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DRDO News

DRDO indigenous submarine proposal to go for CCS approval in couple of months; eight years for first sub

Source: The Hindu, Dt. 22 Feb 2025,

URL: <https://www.thehindu.com/news/national/drdo-indigenous-submarine-proposal-to-go-for-ccs-approval-in-couple-of-months-eight-years-for-first-sub/article69251317.ece>

With the deal to buy six new diesel-electric submarines entering the contract negotiation phase, the Defence Research and Development Organisation (DRDO) is gearing up to bring a proposal to design and develop an indigenous conventional submarine to the Cabinet Committee on Security (CCS) for approval.

The procurement deal comes under Project-75I, while the indigenous development proposal comes under Project-76.

“The inter-ministerial consultation is going on and it should be ready for CCS approval in the next two months,” said an official who did not wish to be named. “Once approved, the design phase is expected to take two to three years, and another five years for construction. So it is expected to take around eight years to have the first submarine, once the project is sanctioned,” the source said.

The indigenous submarine is expected to displace around 3,000 tonnes and will be capable of launching land attack cruise missiles (LACMs), which are still under development, from its torpedo tubes. A new LACM being developed by DRDO fits this criteria, sources stated

.Over 90% indigenous content

As reported by The Hindu last June, DRDO carried out a preliminary study to determine the contours of P-76, after a go-ahead from the Defence Ministry. P-76 will be a continuation of the Advanced Technology Vessel (ATV) project, under which the Arihant series of nuclear ballistic missile submarines (SSBN) are being built, with another project underway to build nuclear-powered attack submarines (SSN).

The project is aiming for 90% to 95% indigenous content, with major systems being sourced domestically including the weapons, missiles, combat management system, sonars, communications, electronic warfare suite, mast, and periscope. Only some chips, electronics, and tubes will have to be imported, sources said, adding that the indigenous SSBNs also have over 90% indigenous content.

Parallel development

Meanwhile, the P-75I tender for six conventional submarines is set to begin contract negotiations after long delays, with the bid by Mazagon Dock Shipbuilders Limited (MDL) in partnership with Germany’s ThyssenKrupp Marine Systems (TKMS) of Germany have cleared the technical evaluation. The deal is estimated to be worth around ₹70,000 crore, way above the earlier

benchmark of ₹43,000 crore. The final contract is expected to take at least a couple of years given the tough negotiations, and the first submarine will be delivered seven years later. This means that the P-75I and P-76 programmes will progress almost in parallel, if the development of the latter goes as per plan.

As reported earlier, the indigenous SSN programme is also in the design phase, which is expected to take four to five years, with another five years estimated for the construction and validation of the first submarine. From the proof of concept to the final construction plan, there are four stages of development, another source said.

Long timeframes

In December, Navy Chief Adm Tripathi said that a realistic timeframe would probably see the first SSN inducted in 2036-37, followed by the second one a couple of years later. Last October, the CCS approved the indigenous construction of two SSNs estimated to cost around ₹35,000 crore, while India's fourth SSBN was launched into the water at the Ship Building Centre in Visakhapatnam.

The SSNs are a critical requirement for the Navy to keep a watch over the Indo-Pacific region as they provide unlimited endurance to perform a variety of tasks; their endurance is only limited by that of the crew.

The Indian Navy currently has 17 conventional submarines in service, but the majority of them are ageing platforms. This includes seven Russian Kilo class submarines, four German HDW submarines, and six French Scorpene submarines. A contract for three additional Scorpene-class submarines is set to be signed very soon, with the first of the them likely to be delivered in 2030.

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Defence News

Defence Strategic: National/International

First Training Squadron Of Indian Navy Arrived At Cam Ranh Bay, Vietnam

Source: Press Information Bureau, Dt. 21 Feb 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2105249>

Building Bridges of friendship whilst training young minds, the ships of First Training Squadron - INS Sujata and ICGS Veera arrived at Cam Ranh Bay, Vietnam on 20 Feb 25. The ships received a warm welcome by the Vietnam People's Navy and members of Indian mission at Vietnam. The

visit is poised to further strengthen the longstanding friendship and growing partnership between the two maritime nations.

During the port call, various cross training visits, professional and community interactions including a visit to Vietnam Naval Academy are planned. The visit will conclude with bilateral exercises with Vietnam People's Navy and Coast Guard. The exercise would further enhance the interoperability and exchange of Best Practices.



India and Vietnam share comprehensive strategic partnership which was further strengthened during the recent visit of the PM of Vietnam to India in Aug 24. Furthering the ties, the visit by Training Squadron of the Indian Navy to Vietnam reinforces closer maritime cooperation and training exchange between the two Navies. The extant deployment is aligned with Government of India's broader initiative to enhance capacity building and strengthen regional maritime security in line with the vision of Security And Growth for All in the Region (SAGAR).

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Indian Army Contingent Departs For India-Japan Joint Military Exercise-Dharma Guardian

Source: Press Information Bureau, Dt. 22 Feb 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2105443>

The Indian Army contingent departed today, for 6th edition of India- Japan Joint Military Exercise DHARMA GUARDIAN. The exercise is scheduled to be conducted in East Fuji Manoeuvre Training area of Japan from 24th February to 9th March 2025. Exercise DHARMA GUARDIAN is an annual event conducted alternatively in India and Japan. Last edition of the same exercise was conducted in Rajasthan in February- March 2024.

The Indian contingent comprising 120 personnel will be represented mainly by troops from a battalion of the MADRAS Regiment along with troops from others arms and services. The Japan Ground Self Defence Force (JGSDF) contingent, also comprising similar strength, will be represented by 34th Infantry Regiment.

Aim of the exercise is to enhance interoperability between the two forces while undertaking joint urban warfare and counter-terrorism operations under UN mandate. The exercise will focus on high degree of physical fitness, joint planning and joint tactical drills. Aspects to be rehearsed will include tactical drills, joint exercises and disaster response strategies, designed to enhance operational capabilities, refine combat skills and strengthen interoperability for effective joint operations.

Building on the momentum of Chief of the Army Staff's successful visit to Japan from 14th to 17th October 2024, Exercise DHARMA GUARDIAN will further strengthen the bilateral defence cooperation between India and Japan. The exercise underscores the shared commitment of India and Japan towards regional security, peace and stability, while advancing their common vision of a free, open and inclusive Indo-Pacific. Exercise DHARMA GUARDIAN reinforces the India-Japan relationship as a cornerstone of regional cooperation, fostering strong military-to-military ties and promoting cultural understanding.

A testament to the enduring bond of friendship, trust and cultural linkages between India and Japan, the exercise sets the stage for meaningful professional engagement, highlighting the unwavering commitment of both nations to broader defence cooperation.

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General Upendra Dwivedi, Chief Of The Army Staff Embarks On A Official Visit To France

Source: Press Information Bureau, Dt. 23 Feb 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2105610>

General Upendra Dwivedi, Chief of the Army Staff (COAS), departed on an official visit to France from 24th to 27th February 2025, as part of efforts to bolster India-France defence cooperation.

On 24th February 2025, the COAS will engage with senior military leadership of France at Les Invalides, Paris. The day will begin with a Guard of Honour followed by discussions with General Pierre Schill, CEMAT (Chef d'État-Major de l'Armée de Terre – the French Army Chief). The aim of the meeting will be to foster stronger military ties between the two nations. The itinerary also includes a visit to the École Militaire, the prestigious Military School and Institution Complex in Paris, where the COAS will be briefed on Future Combat Command (CCF). Additionally, General Dwivedi will be briefed at the Technical Section of the French Army (STAT) and visit the Battle Lab Terre at Versailles.

On 25th February 2025, General Dwivedi will travel to Marseille, where he will visit the 3rd Division of the French Army and will be briefed on the mission and role of the 3rd Division, the bilateral exercise SHAKTI, India-France training cooperation, and the French Army modernisation programme (Scorpion). The following day, General Dwivedi will visit Carpiagne to witness a dynamic demonstration of the Scorpion Division with live firing exercises.

On 27th February 2025, the COAS will visit the Neuve Chapelle Indian War Memorial to lay a solemn wreath in honour of the fallen Indian soldiers who participated in World War I. Later in the day, he will deliver a talk at the École de Guerre, the French Joint Staff College, highlighting the evolving nature of modern warfare and India's strategic vision.

General Dwivedi's visit aims to strengthen the military collaboration between India and France, exploring new avenues of cooperation and enhancing strategic partnerships between the two nations' armed forces.

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India showcases defence innovation and strengthens global ties at IDEK and NAVDEX 2025

Source: DD News, Dt. 21 Feb 2025,

URL: <https://ddnews.gov.in/en/india-showcases-defence-innovation-and-strengthens-global-ties-at-idek-and-navdex-2025/>

India's participation in IDEK and NAVDEX 2025 concludes today, reaffirming the country's commitment to global security cooperation, indigenous defence innovation, and strategic partnerships in the international defence landscape.

The India Pavilion displayed cutting-edge defence technologies, including advanced warships, guided missile systems, precision-guided munitions, electronic warfare systems, and AI-driven defence solutions. Leading defence public sector undertakings (DPSUs) such as Bharat Dynamics Limited (BDL), Bharat Electronics Limited (BEL), Goa Shipyard Limited (GSL), Munitions India Limited (MIL), BEML Limited, Yantra India Limited (YIL), and the Defence Research and Development Organisation (DRDO) participated, along with startups under the iDEX initiative, reflecting India's expanding defence capabilities.

A major highlight of the event was the participation of Indian Coast Guard Ship Shoor, an advanced Offshore Patrol Vessel, which made a port call in Abu Dhabi for NAVDEX 2025.

Commanded by Dushyant Kumar, the vessel demonstrated India's maritime strength and reinforced security collaborations in the region. The India Pavilion, was organized by Department of Defence Production, Ministry of Defence, with the support of the Mazagon Dock Shipbuilders Limited. BEL showcased its expertise in defence electronics, displaying its Coastal Surveillance System, Weapon Locating Radar, Anti-Drone System with Hard Kill capabilities, AESA-based Battlefield Surveillance Radar (Short Range), Upgraded L-70 Gun, Software-Defined Radio, and Electro-Optic solutions.

Munitions India Limited presented a diverse range of advanced defence products, including the Pinaka multiple rocket launch system, hand grenades, low-drag aerial bombs, and large-calibre ammunition such as 155mm artillery shells. These offerings highlight India's advancements in munitions technology and self-reliance. The PHDCCI Defence Industry Delegation, comprising 15 Indian defence companies, participated in IDEX & NAVDEX 2025 to explore business opportunities in the expanding global defence and security sector.

Goa Shipyard Ltd showcased its indigenously designed Fast Patrol Vessels (FPVs) and Offshore Patrol Vessels (OPVs). These vessels exemplify India's naval innovation and self-reliance under the "Make in India" initiative, positioning India as a key player in global shipbuilding. NAVDEX 2025 also featured the India-Russia BrahMos missile system, underscoring India's technological prowess in precision-guided weaponry and bolstering its strategic defence partnerships. A high-level delegation led by Vice Admiral Sanjay Vatsayan, Deputy Chief of Integrated Defence Staff (DCIDS), and Major General C.S. Mann, Additional Director General, Army Design Bureau, Indian Ambassador to UAE Shri Sunjay Sudhir, represented India, reinforcing the country's commitment to innovation, self-reliance in defence manufacturing under the 'Aatmanirbhar Bharat' initiative, and expansion into international defence markets.

IDEX and NAVDEX 2025, hosted by ADNEC Group in collaboration with the UAE Ministry of Defence and Tawazun Council, served as a critical platform for fostering international defence cooperation. The five-day event brought together defence leaders, government officials, and industry pioneers to discuss emerging trends, forge strategic alliances, and introduce military innovations. India's significant presence reaffirmed its role as a global defence partner, contributing to the evolving security landscape.

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Defence ministry forms high-level panel to boost indigenous light fighter jet production

Source: The Economic Times, Dt. 24 Feb 2025,

URL: <https://economictimes.indiatimes.com/news/defence/defence-ministry-forms-high-level-panel-to-boost-indigenous-light-fighter-jet-production/articleshow/118511301.cms>

The defence ministry has constituted a high-level committee to streamline the production of indigenous light combat aircraft (LCA) and enhance the role of the private sector in making the fighter jets as the government is looking to boost combat squadrons of the Air Force.

Sources said the committee was constituted earlier this month by defence minister Rajnath Singh and is headed by defence secretary Rajesh Kumar Singh. It includes representatives from all stakeholders including the Air Force and manufacturer Hindustan Aeronautics Limited (HAL).

The committee has been given a month to submit its findings after scrutinising the current production capacity, constraints being faced and requirements of the Air Force. Sources said a key focus would be to find ways to increase private sector participation in manufacturing the jets.

At present, HAL is manufacturing LCA Mk1A jets at two production facilities in Bengaluru and Nashik. An order for 83 fighter jets worth ₹48,000 crore has been placed on HAL but the deliveries have been delayed by almost a year, largely on account of problems in the supply of jet engines that are made by GE. The delay was also recently flagged by Air Chief Marshal AP Singh.

HAL is already outsourcing a significant amount of work to the private sector for jets, which includes orders for MTAR Hyderabad, Indo MIM Bengaluru, L&T, Godrej and Azad Engineering, among others. The expert panel will look at enhancing that and will also evaluate the possibility of setting up a new line for the aircraft production that could be managed by a private sector player.

Sources explained that the need to involve the private sector in a larger way is being considered as an order for 97 additional LCA Mk1A jets is also being processed. Given the large order book of almost ₹2 lakh crore that HAL currently has, the private sector could contribute in ensuring timely deliveries.

For next-generation fighter jets under the advanced multirole combat aircraft (AMCA) programme, the government is looking at considerable involvement of the private sector. As per current plans, the eventual production of the jets will be undertaken by a special purpose vehicle, consisting of a private sector partner, HAL and the Aeronautical Development Authority. HAL is also looking to offer its existing facilities in Nashik to the private sector partner for manufacturing the AMCA in the future.

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Army plans to boost air defence capabilities with new guns, potent radars

Source: The Economic Times, Dt. 22 Feb 2025,

URL: <https://economictimes.indiatimes.com/news/defence/army-plans-to-boost-air-defence-capabilities-with-new-guns-potent-radars/articleshow/118468586.cms>

With drones and other disruptive technologies impacting the dynamics of warfare as demonstrated in recent conflicts, the Army Air Defence has drawn a roadmap to boost its capabilities through replacement of two of its old platforms, induction of new fragmentation ammunition for existing air defence guns, and deployment of more potent radars. Besides, the army is also hoping to place a contract for the indigenously developed Quick Reaction Surface to Air Missile (QRSAM) system within 4-5 months, a top official said on Friday.

The Corps of Army Air Defence holds a large variety of missile systems and guns in its inventory such as the L70, Zu-23mm, Schilka, Tanguska and Osa-AK missile system.

"The fashion of guns is back. The army sustained them for good reason and these guns can be effectively used with fragmentation ammunition," Director General of Army Air Defence (AAD), Lt Gen Sumer Ivan D'Cunha, said.

Asserting the need for modernisation with an emphasis on 'Aatmanirbhar Bharat', Lt Gen D'Cunha also cautioned that the Indian industry must offer "reduced timelines" when it comes to delivery. The AAD, initially part of the Territorial Army, was later separated from the Artillery in 1994 as a separate corps that looks after destruction of air threat "before it manifests", officials said.

The army is planning to replace the L70 and ZU-23mm with "successor" platforms. However, as of now, it is not looking to import, as far as guns are concerned, they said. The first trials of the indigenous successor platform to replace the old L70 guns is likely to be carried out in July, the officials said, adding that an RFP (request for proposal) is already out for the procurement of 220 such guns.

The L70 guns were originally manufactured by Swedish defence firm Bofors AB in 1950s, and India started inducting over 1,000 of them in the 1960s. On QRSAM, the AAD DG said, "We are hoping to place a contract within 4-5 months. And once it is done, the First of Prototype Model (FoPM) will be there over a period of several months."

In September 2022, the defence ministry in a statement said that the Defence Research and Development Organisation (DRDO) and the Indian Army had successfully completed six flight-tests of the QRSAM system from the Integrated Test Range (ITR) in Chandipur off the Odisha coast.

The flight tests were conducted as part of evaluation trials by the Indian Army. The While Schilka and Tanguska are planned to be replaced by indigenous successor platforms, while Osa-AK missile system is planned to be replaced by QRSAM, thus boosting the air defence capabilities of the Corps, the officials said.

On February 1, the ministry said the DRDO has successfully conducted three successive flight-trials of Very Short-Range Air Defence System (VSHORADS) from Chandipur. These tests were carried out against high-speed targets flying at very low altitude. VSHORADS is a man-portable air defence system designed and developed indigenously by the Research Center Imarat in collaboration with other DRDO laboratories and development-cum-production partners. The missile system has the capability to meet the needs of all the three services of the armed forces -- the army, navy and air force -- it said.

"As you look at higher variety of drones, we have VSHORADS, we need to carry out a cost-benefit analysis and it would be cost prohibitive to use missiles against all drones. So, fragmentation ammunition is the way forward," Lt Gen D'Cunha said. The AAD is also in the process of acquiring radars such as the Low-Level Light Weight (LLLR) radar.

"We had bought LLLR radars as part of an emergency procurement which is capable of picking up Mavic drone without grenade, and can definitely pick up with grenade. Nano drones beyond this size may be able to carry out surveillance but can't carry weapons. So, we are looking at increasing the density of these radars," he said. Greater density is required for mountains and valley, the senior officer said.

Lt Gen D'Cunha also cited the Russia-Ukraine conflict and other recent conflicts to emphasise the importance and growing threat of drones, counter-drones and other disruptive technologies. The employment of drones as a concept manifested in a different way in the Russia-Ukraine conflict. Both drones and counter-drone systems came up in a "big way", he said.

The development of this capability was so "escalatory in matrix" that every day there is new technology coming in, which becomes a challenge for air power, the AAD DG said. "Integrated with proper surveillance grid of radars, it ensured that Russian started flying higher and their vulnerability increased. This has allowed Ukraine to maintain control over its airspace and support its ground forces more effectively," Lt Gen D'Cunha said.

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India's big-ticket defense-tech move: Mahindra Group partners with US-based Anduril Industries

Source: The Economic Times, Dt. 21 Feb 2025,

URL: <https://economictimes.indiatimes.com/news/defence/indias-big-ticket-defense-tech-move-mahindra-group-partners-with-us-based-anduril-industries/articleshow/118451566.cms>

In a significant move to enhance regional security, multinational conglomerate Mahindra Group has announced a strategic partnership with US-based defence technology company Anduril Industries. Anduril Industries, Inc. is an American defence technology company that specializes in advanced autonomous systems.

The collaboration aims to jointly develop and produce future-proof military technologies, focusing on autonomous and counter-unmanned aerial systems. As per a statement, the partnership will concentrate on creating Autonomous Underwater Vehicles (AUVs) designed for rapid deployment in security, survey, and reconnaissance missions.

Additionally, the alliance will focus on developing advanced Counter-Unmanned Aerial Systems (CUAS) technologies capable of detecting and neutralizing drone threats, thereby bolstering defenses against unmanned aerial systems. The announcement of this strategic partnership comes shortly after the Modi-Trump bilateral meetings in Washington DC, where defence cooperation was a top priority.

Vinod Sahay, Group Executive Board Member, Mahindra Group, expressed enthusiasm about the collaboration, stating, "Partnering with Anduril Industries marks a significant milestone in Mahindra Group's commitment to developing advanced security and autonomous technologies. This collaboration combines our deep engineering expertise with Anduril's innovative solutions to deliver cutting-edge capabilities that enhance security and address emerging threats."

Greg Kausner, Senior Vice President of Global Defence at Anduril Industries, emphasized the importance of the partnership, asserting, "Global security forces face a rapidly evolving set of threats from both emerging unmanned systems and legacy manned platforms, and autonomy is key to maintaining credible protection."

Greg Kausner added, "Anduril is thrilled to announce our partnership with Mahindra -- we believe that our two companies together are well poised to bring cutting-edge autonomy-enabled capabilities to the Indian market."

This collaboration underscores a growing focus on enhancing security capabilities using next-generation technologies, paving the way for strengthened defense ties between India and the United States.

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Global Firepower Index 2025: India's military strength ranked-Who's on top?

Source: The Economic Times, Dt. 21 Feb 2025,

URL: <https://economictimes.indiatimes.com/news/defence/global-firepower-index-2025-indias-military-strength-ranked-whos-on-top/articleshow/118446734.cms>

Military spending worldwide has surged in 2025 as nations allocate significant resources to strengthen their defence forces. The United States continues to dominate with a staggering \$895 billion budget, solidifying its position as the world's leading military power. China follows with \$266.85 billion, focusing heavily on modernisation. Russia, despite facing economic hurdles, has increased its military budget to \$126 billion, reinforcing its global influence.

India has emerged as the fourth-largest defence spender with a budget of \$75 billion. This increase reflects the country's commitment to military modernisation, strategic preparedness, and self-reliance in defence production. Saudi Arabia, the United Kingdom, Japan, Australia, France, and Ukraine also feature among the top ten biggest spenders, each prioritising security in an increasingly unstable world.

Top 10 Defence Budgets in 2025 (in USD)

1. United States - \$895 billion
2. China - \$266.85 billion
3. Russia - \$126 billion
4. India - \$75 billion
5. Saudi Arabia - \$74.76 billion
6. United Kingdom - \$71.5 billion
7. Japan - \$57 billion
8. Australia - \$55.7 billion
9. France - \$55 billion
10. Ukraine - \$53.7 billion

(Source: Global Firepower Ranking 2025)

India's Growing Military Strength

India continues to cement its position as a global military power, ranking fourth in the Global Firepower Index with a PowerIndex score of 0.1184. The Indian government has allocated ₹6.81 lakh crore (\$75 billion) to the Ministry of Defence in the Union Budget for FY 2025, making it the highest-funded sector, accounting for 13.45% of total government spending. This investment aims to enhance combat capabilities, technological advancements, and strategic deterrence.

The Global Firepower Index ranks India among the world's most formidable forces, alongside the United States, Russia, and China. Pakistan, which ranked ninth in 2024, has dropped to twelfth, indicating a decline in its military strength.

"The nation benefits from its deep manpower base, financials, material qualities, and potential industrial output to remain the top global power," the Global Firepower website notes.

India's Military Capabilities Across Land, Air, and Sea

Indian Army

- Personnel: 1.45 million active troops, 1.15 million reserves, and over 2.5 million paramilitary personnel.
- Key assets: T-90 Bhishma and Arjun tanks, BrahMos missiles, and Pinaka rocket systems.

Indian Air Force (IAF)

- Fleet Strength: 2,229 aircraft, including 600 fighter jets (Rafale, Su-30MKI), 899 helicopters, and 831 support aircraft.
- Advanced weaponry: Astra, Rudram, Nirbhay, and BrahMos missile systems.

Indian Navy

- Personnel: 142,251 personnel.
- Fleet strength: 150 warships and submarines, including INS Vikramaditya and INS Vikrant aircraft carriers.
- Strategic capabilities: Nuclear submarines, P-8i maritime reconnaissance aircraft, and over 50 new vessels under construction.

India's Global Influence and Military Ranking

As per Forbes' latest rankings, India holds the 12th position in the list of the world's most powerful countries, factoring in its economic standing, international alliances, and military strength. Economically, India ranks fifth in global GDP, following the United States, China, Germany, and Japan.

According to the Global Firepower Military Strength Ranking 2025, the top ten global military powers are:

1. United States (PowerIndex: 0.0744)
2. Russia (PowerIndex: 0.0788)

3. China (PowerIndex: 0.0788)
4. India (PowerIndex: 0.1184)
5. South Korea (PowerIndex: 0.1656)
6. United Kingdom (PowerIndex: 0.1785)
7. France (PowerIndex: 0.1878)
8. Japan (PowerIndex: 0.1839)
9. Turkiye (PowerIndex: 0.1902)
10. Italy (PowerIndex: 0.2164)

The Road Ahead for India's Defence Strategy

India's position as the world's fourth most powerful military underscores its ongoing efforts to modernise its forces, enhance strategic defence, and reduce reliance on foreign imports. With a robust financial commitment, cutting-edge technology, and a strong manpower base, the country is poised to strengthen its global standing further.

As geopolitical uncertainties persist, India's focus on advanced weaponry, indigenous defence manufacturing, and strategic preparedness will be crucial in maintaining its military edge. The 2025 defence budget signals a strong intent to boost national security, ensuring the country remains a formidable power in the years to come.

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Indian Army bolsters counter-IED operations with 'Xploder' unmanned ground vehicles

Source: The Times of India, Dt. 23 Feb 2025,

URL: <https://timesofindia.indiatimes.com/city/pune/indian-army-bolsters-counter-ied-operations-with-xploder-unmanned-ground-vehicles/articleshow/118487968.cms>

Indian Army will soon induct remotely operated unmanned ground vehicles (UGVs) developed in-house into all its operational units, including special forces, for operational preparedness in the northern and northeast sectors.

The UGV, Xploder, met the force's operational requirements during extensive trials conducted over the past two years. "Now it will be mass manufactured by a private industry. Hundreds of these units will be inducted into infantry, SF, and Corps of Engineers units for use in counter insurgency and counter terrorism operations in the next few months," Major Rajprasad told TOI.

The UGV was displayed at Aero India's Indian pavilion and gained significant traction from visitors on the first day. A 10 kg UGV can be easily portable by the troops on their backs for use during operations.

Indian Army has faced IED challenges over the decades due to new methods used by terrorist groups. "Many soldiers lost their lives, and a sizeable number was seriously injured during

operations in the forward areas. This prompted me to work on a tangible solution to counter it," he added.

The UGV was tested rigorously in various terrains to assess its operational efficacy. "Several improvements, as per the requirements of the ground force, were made to the machine," said the officer from the 7 Engineer Regiment.

The Xploder UGV is an all-terrain platform capable of multifarious roles in combat operations like unmanned reconnaissance and surveillance, delivery of explosive payloads, remote disposal of IEDs, and can be used in a kamikaze role during hideout clearance. It is also effective for disaster relief operations.

Within six months, three innovations developed by Major Rajprasad, namely "Vidyut Rakshak-IoT enabled generator monitoring protection and control system", "Agniastra- multi-target portable remote detonation system", and "Xploder- Kamikaze and IED disposal UGV", were launched for induction in the Indian Army. Previously, another innovation named WEDC- Wireless Electronic Detonation System, developed by the officer, was inducted.

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What is India's dilemma over fighter jets? | Explained

Source: The Hindu, Dt. 23 Feb 2025,

URL: <https://www.thehindu.com/news/national/what-is-indias-dilemma-over-fighter-jets-explained/article69252301.ece>

The story so far: The two foremost Fifth Generation Fighter Aircraft (FGFA) of Russia and the U.S., the SU-57 and F-35, got a lot of attention at Aero India, which was held from February 10-14 in Bengaluru, with the former undoubtedly being the showstopper with its manoeuvres. Just as that wound up, U.S. President Donald Trump, addressing a press meet with Prime Minister Narendra Modi, said the U.S. is also paving the way to "ultimately" provide India with F-35 stealth fighters.

What's the F-35?

The F-35 Joint Strike Fighter is a single seat, single-engine strike fighter jet with three variants, F-35A, which has a conventional take-off and landing for the Air Force, F-35B short take-off/vertical landing for the Marine Corps and an F-35C aircraft carrier variant for the Navy and the Marine Corps. In addition to the U.S., the programme has seven international partners, and 10 foreign military sales customers, and the jets are expected to be in service well into the 2080s. As of January 30, 2025, 1,110 F-35s were delivered, according to the lead contractor Lockheed Martin, with 20 participants in the programme.

Noting that it wasn't a firm offer yet and what Mr. Trump meant was that they will look at a roadmap for making the F-35 available, Defence Secretary Rajesh Kumar Singh said recently that India "will look at that offer once it becomes a firm offer." Pointing out that there is a protocol to be followed, he said that first requirements have to be raised by the services, and only then are options on offer studied. "Creating an option of this type is important for us and we will certainly look at it with an open mind," he said.

The U.S. Government Accountability Office (GAO), which is mandated by the U.S. Congress to review the programme, said in a May 2024 report that the Department of Defence estimates that these development efforts — as well as the costs to maintain and operate the 2,470 planned aircraft through 2088 — will exceed \$2 trillion. Based on various estimates, the F-35 costs upwards of \$100 million per aircraft with armaments and associated costs. India has never operated a U.S. fighter, and an advanced fighter like the F-35 will need new facilities for training and maintenance.

What is the status of the Russian fighter jet?

It is pertinent to note that in 2010, India and Russia signed a preliminary design agreement to jointly produce the FGFA, now the SU-57, for use by both countries after which each had invested \$295 million for preliminary design which was completed in 2013. But protracted negotiations followed over the high cost and limited technology transfer. One of the limiting factors was that it was a single seater and the creation of a twin-seat variant, the IAF's preference, would mean a steep rise in costs. India eventually pulled out of the FGFA project and decided to go with its indigenous FGFA, the Advanced Medium Combat Aircraft (AMCA).

What is the IAF's squadron strength?

The IAF has a sanctioned strength of 42.5 fighter squadrons, but, is languishing today at 31 squadrons with a significant proportion of ageing platforms. "Somewhere India got left behind and is stuck in the middle. There is a big gap and major countries have moved forward," noted a senior official. China, Russia and the U.S. have already fielded fifth generation fighter jets, with China recently stealing a march over everyone else as it flew two advanced fifth generation fighters, dubbed by some as a sixth-generation jet, in addition to the two jets already developed and inducted. Reports suggest that Pakistan is looking to acquire 40 J-35 fifth generation jets from China.

In December, the government constituted a high-level committee led by the Defence Secretary to chalk out a roadmap for the IAF and address operational gaps. The report which was scheduled to be submitted by end-January, is still in the works, officials confirmed. India has an ambitious plan to acquire over 500 fighter jets, a bulk of them variants of the Light Combat Aircraft (LCA) and the AMCA, that is at least a decade away from induction.

There has been a delay in the deliveries of 83 LCA-Mk1A already contracted, with 97 more to be ordered. The delay in deliveries has been partly due to engine delays from General Electric (GE), and Hindustan Aeronautics Limited (HAL) has now assured that 12 jets will be delivered to the IAF this year; the order for 83 jets will be completed in three-and-a-half years. Officials said that the more capable LCA-Mk2 is expected to make first flight in early 2026. The AMCA prototype is expected to roll out by end-2026 or early-2027, certified by 2032 and ready for induction by 2034.

In addition, there is the proposal for 114 Multi-Role Fighter Aircraft (MRFA) to be imported and licence-manufactured locally but has seen no progress for many years, with the Request For Information (RFI) issued in April 2019. However, given the gap in numbers, the MRFA as envisaged may now be too expensive and too late to address the crisis. Last October, IAF chief Air Chief Marshal A. P. Singh said the MRFA was "needed as on yesterday."

Will U.S.'s F-35 stealth fighter jets fit into IAF's future plans?

While several experts and observers pitched for two F-35 squadrons as a stopgap, given the complex process and timelines, it would be a decade before the jets arrive. The 36 Rafale deal contracted at €7.87 billion from France in 2016 is a case in point. In addition, India had paid over €1 billion in one-time research and development costs for India-specific enhancements on the Rafales. Speeding up the domestic programmes is of critical importance as any new addition to the IAF's already diverse fleet will create a maintenance nightmare and also take away focus and resources from indigenous efforts.

When did diversification begin?

Russian military hardware has constituted a bulk of the Indian military inventory, including the IAF, for decades and diversification began in the early 2000s. However, diversification shouldn't mean moving from one dependency to another. As per the current plan, by early 2040, the IAF will have 220 LCA-Mk1 variants, at least 120 LCA-Mk2s and the initial batch of AMCAs, all powered by the GE F-404 and F-414 jet engines, a significant proportion of the fighter fleet.

The licence manufacture of the F-414 engine or the new 110KN engine, likely to be co-developed and co-produced with France for the AMCA-Mk2, will mean that India would be dependent on others for the most critical systems. The Indian aero engine space for both fixed wing and helicopters will be powered by the U.S. and France for the rest of the century, as French co-developed engines power India's indigenous helicopters.

So adding new fighters, that too of the highest technological threshold of the U.S., would surely come with a lot of riders, some intrusive and some that could stymie operational flexibility and impact plans on indigenous manufacturing.

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Trump's trap or India's chance at defence modernisation?

- Lt General K J Singh (Former GOC-in-C, Western Command, Indian Army)

Source: The Times of India, Dt. 23 Feb 2025,

URL: <https://timesofindia.indiatimes.com/blogs/generals-jottings/trumps-trap-or-indias-chance-at-defence-modernisation/>

PM Modi returned after fairly satisfactory parleys with President Trump earlier this month. There is considerable hype about Trump's eulogies on our PM's negotiating skills, but it will be prudent to remain cautious, for behind 'taareef' (praise), lurks tariff.

Modi's US visit covered a wide range of subjects and rolled out ambitious programmes, like Catalysing Opportunities for Military Partnership, Accelerated Commerce and Technology (Compact) and Transforming Relationships Utilising Strategic Technology (Trust). In many ways, it could well be repackaging of erstwhile programmes, like Biden's iCET (Initiative on Critical and Emerging Technology) and the earlier Defence Trade and Technology Initiative (DTTI) during Trump 1.0. The bottom line is to build trust rather than new acronyms.

Here, we need to apply the Chinese word for crisis, weichi, which combines wei (danger) and chi (opportunity). In the board game with the same name, it is all about creating strategic

opportunities. Our challenge is to sidestep the traps and seek avenues for capability building and smart Atmanirbharata through technology transfer.

Fundamental rules: Tech partnerships

First, self-reliance is a long, tedious process. It can be aided by genuine technology partnerships, coupled with achieving technology threshold in critical areas. Second, an incremental and collaborative approach is the way forward. Brahmos, joint project with Russia, is currently only 76% indigenous and likely to reach 85%; hence, at times, it is smart to be the lead integrator and not be focused on 100% indigenous content. Third, in certain niche areas, disruptive weapons like Bayraktar drones have given Turkey significant leverages.

Fourth, developing disruptive technologies, like Elon Musk's Starlink, can redress technology asymmetry as evidenced in the Ukrainian conflict. Fifth, technology transfers preclude core and critical source codes. Hence, in transfer of technology (ToT), it is largely 'print or produce to design' at best, passing off 'know-how' but most rarely 'know-why'. Sixth, reverse engineering is abundantly used, notably by China and Iran, to clone crude versions of advanced weapons. The most important rule is that there are no free lunches.

Challenges, opportunities

As per the US Congressional report drawing on reputed sources like Stockholm Peace Research Institute (SIPRI), India is the largest importer of armaments in terms of value, accounting for approximately 10% of global imports from 2008 to 2023. In value terms, Russian-origin equipment accounts for 62%, declining from 76%. Other top suppliers are France (11%), USA (10%) and Israel (7%).

Our biggest challenge is the inability of DRDO and DPSUs to realise planned deadlines. Tejas and MBT Arjuna being striking examples. Failure of Kaveri programme for aero-engines translated to reliance on US F-404/414 engines. Similarly, delay in supply of Ukrainian marine gas-turbines have caused significant delays and raised questions on hype of indigenous naval platforms. In case of tank powerpacks, German MTU failed to supply 800HP engines for Zorawar, forcing switch to American 760HP Cummins. Even the Shakti engine for helicopters is a collaborative effort with Safran.

A national engine mission/challenge is long overdue. India deploys the largest fleet of T-90 tanks, even larger than Russia. We also have the largest operational inventory of C-17 Globemaster and P8I Poseidon aircrafts outside the US. The sheer size of Indian inventories provide an opportunity as no major arms producer wants to be left out in this lucrative market. It also is the most appropriate global/ regional hub for maintenance repairs and overhaul (MRO) and warehousing.

USSR and others

Indian experience with the Soviet Union has been mixed. Equipment is robust and relatively economical, but a notch below cutting edge. It follows an evolutionary model and customisation has been possible.

Russia has been benign in early years, accepting rupees and even commodity (banana) payment. They have also leased strategic platforms like Chakra submarines enabling the Arihant series.

Notwithstanding, the foregoing, many ToTs have really meant licensed production with even annual capping on numbers and spare parts supply has been unreliable. Sourcing from France and Israel has enabled induction of hi-tech weapons and customisation with offsets to local manufacturers.

US sales

The US follows a govt-to-govt route for foreign military sales (FMS). American equipment is cutting edge, with reliable support but expensive. Only limited trials are allowed, offsets are difficult and possible only in peripherals. Source codes are not shared, obviating customisation and has strict end-user restrictions. The US also has the Countering American Adversaries Through Sanctions Act (CAATSA). India managed a rare waiver for S400 AD systems from Russia. The recent announcements include the possibility of India buying Strykers, wheeled combat vehicles and Javelin missiles. Stryker and Javelin missiles have a two-decade old technology. They were offered to India during Yudh-Abhyas exercises in 2006.

Reportedly, during recent trials, there were issues with the engine, which the US has agreed to replace. It is surprising that Strykers are being pushed, when a vibrant ecosystem by TATAs, Mahindra and L&T for protected platforms is operational, with TATAs even setting up a plant in Morocco.

India has already acquired more economical Spike missiles from Israel, and the indigenous NAG system is becoming operational. Enough has been articulated about spanner in the works type of offer of F-35 and its comparison with Su-57. The delay in supply of F404 engines for Tejas and six Apache attack helicopters could well be part of some armtwisting for Strykers, Javelin and even F-35. If forced, the F-35 can at best be bought in limited numbers, two odd squadrons and will have to be operated largely as standalone platforms. Our focus should be to ensure continued F404/414 supplies for keeping the Tejas programme on track. We should realistically review our 42-squadron target and bolster air power with drones and surveillance. This will require flexibility, commitment and astute tech diplomacy.

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Top EU leadership to visit India next week, trade and defence on agenda

Source: Hindustan Times, Dt. 21 Feb 2025,

URL: <https://www.hindustantimes.com/india-news/in-unprecedented-move-entire-eu-leadership-to-visit-india-on-feb-2728-101740156454582.html>

European Commission President Ursula von der Leyen and the 27-nation bloc's political leadership will visit India next week to enhance trade, economic security and defence cooperation at a time of geopolitical turmoil in Europe caused by US President Donald Trump's policies. The trip by Von der Leyen and the European Union (EU) College of Commissioners, or political leaders of the 27 member states, is being described as unprecedented as it is rare for the entire leadership to jointly visit any foreign country. This is also one of the first foreign visits by the European Commission elected last year.

The EU announced on Friday its leadership will travel to New Delhi on February 27-28 to emphasise the importance of strengthening ties in key areas “vital to the prosperity and security of both Europe and India”. Von der Leyen said Europe stands for openness, partnership and outreach in an era of intense geostrategic competition and seeks to deepen ties with “one of our most trusted friends and allies – India”.

Describing the two sides as like-minded partners bound by the “shared conviction that democracy best serves the people”, she added: “We are committed to strengthening our strategic partnership to advance trade, economic security, and resilient supply chains, along with a common tech agenda and reinforced security and defence cooperation.”

External affairs ministry spokesperson Randhir Jaiswal said the EU-India strategic partnership is “very important” for New Delhi. “We are looking forward to this particular conversation happening at the high level so that we can further strengthen the India-EU partnership,” he said. “All aspects of the relationship, including trade [and] technology issues, will be discussed during the visit.” The EU College of Commissioners and the Indian government will hold a plenary session co-chaired by Prime Minister Narendra Modi and Von der Leyen. Members of the College will meet their Indian counterparts individually, and Von der Leyen and Modi will also hold a bilateral meeting.

The second meeting of the India-EU Trade and Technology Council (TTC) will also be held during the visit, with the EU being represented by vice-president Henna Virkkunen, high representative for foreign and security policy Kaja Kallas, and commissioners Maroš Šefčovič and Ekaterina Zaharieva. The objective of the TTC is to boost collaboration on digital transition, green technologies and trade and investment. Among the issues it will discuss are collaboration on digital public infrastructure and its compatibility, resilience of key value chains, and cooperation on global trade issues, the EU said.

The EU leadership’s visit comes at a time when the bloc’s 27 members are being forced to consider a more independent approach to defence and security following Trump’s repeated attacks on Ukrainian President Volodymyr Zelensky, whom he has called a “dictator”, and his claims that the war in Ukraine was not started by Russia. European states have also been concerned by Trump’s overtures to Russian President Vladimir Putin and his efforts to negotiate an end to the war without involving Ukraine.

The visit follows Von der Leyen’s announcement of a new strategic agenda for India that will be presented at the EU-India Summit to be held later this year. The EU said that as the world’s two largest democracies, the European Union and India “share a commitment to a rules-based global order, effective multilateralism and sustainable development”.

The EU is India’s largest trading partner, with trade in goods valued at €124 billion in 2023, marking an increase of almost 90% in the past decade. Around 6,000 European companies are present in India, directly providing 1.7 million jobs. The two sides resumed negotiations on a free trade agreement in 2022, and the next round is scheduled to be held in Brussels during March 10-14.

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Panel on cost soon to firm up sub project

Source: The New Indian Express, Dt. 24 Feb 2025,

URL: <https://www.newindianexpress.com/nation/2025/Feb/24/panel-on-cost-soon-to-firm-up-sub-project>

Formation of a cost negotiation committee is under way to speed up the Indian Navy's Project 75 (India) project under which submarines will be built in alignment with the Atmanirbhar Bharat Abhiyan. The CNC to be firmed up soon will include officials from the Ministry of Defence (MoD), Navy and Defence Finance in addition to representatives of Mazagon Dockyard Limited (MDL) that will lead the project under strategic partnership (SP) with Germany's TKMS (ThyssenKrupp Marine Systems), said sources.

"Once the project is firmed up, MDL and Germany must adhere to the objectives of the Atmanirbhar Bharat Abhiyan. TKMS will need to meet 100% of the commercial and technical requirements, including transfer of technology and Indian content," an MoD source said. "This area will be closely scrutinised to ensure that actual design knowledge is transferred to India after the delivery of the first submarine, allowing India to freely use this technology as needed," the source added.

"A contract will be signed between the MoD and MDL. Further, there will be a contract between MDL and TKMS. Work share and responsibilities will be finalised under the contracts," another source said. "Firstly the design will be confirmed and then it will be work converted into a functional system. The transfer of technology from the original equipment manufacturer (OEM) should be such that the next class of submarines should be totally Indian, from scratch to operational system," the source said.

"Historically Germans are not known for sharing such extensive knowledge in defence programmes, so the successful implementation of the SP model is will be seen as significant," the source added. Another concern voiced by the sources emanates from the past experience of the cost and time overrun in construction of the Scorpene Class submarines. In the case of Scorpene (P75), the Naval Group of France was involved with the MDL.

The delay in P75 was substantial as the contract for six Scorpene submarines (Kalvari-class) worth Rs 18,706 crore was signed in 2005. While the cost escalated to about Rs 23,000 crore, the first of the Scorpene submarines built at MDL was inducted in 2017 instead of 2012. While the envisioned plan for the project inked in 2005 was to induct all six by 2017, the last one, INS Vagsheer, was inducted in January this year.

Earlier in 1994, India manufactured two German submarines but the gap of 11 years led to loss of this specialised skill. Things are already delayed for the Expression of Interest for six advanced AIP integrated submarines was issued in 2019. From the date of the contract signed it would take 7-8 years for the first submarine to get inducted. The Project 75 Scorpene class, with the French Naval Group, faced huge time and cost overrun. The Project 75I is already delayed and if the project gets confirmed this year the first submarine of its class will be inducted by 2032. As reported earlier, the Rs 45,000 crore project aims at constructing six advanced submarines under Project 75I, which aims to boost to 'Make in India' programme.

Cost and time overrun in construction

Another concern voiced by the sources emanates from the past experience of the cost and time overrun in construction of the Scorpene Class submarines. In the case of Scorpene (P75), the Naval Group of France was involved with the MDL. The delay in P75 was substantial as the contract for six Scorpene submarines (Kalvari-class) worth `18,706 crore was signed in 2005. While the cost escalated to about `23,000 crore, the first of the Scorpene submarines built at MDL was inducted in 2017 instead of 2012. While the envisioned plan for the project inked in 2005 was to induct all six by 2017, the last one, INS Vagsheer, was inducted in January this year.

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Indian Navy To Receive First Of Five Fleet Support Ships By Mid-2027

Source: Swarajya, **Dt.** 21 Feb 2025,

URL: <https://swarajyamag.com/news-brief/indian-navy-to-receive-first-of-five-fleet-support-ships-by-mid-2027>

The Indian Navy is set to bolster its operational capabilities with the delivery of the first of five Fleet Support Ships (FSS) by mid-2027. The milestone was reaffirmed as the steel cutting ceremony for the third vessel in the series took place at Larsen & Toubro (L&T) Shipyard in Kattupalli on 20 February.

Rear Admiral Satish Shenai, Flag Officer Commanding Tamil Nadu and Puducherry Naval Area, along with senior officials from the Indian Navy, Hindustan Shipyard Limited (HSL), and L&T, attended the event. The Indian Navy had signed a contract with HSL for acquisition of Five Fleet Support Ships (FSS) in Aug 2023, with the delivery commencing mid-2027, the Defence Ministry said in a statement.

To ensure timely completion, HSL has partnered with L&T for partial construction of two ships. Upon induction, these 40,000-tonne displacement vessels will enhance the Navy's blue water capabilities by facilitating at-sea replenishment of fuel, ammunition, and other supplies, extending the operational reach of the fleet.

Additionally, they will be equipped for Humanitarian Assistance and Disaster Relief (HADR) operations, enabling swift evacuation and relief efforts during crises. With an entirely indigenous design and the majority of components sourced from domestic manufacturers, the FSS project aligns with Modi government's Aatmanirbhar Bharat, Make in India, and Make for the World initiatives, further strengthening the country's naval infrastructure and shipbuilding industry, according to the Defence Ministry.

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Science & Technology News

Novel technique unearthed to enhance next-generation lighting

Source: Press Information Bureau, Dt. 21 Feb 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2105309>

An innovative method to minimize anion migration in perovskite nanocrystals, thereby reducing their sensitivity to heat and moisture, as well as colour instability, paving the way for efficient, durable optoelectronic devices.

Lighting consumes nearly 20% of global electricity, and advancements in lighting technology have significantly improved energy efficiency. From the incandescent and fluorescent lamps of the past to the invention of LEDs in the 1960s, lighting has come a long way.

A pivotal breakthrough occurred in 1993 when Shuji Nakamura and his team members developed high-brightness blue LEDs, enabling energy-efficient white LEDs (WLEDs), a feat recognized with the 2014 Nobel Prize in Physics. Today, LEDs lead the market in efficiency and lifespan.

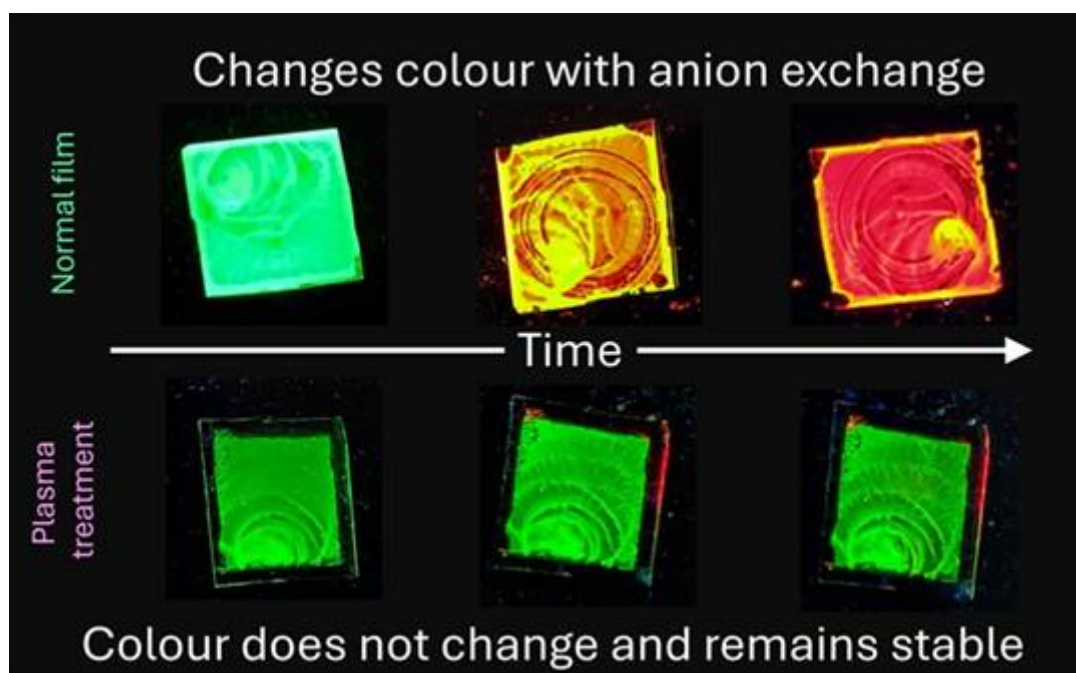
Currently, emerging light related technologies like OLEDs that offer vibrant colors, QLEDs that provide precise colour control and durability and micro/mini-LEDs that deliver high brightness and stability, are shaping the future of lighting.

While thin and flexible OLEDs (Organic LEDs) are costly and have shorter lifespans, QLEDs (Quantum Dot LEDs) are toxic and their production is challenged by resource scarcity and Micro/Mini-LEDs are limited in their application due to high production costs.

Perovskite (class of compounds which have the same type of crystal structure as CaTiO_3 – Calcium Titanate) LEDs (PeLEDs) combine the advantages of OLEDs and QLEDs, positioning them as an excellent choice for next-generation lighting. However, their widespread application is limited by challenges such as sensitivity to heat and moisture, as well as colour instability caused by anion migration (which occurs when halide ions -- chloride, bromide, or iodide move between quantum dots in mixed layers).

To tackle this issue, researchers at the Centre for Nano and Soft Matter Sciences (CeNS) in Bengaluru, an autonomous institute under the Department of Science and Technology (DST), have developed an innovative method to minimize anion migration in CsPbX_3 perovskite nanocrystals.

The team, led by Dr. Pralay K. Santra, synthesized green light emitting cesium lead bromide (CsPbBr_3) perovskite nanocrystals using a hot injection method, where oleylamine serves as the passivating ligand. To enhance stability, they applied argon-oxygen (Ar-O_2) plasma treatment, which immobilizes the surface ligands by creating a cross-linked, hydrophobic layer. This approach effectively stabilizes the ligands and slows anion exchange, significantly improving colour stability by several orders.



This breakthrough published in the journal *Nanoscale*, provides valuable insights into stabilizing perovskite nanocrystals, paving the way for efficient, durable optoelectronic devices.

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Majorana 1: A quantum phenomenon

Source: *The Hindu*, Dt. 23 Feb 2025,

URL: <https://www.thehindu.com/sci-tech/technology/majorana-1-a-quantum-phenomenon/article69252315.ece>

In a head-turning announcement earlier this week, Microsoft unveiled a new quantum chip called Majorana 1. According to its press release, it consists of four qubits made of a “new state of matter”.

Qubit is short for ‘quantum bit’, the fundamental unit of operations in a quantum computer, similar to classical bits in conventional computers. A single qubit represents more information than a single bit. A quantum computer heightens the advantages of this ability using quantum phenomena like superposition and entanglement to solve complex mathematical problems in fewer steps than perhaps the most powerful conventional computer.

Quantum computers differ depending on their choice of qubit. For example, Google’s Willow chip uses small circuits that mimic the properties of atoms in a quantum state. Microsoft has said its new chip uses Majorana particles, elusive subatomic entities supposed to appear in materials called topological superconductors. These particles have unusual properties that physicists believe could be used to build qubits that are less error-prone than the designs Google and IBM use.

“Topological qubits can win if, and only if, they turn out to be so much more reliable that they leapfrog the earlier approaches...,” University of Texas at Austin professor Scott Aaronson wrote

on his blog. “Whether that will happen is still an open question, to put it extremely mildly.”



A view of Microsoft’s Majorana 1 chip

A physics primer

If you cool some water vapour, it will become water and then ice. If you keep lowering the temperature until nearly absolute zero, the system will have minimal thermal energy, allowing quantum states of matter to show. In the 1970s, Michael Kosterlitz and David Thouless found that the surface of superfluid helium sometimes developed microscopic vortices that moved in pairs. When they raised the temperature, the vortices decoupled and moved freely. It was a new kind of quantum phase transition: the object’s topological attributes changed in response to changes in energy.

Topology is the study of the properties an object retains when it is deformed continuously, e.g. when it’s stretched but not ruptured. Topological materials are materials with topologically protected states: the ‘protection’ keeps the state stable against impurities or small disturbances. For example, a vortex in a bucket of water will fade as it loses kinetic energy. But vortices in superfluid helium are topologically protected. With the right internal conditions, they will keep spinning. Only quantum physics allows this.

Similarly, topological superconductors are materials whose ability to conduct an electric current without resistance is topologically protected. The signature of a topological superconductor is its ability to host Majorana particles. These materials are not found in nature. Instead, scientists engineer them in the lab to have the combination of internal properties that allows Majorana particles to exist. Microsoft has reportedly used indium arsenide with aluminium.

A fundamental tensionBut since the announcement, independent experts have asked whether the new chip really has Majorana particles. Many previous attempts, including some sponsored by Microsoft, that claimed to have found these particles were later overturned by further scrutiny.

Microsoft’s press release also claimed that a paper simultaneously published in Nature provided “peer-reviewed confirmation” that its team had created Majorana particles for use as qubits — but the paper, authored by the same team, stated that the work therein didn’t test whether the particles were really Majorana. Microsoft researcher Chetan Nayak later clarified on Mr. Aaronson’s blog that the team submitted the paper to Nature in March 2024 and that team members have “continued to make progress in the intervening year”.

The contradiction still subtracted from confidence in Microsoft’s claims because it had leaped from a paper describing older work to a press release making new claims. This is a familiar problem: when the private sector does cutting-edge research, its need to protect IP may prevent it from sharing all the information necessary to confirm the validity of a claim, at the expense of doing right by the research community whose approval it seeks.

For now, scientific opinion about the alleged prowess of Majorana 1 is uneven but also mostly sceptical. Microsoft thus has a lot to gain, or lose, by showing the chip at work, but its actions may have left it with little choice.

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First detailed map of moon’s south pole area made from Chandrayaan data

Source: The Hindu, Dt. 24 Feb 2025,

URL: <https://www.thehindu.com/sci-tech/science/moon-south-polar-region-detailed-geological-map-chandrayaan-3-data/article69226143.ece>

Astronomers are excited to be poring over the first ever detailed geological map of the moon’s south polar region, where India’s Chandrayaan-3 lunar module, Vikram, touched down on August 23, 2023. The map is expected to throw new light on the moon’s origin and evolution.

Researchers from the Physical Research Laboratory (PRL) in Ahmedabad, Panjab University in Chandigarh, and the Laboratory for Electro-Optics Systems, Indian Space Research Organisation, Bengaluru, created the map using data from the rover Pragyan, which was deployed by Vikram on a nine-day mission to analyse the chemical composition of the regolith — the loose rock fragments and dust that cover the lunar surface.

The eyes and ears of Pragyan that help rover find its way on moon

The cornucopia of geological information from the mission has helped scientists confirm what they always suspected: the moon harbours an underground ocean of molten rock, or primordial magma. Data from previous missions, such as the US uncrewed Surveyor spacecraft, the crewed Apollo moonshots, and the robotic Russian Luna and Chinese Chang’e 3 probes, indicated the presence of such a sea of lava beneath the lunar surface. But the actual extent of magma on the moon was not known since all the available data came from landing sites near the lunar equatorial and mid-latitude regions, which are far away from the poles.

Chandrayaan-3, however, was the first mission to land in a high-latitude polar region of the moon, 630 km from the south pole, and scientists considered it the best bet to solve the magma mystery.

In September 2024, a team of lunar geologists from PRL announced that the Alpha Particle X-ray Spectrometer aboard the Pragyan rover had detected magma under the landing site. This meant the ancient ocean of molten lava extended across the entire moon.

The new map of Vikram's landing site, published in the journal *Advances in Space Research* on January 20, shows an undulating landscape of highlands and low, flat plains around the lander. The researchers traced the alignment of secondary craters — dug up when debris from an impact crater lands elsewhere — and identified Schomberger to be the primary source of the debris covering the Chandrayaan-3 landing zone.

A common origin Using the map, the scientists calculated the age of the region to be around 3.7 billion years, around the same time the first signs of microbial life emerged on the earth. In fact, the earth and the moon have had similar evolutionary trajectories, as is evident in the dynamics of the earth-moon system. The inclination, or tilt, of the moon's orbit is for example to the earth's rotation and both bodies are similarly aligned to the ecliptic plane of the solar system. Their terrestrial and lunar geochemistries are also complementary, with both possessing several common isotopes, pointing to their origins from the same cloud of molten material.

Astronomers believe that some 4.5 billion years ago, when the planets of the solar system were coalescing out of the rubble floating around the sun, the young earth had collided with a massive planetary rock roughly the size of Mars. The resulting debris from the collision was flung outwards explosively, before it cooled over millions of years. This proto-planetary material gradually solidified into a molten sphere that was eventually captured by the earth's gravity to become the moon we see today.

In those early millennia, the infant moon must have been pummelled by asteroids and space rocks as is evidenced by its surface, which is studded with numerous craters. The Vikram lander had touched down close to one of the oldest of these craters: the South Pole-Aitken Basin, which is also one of the largest impact craters in the Solar System.

Lunar craters are of great interest to astrogeologists, who study them to learn more about the evolution of impact craters elsewhere on the earth and on the inner planets of the solar system.

The cratering history

The airless and arid conditions on the moon render it a sterile environment in which craters can survive erosion for millennia — unlike on the earth where atmospheric elements abrade craters very quickly. In fact, lunar impact basins are veritable time capsules because they preserve the original records of space-rock smash-downs that occurred during the formation of the solar system.

The scientific value of lunar craters becomes even clearer when we consider how scientists can't, even with the help of supercomputers, reconstruct the cratering history of the earth beyond a few hundred million years.

Given that lunar craters are important tools for scientists to calculate the age of geological features on other planets with solid surfaces, moon maps like the new one assume greater significance. Sadly, the "magnificent desolation" of the moon — words Apollo 11 astronaut Edwin "Buzz"

Aldrin used to describe the crater-studded lunar wilderness — may not endure undisturbed for very long as efforts to colonise the moon get underway.

Littering the regolith

After the erstwhile Soviet Union's Luna 2 lander became the first probe to 'land' (it was intentionally crash-landed) on the moon way back in 1959, scores of robotic and crewed spacecraft from the US, China, India, Israel, Japan, and the European Space Agency have reached the moon's surface.

Alas, these missions have also left spacecraft components and other waste items behind, littering the regolith. It is largely unknown how the landers, rovers, and the dozen US astronauts — who planted flags, hit golf balls, drove around in rovers, and collected hundreds of kilograms of moon rock — may have disturbed the regolith, which sustains the thin lunar atmosphere. The moon's exosphere was formed when space rocks and the solar wind, the stream of charged particles flowing outwards from the sun, kicked up the powdery dust from the lunar surface.

Scientists also worry about the contamination of lunar ice reserves by exhaust fumes from lunar landers. When a spacecraft touches down on the moon, the water vapour released from its engines spreads across the lunar surface and ends up freezing at the poles. This leads to inaccurate readings for scientists who are studying the presence and the distribution of lunar water ice. These concerns are bound to increase as more and more missions head for the moon and mining for lunar resources eventually becomes a reality.

Compacts like the Outer Space Treaty of 1967 are silent on these issues, merely making vague statements on the need to avoid contaminating space. It is high time an international legal framework is put in place to prescribe rules and guidelines for the first human colonies on the moon, which are not very far away. The sooner this is done, the better the chances of preserving the pristine nature and unique landscape of our nearest neighbour in space.

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French scientists break world record with 'artificial sun'; advancing the future of clean energy

Source: The Times of India, Dt. 22 Feb 2025,

URL: <https://timesofindia.indiatimes.com/science/french-scientists-break-world-record-with-artificial-sun-advancing-the-future-of-clean-energy/articleshow/118451494.cms>

In a breakthrough in history, French scientists have set new records in nuclear fusion experiments by achieving a new world record with their 'artificial sun' reactor.

On 12 February, France's Atomic Energy and Alternative Energies Commission (CEA) successfully operated its WEST (W Environment in Steady-State Tokamak) reactor, holding a plasma state for more than 22 minutes. The record has the power to change the world when it comes to producing clean, green energy.

Nuclear fusion promises a sustainable solution for global energy needs

This technology relies on nuclear fusion, the same process that powers the Sun. Using hydrogen isotopes, nuclear fusion has the potential to provide the world with virtually limitless clean energy.

In contrast to conventional fission reactors that emit lethal radiation and create poisonous waste, fusion reactors have the potential to provide vast quantities of energy without emitting greenhouse gases or any poisonous by-products. For example, one gram of deuterium and tritium (both hydrogen isotopes employed as fusion fuel) contains as much energy potential as 11 tonnes of coal.

In the process of attaining nuclear fusion, hydrogen isotopes must be heated to high temperatures, well over 50 million degrees Celsius, which makes them plasma, the fourth form of matter. The greatest challenge is to keep the plasma and the high temperature for some duration without cooling off or reverting to a gas state.

22-minute plasma breakthrough brings nuclear fusion closer

The historic milestone for the WEST reactor was a record of maintaining hydrogen plasma for over 22 minutes with 2 MW of power heating. Anne-Isabelle Etievre, Director, Fundamental Research, CEA, spoke about the significance of the milestone: "WEST has reached a new key technological record by maintaining hydrogen plasma for twenty minutes with the injection of 2 MW of power heating."

Experiments will also be continued at greater power. This milestone brings us one step nearer to the day when nuclear fusion can become a reality as a source of energy.

Scientists make historic progress in nuclear fusion with WEST reactor breakthrough

For over eight decades, scientists around the globe have attempted to recreate the Sun's fusion process. In contrast to conventional nuclear energy, which tears apart atoms using a process called fission, fusion is the opposite: it brings atomic nuclei together, resulting in the release of vast energy.

In spite of dramatic progress, the problem of stabilizing plasma at the high temperatures necessary for fusion has kept the technology tantalizingly out of reach—until now.

Controlling nuclear fusion could change the course of the world's energy. If fusion were possible, it is theoretically boundless clean energy. It would dramatically reduce our use of fossil fuels, consign greenhouse emissions to the history books, and offer a clean solution to current nuclear fission power plants, leaving only toxic leftovers.

Despite existing challenges, accomplishment of the WEST reactor is a leap in bounds towards the achievement of the sustainable, fusion-created energy vision. As scientists make progress and make fusion technology a better reality, the idea of an artificial sun—providing limitless clean energy—is an ever-increasing reality, with it potentially being a new epoch of energy.

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PM Modi hails Isro's century in rocket launches, urges people to dedicate a 'Day for Science'

Source: The Times of India, Dt. 24 Feb 2025,

URL: <https://timesofindia.indiatimes.com/india/pm-modi-hails-isros-century-in-rocket-launches-urges-people-to-dedicate-a-day-for-science/articleshow/118515674.cms>

PM Narendra Modi, during the 119th episode of his monthly radio programme 'Mann Ki Baat' on Sunday, hailed Isro, saying it has hit the century in space. On Jan 29, India witnessed Isro's 100th rocket launch when GSLV-F15 rocket launched navigation satellite NVS-02. He urged people to observe National Science Day by spending "One Day as a Scientist", which he said will foster curiosity among children and youth about science.

On the country's space sector achievements, Modi said, "Champions Trophy is going on these days and there is an atmosphere of cricket for everyone. We all know the thrill of a century in cricket. But today, I am not going to talk about cricket, rather I will talk about the wonderful century that India has made in space. Last month, the country was a witness to Isro's 100th rocket launch. This is not just a number, but it shows our resolve to achieve ever-new heights in space science. Our space journey started in a very normal manner. There were challenges in every step, but our scientists continued moving forward achieving victory over them."

"With time, the list of our achievements in space flights continues to grow longer. Be it building a launch vehicle, success of Chandrayaan, Mangalyaan and Aditya L1 or carrying out the unprecedented mission of sending 104 satellites into space in one go with one rocket. The ambit of Isro's success has been quite large. In the past 10 years, around 460 satellites have been launched, in which many satellites of other countries are also included," the PM said.

On growing women's power in the industry, Modi said, "The participation of women power has been continuously rising in the space sector. I feel very happy seeing that today the space sector has become a favourite of the youth. For our youth who want to do something thrilling and exciting in their life, the space sector is becoming an excellent option for them."

Speaking about National Science Day 2025, which will be celebrated on Feb 28, the PM said that the interest and passion of youth in science matters a lot. "You try to spend one day as a scientist. You must visit places like a research lab, planetarium or space centre that day. This will increase your curiosity about science. Like space and science, India is rapidly making its mark in another field. That is AI (Artificial intelligence). I went to Paris to take part in an AI summit. There, people lauded India's strides in the field of AI," PM Modi said.

He also mentioned a teacher from Telangana, Thodasam Kailash, who is harnessing AI technology in digital song and music to help preserve the tribal languages, including Kolami. His tracks are being liked a lot by the tribal people. "People of India are second to none in adopting and using new technologies," he said.

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Use AI for revolution at grassroots; to counter target terror organisations: Experts

Source: The Week, Dt. 23 Feb 2025,

URL: <https://www.theweek.in/news/sci-tech/2025/02/23/use-ai-for-revolution-at-grassroots-to-counter-target-terror-organisations-experts.html>

As the second AI Action Forum, co-chaired by Prime Minister Narendra Modi, concluded in Paris, think tanks, policymakers, academia and civil society have started discussing ways to take advantage of the dawning AI age. Experts point out that innovation in AI needs to solve the problems of the last person in the societal strata. At a colloquium organised by the Society to Harmonise Aspirations for Responsible Engagement (SHARE) in Assam, R. K. Mathur, former lieutenant governor of Ladakh and former defence secretary, highlighted the need for an AI revolution at grassroots level, for India to top this global AI race.

Mathur encouraged focus on the six-point resolutions passed in the AI Action Summit and draw policy guidance from it to solve hyperlocal challenges through artificial intelligence. He urged policymakers to identify such problems and collaborate with the technocrats to resolve them. One such area of intervention would be agriculture, he said. Pointing out the great equalizing impacts of artificial intelligence, Bhaskar Jyoti Mahanta, former DGP of Assam said, policymakers, experts and technocrats must take heart from what DeepSeek has done. Mahanta was highlighting how a low-cost model with a small team of young professionals disrupted the AI industry, leading to one of the biggest market losses for the major AI and allied companies of the west. "It is the most pertinent example of how innovation and talent could trump resources," he said.

Industry leaders like KPMG, represented by Shubham Arora, highlighted several use cases of AI-enabled solutions with mass-level impact. At the same time, SHARE released a report titled 'Evolving Landscape of Tech-Terror Nexus and Response Options for Global South,' focusing on terror groups using emerging technologies to outplay global security.

As per a study by 'Tech Against Terrorism' in November 2023', cited in the SHARE report, showed how AI is leveraged by terror outfits like Al-Qaeda and Daesh as well as other extremist groups. Using open source tools (CAMEL, PyArabic, Bhashini, etc.) available for free, these groups are able to scale their propaganda both vertically and horizontally. From recruitment to radicalization and covert communication, open source tools like Conversations, SilentCircle, Redphone and Signal play a critical role for these threat actors, says the report. The report also raises concern that unlike global north, in global south, efforts to tackle terror networks are often marred by resource constraints faced by law enforcement agencies.

For instance, the US 2024 internal security budget was estimated to be \$65.9 billion, while India's was \$25.8 billion. Countries like Thailand, Mexico, Egypt, Brazil, Indonesia, Argentina and South Africa allocated much less for their internal security. Using the same tools and repurposing them for counter-terror purposes, the report stresses how the agencies could outplay the threat actors, with much lower resources.

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