praveen Nair, Assumes Charge as Controller Personnel Services

Vice Admiral C.R. Praveen Nair assumed charge as the Controller Personnel Services (CPS) on July 31, 2025. Vice Admiral C.R. Praveen Nair was commissioned in the Indian Navy on July 1, 1991. A Surface Warfare Officer, he is a specialist in Communications and Electronic Warfare. He has held a wide range of command, operational and staff appointments over his distinguished naval career spanning more than three decades. The Flag Officer has commanded Missile Corvette INS Kirch, Guided Missile Destroyer INS Chennai and Aircraft Carrier INS Vikramaditya.

Rear Admiral V. Ganapathy assumes charge as Commandant of Military Institute of Technology, Pune

Rear Admiral V. Ganapathy has assumed the command of the Military Institute of Technology (MILIT), Pune, under the Headquarters Integrated Defence Staff. During his illustrious naval career, Rear Admiral Ganapathy has held several key operational, staff and instructional appointments, demonstrating a rare blend of operational insight, institutional leadership and future-oriented thinking. As the head of India's premier Tri-services technical training institution, he now helms the mission of preparing mid-career officers from the Army, Navy, Air Force and friendly nations in cutting-edge military technologies.

INS ARNALA COMMISSIONED INTO INDIAN NAVY

INS Arnala, the first of the Anti-Submarine Warfare Shallow Water Craft, was commissioned into the Eastern Naval Command of the Indian Navy on June 18, 2025 in the presence of General Anil Chauhan, the Chief of Defence Staff. Designed for a broad range of Anti-Submarine operations, INS Arnala is equipped to conduct Sub-Surface Surveillance and Interdiction, Search and Rescue Missions; and Low-Intensity Maritime Operations (LIMO). This 77-meter-long warship, with a gross tonnage of over 1,490 tonnes, is the largest Indian Naval warship to be propelled by a Diesel Engine-Waterjet combination. The ceremony was hosted by the Flag Officer Commanding-in-Chief, Eastern Naval Command and attended by senior naval officials and distinguished civilian dignitaries.

CONSTRUCTION COMMENCES OF MOST ADVANCED AUV DESIGNED BY INDIAN NAVY

Krishna Defence and Allied Industries Ltd (KDAIL), hosted a ceremonial plate-cutting ceremony on June 10th, 2025, at their facility in Halol, Gujarat, to mark the commencement of construction on the country's largest and most advanced Autonomous Underwater Vehicle (AUV), designed by Indian Navy. The event was graced by Vice Admiral R. Swaminathan and other senior officials from the Indian Navy, highlighting the event's importance in advancing India s indigenous defence capabilities.

INDIGENOUS ADVANCED STEALTH FRIGATE HIMGIRI DELIVERED TO INDIAN NAVY

Himgiri (Yard 3022), the third ship of Nilgiri Class (Project 17A) and the first of the class built at Garden Reach Shipbuilders & Engineers (GRSE), was delivered to the Indian Navy on July 31, 2025. Project 17A frigates are versatile multi-mission platforms, designed to address current and future challenges in the maritime domain. This state-of-the-art frigate reflects a quantum leap in naval design, stealth, firepower, automation and survivability.

Designed by the Warship Design Bureau (WDB) and overseen by the Warship Overseeing Team (Kolkata), P17A frigates reflect a generational leap in indigenous ship design, stealth, survivability, and combat capability. P17A ships are fitted with an advanced weapon and sensor suite compared to the P17 (Shivalik) class. These ships are configured with Combined Diesel or Gas (CODOG) propulsion plants, comprising a diesel engine and gas turbine, that drives a Controllable Pitch Propeller (CPP) on each shaft, and a state-of-the-art Integrated Platform Management System (IPMS). The weapon suite comprises supersonic Surface-to-Surface missile system, Medium-Range Surface to Air Missile system, 76mm Gun, and a combination of 30mm and 12.7mm rapid-fire Close-in Weapon Systems.

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