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DRDO News

DRDO conducts successful Release Trials of Long-Range Glide Bomb ‘Gaurav’ from Su-30 MKI aircraft

Source: Press Information Bureau, Dt. 11 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2120989>

Defence Research and Development Organisation (DRDO) successfully conducted the Release Trials of Long-Range Glide Bomb (LRGB) ‘Gaurav’ between April 08-10, 2025 from the Su-30 MKI aircraft. During the trials, the weapon was integrated to multiple stations in different warhead configurations, with land target on Island. The trials successfully demonstrated range close to 100 kms with pin-point accuracy.

LRGB ‘Gaurav’ is a 1,000 kg class glide bomb, designed and developed indigenously by Research Centre Imarat, Armament Research and Development Establishment and Integrated Test Range, Chandipur. Senior officials of DRDO and the Indian Air Force (IAF) participated and reviewed these trials.

The system has been realised with the support of Development-cum-Production Partners - Adani Defence Systems & Technologies, Bharat Forge and various MSMEs. The trials are paving the way towards induction of the weapon into the IAF. The Centre for Military Airworthiness & Certification and Directorate General of Aeronautical Quality Assurance contributed towards Certification and Quality Assurance.

Raksha Mantri Shri Rajnath Singh complimented DRDO, IAF and industry for successful development trials of ‘Gaurav’. He said the development of LRGB will further enhance the capabilities of the Armed Forces to a great extent.

Secretary, Department of Defence R&D and Chairman DRDO Dr Samir V Kamat also congratulated the entire DRDO team on conducting the successful release trials.

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India gets first laser-based weapon to shoot down aerial targets, joins select list of countries

Source: Money Control, Dt. 13 April 2025,

URL: <https://www.moneycontrol.com/news/india/india-develops-laser-based-weapon-to-shoot-down-aerial-targets-joins-select-list-of-countries-12992893.html>

In a first, India has successfully developed a laser-based weapon system that can neutralise aerial targets, including fixed-wing aircraft, missiles and swarm drones, marking a huge milestone in the country’s defence technology. India has joined the list of elite countries, including the US, China, and Russia, to possess such advanced laser weapon capabilities.

A team of Defence Research and Development Organisation (DRDO) officials tested the new 30-kilowatt laser-based directed-energy weapon (DEW) in Kurnool, Andhra Pradesh, with positive results, ANI reported.

The indigenously designed and developed Mk-II(A) DEW system was demonstrated in its entire spectrum of capability by engaging the fixed wing drones at long range, thwarting a multiple drone attack and destroying enemy surveillance sensors and antennae, according to DRDO sources, News18 reported.

The lightning speed of engagement, accompanied by the precision of the strike within a few seconds, makes it one of the most potent counter-drone systems. This weapon system was developed by DRDO's Centre for High Energy Systems and Sciences (CHESS), Hyderabad.

"CHESS DRDO conducted a successful field demonstration of the Land version of Vehicle mounted Laser Directed Weapon(DEW) MK-II(A) at Kurnool today. It defeated the fixed wing UAV and Swarm Drones successfully causing structural damage and disabled the surveillance sensors. With this successful trial country has joined the exclusive club of the Global powers who possess the high power Laser DEW System," the DRDO said in a post on X.

This laser-based weapon can target aerial threats like drones and helicopters within a range of 5 km and also includes electronic warfare capabilities like jamming communication and satellite signals.

The DEW will replace traditional kinetic weapons and missile defence systems due to its ease of operation and cost-effectiveness. The requirement for cost-effective defence solutions to offset the low-cost drone attacks is driving the adoption of DEWs by military organisations worldwide.

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Defence News

Defence Strategic: National/International

KEEL LAYING OF THIRD NEXT GENERATION OFFSHORE PATROL VESSEL (YARD 3039)

Source: Press Information Bureau, Dt. 11 April 2025,
URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121084>

Keel Laying ceremony of Yard 3039, the third Next Generation Offshore Patrol Vessel (ex-GRSE) was held at GRSE Ltd, Kolkata on 11 Apr 25 with Shri Sugata Ghosh Dastidar, IDAS, Financial Advisor (Defence Services) as the Chief Guest. Cmde P R Hari (Retd), Chairman & Managing Director, GRSE and other senior officials from the Indian Navy and the Shipyard were present for the event.

The contracts for indigenous design and construction of eleven NGOPVs were concluded on 30 Mar 23 with Goa Shipyard Ltd (GSL), Goa and Garden Reach Shipbuilders and Engineers (GRSE), Kolkata, with seven ships to be constructed by Lead Shipyard GSL and four ships by Follow Shipyard GRSE.

The NGOPVs, with an approximate tonnage of 3000T, are designed for Coastal Defence & Surveillance, Search and Rescue operations, Protection of Offshore Assets and Anti-Piracy missions. Keel Laying of these vessels marks a significant milestone in the overall project timeline. The eleven NGOPVs are being built in consonance with the nation's vision of *Aatmanirbhar Bharat* and Make in India and are poised to augment the Indian Naval maritime prowess.

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GCULMINATION OF FIRST EDITION OF NAVAL COMMANDERS' CONFERENCE 2025

Source: Press Information Bureau, Dt. 11 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121045>

The first edition of the biannual Naval Commanders' Conference 2025 concluded today in New Delhi. The week-long apex-level conference, held from 05 to 11 Apr 25 in two phases at Karwar and New Delhi, engaged the commanders in deliberations on security challenges in the maritime domain and review of Indian Navy's operational preparedness. The Hon'ble Raksha Mantri, Shri Rajnath Singh, presided over the inaugural session of the conference at Karwar, with the Chief of the Defence Staff, Defence Secretary, senior MoD officials and Naval Commanders in attendance. The Hon'ble Raksha Mantri, while acknowledging the Navy's centrality in India's Maritime Security stated that "just like the oceans have no boundaries, there is no limit to Navy's roles and responsibilities - the Indian Navy will have to assume full responsibility for the entire IOR."

<https://pib.gov.in/PressReleasePage.aspx?PRID=2119284>

The first phase of the conference at Karwar also coincided with the flag-off of IOS Sagar by the Hon'ble Raksha Mantri. The landmark voyage of IOS Sagar represents India's strong commitment to cooperation and collaboration with IOR nations, and **aptly reflects the growth of Government of India's vision of SAGAR to MAHASAGAR (Mutual And Holistic Advancement for Security Across the Regions)**. While at Karwar, Shri Rajnath Singh also inaugurated nine state-of-the-art marine piers, eight residential buildings and several important utilities, created as part of Project Seabird. The first phase concluded with a review of Indian Navy's operational readiness and modernisation plans, wherein the **Hon'ble Raksha Mantri acknowledged Indian Navy's crucial role as a principle enabler of peace and security in the Indian Ocean Region.**

The second phase, chaired by Admiral Dinesh K Tripathi, Chief of the Naval Staff, commenced at Nausena Bhawan in New Delhi on 07 Apr 25. The proceedings featured comprehensive assessment of operational, materiel, logistics, human resources, training and administrative aspects. The Indian Navy's Space Vision, Indian Naval Air Publication, Indian Navy's Operational Data Framework, and a compendium for veterans, 'Navy for Life and Beyond', were the publications released on the occasion.

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2120559>

The conference facilitated interaction of the Naval Commanders with the Chief of the Defence Staff, Chief of the Army Staff and Chief of Air Staff, who shared their assessment of the operating environment, outlining readiness levels to counter evolving security challenges, through strong convergence and Tri-Service synergy. Additionally, Shri Vikram Misri, Foreign Secretary, and Shri Amitabh Kant, India's G20 Sherpa, also engaged with the Commanders. Whereas the Foreign Secretary offered insights into the shifting global order and its implications for maritime security in the IOR, Mr Amitabh Kant underscored Navy's significance in national growth and in India's emergence as the '*Preferred Security Partner*' in the region.

On the sidelines of the conference, Naval Commanders also interacted with several subject matter experts and strategic thinkers during the *Sagar Manthan* event on 07 Apr 25. The event centered around India's strategic vision of *MAHASAGAR* and focused on Indian Navy's key role in fueling national maritime growth.

Overall, deliberations at the first edition of Naval Commanders' Conference 2025 re-affirmed Indian Navy's commitment to a safe, secure and rules-based maritime environment amidst emerging geopolitical challenges, while reinforcing its steadfast pursuit of being a *Combat Ready, Credible, Cohesive and Future Ready force*.

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AFRICA INDIA KEY MARITIME ENGAGEMENT 2025

Source: Press Information Bureau, Dt. 12 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121218>

The inaugural edition of the large-scale multilateral exercise **Africa India Key Maritime Engagement**, *AIKEYME*, which means 'Unity' in Sanskrit, is planned for six days from 13 to 18 Apr 25 and will include participation from Comoros, Djibouti, Kenya, Madagascar, Mauritius, Mozambique, Seychelles and South Africa, alongside the co-hosts India and Tanzania.

This initiative aligns with the vision of the Honourable Prime Minister of India, Shri Narendra Modi, promoting Mutual and Holistic Advancement for Security and Growth Across Regions (*MAHASAGAR*).

The Indian Naval Ships INS Chennai (destroyer) and INS Kesari [Landing Ship Tank (Large)] arrived in Dar-es-Salaam on 10th and 11th Apr 25 respectively, and the inauguration ceremony of *AIKEYME* will be co-hosted onboard, along with the Tanzanian Peoples' Defence Force (TPDF). The ships were welcomed by DA Tanzania and Liaison team. A Ceremonial Guard was also paraded onboard INS Chennai with TPDF and Indian Navy band playing in unison the National Anthems of respective countries.

The harbour phase for AIKEYME 25 will include an inauguration ceremony and a deck reception with the Honorable Minister of State for Defence, Shri Sanjay Seth and Defence Minister, Tanzania as Chief Guests

Planned activities during this phase include Table Top and Command Post Exercises focused on anti-piracy ops and information sharing, alongside joint training in seamanship and Visit Board Search and Seizure (VBSS) exercises in collaboration with the TPDF. To promote camaraderie, activities such as sports fixtures and yoga sessions will also take place. Additionally, the Indian Naval ships will be open to visitors during the harbour phase to engage with the local population.

The sea phase, scheduled from 16 to 18 Apr 25, will focus on strengthening maritime security cooperation among the participating maritime nations.

AIKEYME aims to develop collaborative solutions to common regional maritime challenges. This maiden initiative by the Indian Navy seeks to enhance interoperability and synergise combined operations among the maritime forces of partner nations. It also highlights the strong and friendly relations between India and the African nations.

INS Sunayna which sailed out from Karwar on 05 Apr 25, as Indian Ocean Ship SAGAR, will also be participating in AIKEYME.

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EXERCISE TIGER TRIUMPH 2025 CULMINATES WITH DISTINGUISHED VISITORS' DAY AT KAKINADA, ANDHRA PRADESH

Source: Press Information Bureau Dt. 12 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121234>

The fourth edition of bilateral tri-service Humanitarian Assistance and Disaster Relief (HADR) amphibious Exercise Tiger Triumph 2025 between India and the United States culminated with a Distinguished Visitors' (DV) Day at Kakinada, on 11 Apr 25. The DV Day was attended by the Flag Officer Commanding Tamil Nadu & Puducherry Naval Area (FOTNA), US Consul General, Commander US Navy Strike Group Five and Deputy General Officer Commanding 54 Infantry Division, along with other senior dignitaries.

The DV Day witnessed seamless execution of complex operations at and off the coast of Kakinada including Standoff and Hard Beaching, Slithering Operations by Special Operations Forces from SC and Mi-17 V5 helicopters, participation of C-130 aircraft and integrated air operations by the Indian Navy, Indian Army, Indian Air Force, US Navy, US Army, and US Marine Corps.

The operations reflected the enhanced degree of combined combat drills, jointmanship and interoperability achieved between the Armed Forces of India and United States of America.

Conducted from 01 to 11 Apr 25, the exercise provided invaluable training in HADR operations and familiarised participants with each other's capabilities, techniques, and procedures. Notably, Ex Tiger Triumph was first held in 2019, with the primary aim of strengthening operational synergies, facilitated by logistics exchange under the Logistics Exchange Memorandum of Agreement (LEMOA) and towards integrating emerging technologies between the two militaries.

The harbour phase of the exercise was conducted from 01 to 07 Apr 25 at Visakhapatnam. The phase commenced with an opening ceremony attended by Mr. Jorgan K. Andrews, Chargé d'Affaires, US Embassy, and Vice Admiral Sameer Saxena, Chief of Staff, Headquarters Eastern Naval Command. Activities during this phase included Pre-Sail Conferences, Subject Matter Expert Exchanges (SMEEs) on key technologies including medical, drone, and space. The harbour phase also included cross-deck visits, ship boarding drills and friendly sports fixtures.

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Harbour phase of Indian Navy's maiden initiative 'Africa-India Key Maritime Engagement exercise' inaugurated by Minister of Defence and National Service of Tanzania & Raksha Rajya Mantri onboard INS Chennai at Dar es Salaam

Source: Press Information Bureau, Dt. 12 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121495>

The harbour phase of Indian Navy's maiden initiative of Africa-India Key Maritime Engagement exercise (AIKEYME) was inaugurated by Minister of Defence and National Service of Tanzania Dr Stergomena Lawrence Tax and Raksha Rajya Mantri Shri Sanjay Seth onboard INS Chennai at Dar es Salaam on April 13, 2025. AIKEYME, co-hosted by India and Tanzania, involves participation from Comoros, Djibouti, Kenya, Madagascar, Mauritius, Mozambique, Seychelles and South Africa.

Raksha Rajya Mantri also joined the digital inauguration of Weapons Training Simulator facility established at Arusha and inauguration of Defence Expo. In the Defence Expo, 22 companies from India are participating with their key products on display.

In his address, Raksha Rajya Mantri emphasised on oneness, and unity of purpose to overcome the vast maritime challenges and to ensure a peaceful & prosperous future. He recalled the age-old relations between India & Africa and reiterated the principle of MAHASAGAR (Mutual and Holistic Advancement for Security and Growth Across the Region) for further strengthening the bond with our friends in Africa.

Shri Sanjay Seth stressed on the African proverb: "If you want to go fast, go alone; if you want to go far, go together," highlighting the need for enduring partnerships in maritime security. He expressed gratitude to Tanzania for hosting AIKEYME 25, marking a significant step towards long-term collaboration.

Minister of Defence and National Service of Tanzania thanked India for co-hosting the Exercise and she termed the Exercise a strategic initiative to build strong maritime partnership. She underscored the necessity of a collective approach to address challenges such as piracy and trafficking.

Dr Stergomena Lawrence Tax reaffirmed Tanzania's commitment to hosting future editions of AIKEYME and detailed the collaborative framework for regional maritime security, emphasizing innovation and information sharing. Her remarks firmly established that the relationship extends beyond military affairs, advocating for a broader regional cooperation.

Dignitaries present included the Chief of Defence Force, Tanzania People's Defence Force, the Chief of Naval Staff of the Indian Navy, and the High Commissioner of India to Tanzania, reinforcing the importance of bilateral defence relationships. The event was punctuated by a parade of a 50-man guard and the stirring performance of the Indian Navy Band, embodying the spirit of maritime cooperation.

Raksha Rajya Mantri also briefly interacted with the crew of participating countries of the Exercise and IOS SAGAR ship. He did a walkaround of INS Chennai. He gifted 15 sets of Parachutes, books for NDC and a Tri-Services War Gaming Simulator to Tanzania as a token of strong bonds and friendship between the two countries.

The exercise represents commitment of the participating countries to a free, open and secure Indian Ocean. A new chapter has been added today to the growing relations between India and Africa. AIKEYME 25 and IOS SAGAR symbolize a transformative journey towards enhanced multinational collaboration in securing the seas, forging connections that transcend borders.

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IOS SAGAR MAKES FIRST PORT CALL AT DAR-ES-SALAAM, TANZANIA

Source: Press Information Bureau, Dt. 12 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121381>

INS Sunayna, designated as Indian Ocean Ship (IOS) SAGAR ship, entered the Port of Dar-es-Salaam, Tanzania on 12 Apr 25. The ship had sailed from Karwar, Karnataka, on 05 Apr with 44 naval personnel from nine Friendly Foreign Nations (FFNs) of the Indian Ocean Region (IOR), embarked as part of the ship's crew. The FFN include Comoros, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, Sri Lanka and South Africa.

OS SAGAR was accorded a warm welcome by RAdm AR Hassan, Chief of Tanzania Navy, Rear Admiral Nirbhay Bapna, ACNS (FCI) and Commodore Agyapal Singh, Defence Attaché for Tanzania, alongside dignitaries from the Indian High Commission and Tanzania People Defence Force. During this port call, the ship will also participate in the harbour phase of Exercise *AIKEYME*, a key naval exercise which will be inaugurated by Hon'ble Minister of State for Defence Shri Sanjay Seth on 13 Apr 25. The exercise will focus on enhancing operational coordination, refining joint strategies and improving interoperability in maritime operations. Two of the Indian Navy ships, INS Chennai (Destroyer) and INS Kesari [Landing Ship Tank (Large)], will also be participating in the exercise alongside INS Sunayna.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2121218>

The participation of personnel from FFNs onboard INS Sunayna further underscores the significance of this initiative in promoting global maritime cooperation. Through such exercises and engagements, the Indian Navy remains committed to advancing collective maritime security, fostering goodwill and ensuring the free and safe movement of shipping lanes in the region.

The ship will depart Dar-es-Salaam on 15 Apr 25 for next port of call, Nacala, Mozambique to continue with IOS SAGAR mission.



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Raksha Rajya Mantri Shri Sanjay Seth calls on Tanzanian Vice-President Mr Philip Isdor Mpango and Minister of Defence & National Service Dr Stergomena Lawrence Tax in Dar es Salaam

Source: Press Information Bureau, Dt. 14 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121709>

Raksha Rajya Mantri Shri Sanjay Seth called on Vice-President of Tanzania Mr Philip Isdor Mpango and Minister of Defence & National Service Dr Stergomena Lawrence Tax in Dar es Salaam on April 14, 2025. During his meeting with the Tanzanian Vice-President, Raksha Rajya Mantri updated him on the Africa-India Key Maritime Engagement cooperation from Indian defence industries to exercise (AIKEYME) and Defence Expo inaugurated on April 13, 2025. He offered to fulfil the defence requirements of Tanzania People's Defence Force. India-Tanzania development partnership, cultural connections and cooperation in health and education were also discussed.

During the meeting between Tanzanian Minister of Defence & National Service and Raksha Rajya Mantri, the ongoing defence cooperation was reviewed and new ways were explored to further bolster the ties. Training of Tanzania officers in military training institutes of India, defence industry collaboration, cooperation in counter-insurgency and counter-terrorism operations, and cyber security were some of the key areas of cooperation deliberated upon during the meeting.

Raksha Rajya Mantri ended his day with an Indian Community event where he highlighted the progress India has made in various spheres in recent years. He dwelt upon the contribution of the Indian diaspora in growth and prosperity of not only India but Tanzania too. He visited Sanatan Dharma and Swaminarayan Mandir prior to the interaction with the Indian community. He also participated in the Ambedkar Jayanti celebrations organised in the High Commission of India in Tanzania.

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The latest in Indian defence? ISRO to build military satellites for surveillance and intelligence

Source: The Week, Dt. 10 April 2025,

URL: <https://www.theweek.in/news/defence/2025/04/10/the-latest-in-indian-defence-isro-to-build-military-satellites-for-surveillance-and-intelligence.html>

India has taken a big step toward this future, as Chief of Defence Staff General Anil Chauhan announced plans to launch several satellites for intelligence and surveillance during the Indian DefSpace Symposium in Delhi. These satellites will be built by the Indian Space Research Organisation (ISRO) and will boost the military's ability to watch and listen from space.

A military space doctrine will also be ready in three months, guiding how these tools will be used. With India's long borders and strategic needs, this move shows how seriously the nation is taking space as a new frontier for defence.

In the backdrop of this development and with India planning to launch dedicated satellites for intelligence and surveillance their significance is of utmost importance. These satellites play two key roles watching over vast areas (surveillance) and gathering secret information (intelligence). Together, they give the military a powerful advantage in today's fast-moving world.

Military satellites are also important because they provide information that ground-based systems cannot match. Positioned high above the Earth, they can see and listen across huge distances, beyond borders, and in places where it's hard or dangerous to send people. Unlike planes or drones, satellites do not need to refuel or land and they keep working around the clock. This constant presence makes them essential for staying ahead of threats.

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IAF wraps up multinational exercise INIOCHOS-25 in Greece

Source: The Economic Times, Dt. 13 April 2025,

URL: <https://economictimes.indiatimes.com/news/defence/iaf-wraps-up-multinational-exercise-iniochos-25-in-greece/articleshow/120247269.cms?from=mdr>

In a display of precision, cooperation, and operational strength, the Indian Air Force (IAF) concluded its participation in Exercise INIOCHOS-25, hosted by the Hellenic Air Force (HAF) at Greece's Andravida Air Base. The HAF announced the successful wrap-up of the multinational drill on X, posting: "INIOCHOS-25 - A demanding exercise successfully concludes, highlighting operational excellence, precision, and seamless multinational cooperation." Held from March 31 to April 11, 2025, the biennial air exercise saw the participation of air and surface assets from fifteen countries. Representing India, the IAF deployed a fleet comprising Su-30 MKI fighter jets, IL-78 mid-air refuelling aircraft, and C-17 strategic airlifters.

This deployment enabled the IAF to demonstrate its combat reach, rapid mobility, and ability to operate in joint environments alongside partner nations.

INIOCHOS-25 provided a high-intensity training ground for multinational forces, with missions designed to replicate modern air warfare conditions. The exercise focused on refining tactics, strengthening interoperability, and building synergy between participating air forces through the execution of combined air operations under complex and realistic combat scenarios.

According to the Defence Ministry, "The IAF looks forward to participating in Exercise INIOCHOS 25, a platform to enhance international cooperation, synergy and interoperability among participating Air Forces."

The statement highlighted the opportunity to train in planning and executing coordinated missions, further noting that the exercise allowed the IAF to gain insights into operational best practices through shared learning with other nations. With all operations conducted from Andravida, the IAF's presence contributed both to strengthening its operational capabilities and to advancing mutual understanding.

The statement concluded: "IAF's participation in INIOCHOS-25 reflects its commitment to global defence cooperation and operational excellence. The exercise will further reinforce India's strategic partnerships - and bolster its capabilities in joint operations with friendly nations."

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HAL clarifies no consultancy firm selected to benchmark its R&D, process is on

Source: The Tribune, Dt. 12 April 2025,

URL: <https://www.tribuneindia.com/news/business/hal-clarifies-no-consultancy-firm-selected-to-benchmark-its-rd-process-is-on/>

Hindustan Aeronautics Ltd (HAL) has rubbished social media posts claiming that the state-owned defence company has selected consultancy firm PwC to benchmark its R&D.

In a post on X, HAL noted a few posts on social media (X) have falsely stated that HAL has finalized the selection of a consultancy firm, PricewaterhouseCoopers (PwC) to benchmark its R&D activities.

HAL clarified that no firm has been finalized yet for the benchmarking of its R&D processes.

"HAL would like to state that no firm has been finalized yet for the benchmarking of its R&D processes. HAL had issued a Request for Quotation (RFQ) to engage a consultancy firm to conduct a benchmarking study of its R&D framework against global Aerospace and Defence companies," it asserted.

The X post added that the decision to initiate this benchmarking exercise was based on the recommendations made by the high-power committee on Public Undertakings as part of HAL's continuous improvement and modernization efforts.

"The selection process is being conducted through a transparent and competitive methodology on the Government of India's GEM Portal in compliance with all applicable procurement guidelines. The process is currently ongoing," it added in the X post.

"HAL reiterates that no official award of work has been made so far, and any information suggesting otherwise is premature and incorrect. HAL remains committed to upholding transparency and fairness in all its procurement actions," it concluded the X post.

Earlier on Friday, Hindustan Aeronautics Ltd said that speculative stories with malicious intentions have been written and published on various media platforms ever since the accident of the Advanced Light Helicopter (ALH) operated by the Indian Coast Guard crashed in January

"HAL would like to bring to the notice of all its stakeholders, media and all forms of publications--online, print, websites, blogs, social and digital media platforms, etc. that of late, ever since the unfortunate accident of ALH operated by the Indian Coast Guard in January, speculative stories with malicious intentions on HAL are being written and published on these platforms," HAL said in a statement.

"These stories are authored by so-called Defence analysts, former pilots, officers of the Defence Forces and arm-chair critics," it added.

The company said that these stories are written without offering HAL's perspective, and arguments are one-sided and biased. There are inaccuracies and references to outdated issues that HAL has long resolved by taking its customers into confidence. HAL said that it cannot respond to or comment on all these reports one-on-one due to the sensitive nature of Defence issues and products.

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Faster Than Fire: Why Lasers Are The Future Of Drone Defense Inside India's Strategic Leap Against Swarm UAVs

Source: Eurasian Times, Dt. 15 April 2025,

URL: <https://www.eurasiantimes.com/faster-than-fire-why-lasers-are-the-future-of-drone/>

Somewhere near a forward outpost in Arunachal Pradesh (China border). 0400 hours.

A sudden blip on the radar. Then fifty more. They're not enemy aircraft. They're not birds. They're drones—small, fast, and arriving en masse from multiple directions.

Each drone is no larger than a microwave oven, flying low, with irregular movement patterns that confuse radar and targeting systems. They carry a variety of payloads—some with small explosives, others with cameras, jammers, or even chemical sprayers.

Their job? To blind sensors, damage equipment, and create confusion before a major ground assault. The defense team is ready, but its traditional tools feel inadequate. Missiles are too expensive and too few, guns are limited in range and accuracy, and jamming may not stop pre-programmed or autonomous drones.

Then, from a camouflaged trailer on the ridgeline, a silent beam of light slices through the darkness. One drone wobbles mid-air and crashes, followed by another. There is no sound, no fireball, just the smell of burned circuits. The swarm is disoriented. A few more beams later, the rest retreat or fall. Welcome to the age of directed energy warfare.

Why Traditional Defences Fall Short Against Drone Swarms

Drones have changed the face of modern warfare. Once limited to reconnaissance, today's drones can carry explosives, jam communication networks, drop weapons, or act as suicide bombers. And when deployed in swarms, they overwhelm even the most advanced air defense systems.

Missiles are too costly to be used against drones. Each interceptor may cost tens of lakhs of rupees or more. Using a high-end missile to destroy a low-cost drone makes little financial or tactical sense.

Gun systems are effective only at close range and struggle to track fast erratic targets. Moreover, in a swarm scenario, guns can't reload fast enough to match the speed and volume of the threat.

And even electronic jamming has its limits. Some drones operate on encrypted or pre-programmed paths and are unaffected by common jamming techniques.

So what's the alternative? Enter laser weapons.

How Laser Weapons Work: A Simplified Explanation

Laser weapons are part of the broader category of Directed Energy Weapons (DEWs). These systems use concentrated beams of electromagnetic energy to damage or destroy targets.

Unlike bullets or missiles, lasers have no mass. They use light energy to generate heat at the target site, burning through plastic, metal, or sensitive electronic circuits.

A laser weapon typically includes:

- A power source or generator
- A beam director (like a turret or gimbal)
- A tracking system (radar, lidar, or optical)
- A cooling system to prevent overheating

When the system detects an incoming drone, it locks on and directs the beam precisely at a weak point—the motor, battery pack, or onboard sensor. In a matter of seconds, the heat disables the drone, causing it to crash or burn out mid-air.

Why Lasers Are The Ideal Anti-Drone Solution

1. **Speed of Engagement:** Laser beams travel at the speed of light. Once a target is identified, the laser hits it instantly. There's no time-of-flight delay like with missiles.
2. **Low Cost Per Shot:** Firing a missile costs thousands or lakhs of rupees. A single laser "shot" costs the price of electricity used—often just a few hundred rupees.
3. **High Precision:** Lasers can target a drone's weak spots—motors, sensors, or wings—while the rest of the drone remains intact, minimizing debris and risk to nearby infrastructure or people.
4. **Unlimited Ammo (Almost):** As long as the weapon has power and isn't overheated, it can keep firing. This is vital in swarm scenarios where dozens or hundreds of drones may attack at once.
5. **Silent and Stealthy:** Lasers don't make noise. They don't create explosions. They leave minimal trace. This is useful for covert defense in urban areas or along sensitive borders.

India's Directed Energy Arsenal: Where We Stand

India is steadily developing indigenous DEW capabilities. Two main programs stand out:

1. **DURGA-II:** The Directionally Unrestricted Ray-Gun Array (DURGA-II) is a DRDO-led project aimed at developing mobile laser weapons for the Army and Air Force. These systems can be mounted on trucks or tanks and deployed to high-threat zones. They are designed to neutralize drones, rockets, and even mortar shells in real-time.
2. **KALI:** The Kilo Ampere Linear Injector (KALI) isn't a laser in the traditional sense. It is a particle beam accelerator capable of emitting high-energy pulses that can disable the electronics of incoming weapons. While KALI is more experimental, it could evolve into a strategic anti-satellite or anti-missile tool.

While not yet at full operational capability, these programs show that India recognizes the urgency of DEWs and is laying the groundwork for future deployment.

Implications For The Armed Forces

Indian Army: The Indian Army operates in diverse terrains—from deserts and plains to mountains and urban zones. Each of these presents a different kind of challenge when dealing with UAVs and drones. Laser weapons could be deployed on border posts in high-altitude areas like Ladakh to target Chinese reconnaissance drones or swarming loitering munitions.

During counter-insurgency operations, portable laser systems mounted on jeeps or armored vehicles can neutralize low-flying drones without risking collateral damage. Lasers also offer a way to protect artillery, radar stations, and ammunition dumps in remote areas where resupply of missiles is difficult.

Indian Navy: Indian naval ships face a unique challenge. Drones and loitering munitions flying low over the sea surface can bypass radar detection and threaten high-value vessels like destroyers or aircraft carriers. DEWs offer a perfect defensive solution—they work well at sea where line-of-sight is unobstructed.

Lasers can protect vessels during chokepoint crossings such as the Malacca Strait or while deployed in contested waters of the South China Sea. Lasers could also be deployed on Coast Guard ships for maritime anti-piracy operations where pirate drones are used for surveillance, communication jamming, or direct attack.

Indian Air Force: For the Indian Air Force, DEWs present both an opportunity and a necessity. Ground-based DEW units can protect forward airbases, runways, fuel depots, and radar stations against low-cost drone incursions.

They can be integrated into layered air defense systems, offering a close-in solution when missile systems are saturated or ineffective. In the future, laser pods may be mounted on fighter aircraft or UAVs for aerial interception of hostile drones. IAF's AWACS and AEW&C platforms, which are slow-moving and highly valuable, can benefit from onboard DEWs for self-defense.

Civilian Applications: Protecting National Infrastructure

Civil Aviation and Airports: Civilian airports are becoming high-risk zones for drone disruptions. Drones flown near runways can force flight diversions, delays, or even shutdowns. Lasers offer an immediate, non-lethal option for neutralizing such threats.

Airport authorities can install rooftop laser turrets that automatically detect and disable drones without disrupting airport communication systems.

Shipping and Maritime Infrastructure: Indian shipping lanes, especially through the Gulf of Aden and the Arabian Sea, face constant threats from pirates and state-sponsored disruption tactics.

Ships equipped with DEWs can defend themselves against drone scouts or explosives-laden UAVs. Ports and harbor installations can install stationary laser systems as part of their perimeter defense mechanism.

Oil and Gas Facilities: Critical infrastructure like oil refineries, LNG terminals, and nuclear plants is increasingly vulnerable to drone surveillance and sabotage. Lasers can act as an invisible, always-on perimeter fence. The advantage is that no projectile is involved, so the surrounding areas remain safe from misfires.

VIP Protection and Government Installations: In high-security zones such as Parliament, Prime Minister's residence, or military HQs, small UAVs can be used for spying or attacks. Portable DEWs can be deployed for perimeter protection, especially during high-profile public events. This can be scaled to large gatherings such as Republic Day parades or major religious festivals.

Challenges & Limitations

1. **Power Requirements:** High-powered lasers need a steady and substantial power supply. Integrating them into vehicles or mobile units requires advanced energy storage and distribution solutions.
2. **Atmospheric Conditions:** Dust, rain, fog, and pollution can disperse or weaken laser beams, limiting their effectiveness in certain terrains and weather.
3. **Cooling Systems:** Laser weapons produce immense heat. Without efficient cooling, they can overheat and shut down.
4. **Targeting Accuracy:** In a dense swarm, picking out the most dangerous drones and locking onto them in real time requires advanced tracking algorithms and AI.

Despite these, progress is rapid. Global benchmarks show lasers are transitioning from testbeds to battlefield tools.

What India Must Do Now

1. **Accelerate Field Trials:** Move from lab tests to real-world deployments along the western and northern borders.

2. **Integrate AI-Based Tracking:** Use machine vision and neural networks to identify, prioritize, and lock onto the most dangerous threats in a swarm.
3. **Develop Naval and Airborne Variants:** Create rugged laser systems that can withstand the vibration, motion, and power challenges of aircraft and ships.
4. **Public-Private Collaboration:** Leverage Indian private defense startups and PSU giants to accelerate innovation and manufacturing.
5. **Export Capability:** India should position itself as a provider of low-cost laser defense solutions to developing nations facing drone threats.

Conclusion: Light Is The New Shield

The battlefield has changed. The enemy is unmanned, autonomous, and increasingly artificial. Whether it's a swarm over Ladakh, a rogue drone near Mumbai airport, or a piracy drone attack near the Gulf of Aden, India needs a shield that doesn't run out, doesn't miss, and doesn't cost a fortune per shot.

That shield is light.

With the right investment, collaboration, and urgency, India can be not just a consumer but a global leader in laser defense.

The war of the future won't be won with bullets or bombs. It will be won with beams.

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Science & Technology News

Dr. Jitendra Singh Hails International Certification for Indigenously Developed Underwater Acoustic Test Facility

Source: Press Information Bureau, Dt. 12 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121247>

Union Minister of State (Independent Charge) for Science and Technology; Earth Sciences and Minister of State for PMO, Department of Atomic Energy, Department of Space, Personnel, Public Grievances and Pensions, Dr. Jitendra Singh today hailed the global recognition and international certification of the Underwater Acoustic Test Facility (ATF) at the National Institute of Ocean Technology (NIOT), Chennai, describing it as a proud milestone in India's journey towards scientific self-reliance in underwater acoustics and ocean technology.

After unveiling the commemorative plaque, Dr. Jitendra Singh witnessed a live demonstration of the facility's capabilities, which include precise testing and calibration of a wide range of underwater acoustic instruments such as hydrophones, transducers, and acoustic modems—vital for both strategic and civilian applications.



Describing the facility as a “critical national asset,” the Minister highlighted its pivotal role in strengthening India’s self-reliance in ocean technology. “The Acoustic Test Facility enhances our ocean observation capabilities, supports tsunami detection systems, and reinforces national security through its strategic applications,” he said.

Established in 2004 under the Ministry of Earth Sciences, the ATF is India’s only facility accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) for hydrophone calibration. Since 2005, it has consistently maintained this accreditation and caters to a broad spectrum of users, including naval laboratories, IITs, universities, and major industrial players such as BEL, L&T, and Tata Power.

In 2018, the facility’s global competence was validated when it participated in a Key Comparison Test organized by the National Physical Laboratory, UK, alongside laboratories from seven other countries, including the US, UK, and Russia. The ATF’s calibration results matched international benchmarks, establishing its parity with top global labs.

In a significant milestone, the facility was recently recognized as India’s “Designated Laboratory” in the field of underwater acoustics under the International Bureau of Weights and Measures (BIPM), Paris, through CSIR-NPL, effective January 30, 2024. This means NIOT now holds the national standards for measurements in underwater acoustics—a crucial responsibility for ensuring measurement accuracy across strategic sectors.

Experts say this recognition not only boosts India’s scientific credibility but also opens up opportunities for global collaborations in underwater research and maritime technology.

As India scales up its ambitions in ocean exploration and maritime security, the Acoustic Test Facility is expected to play a defining role in shaping future technologies, offering both precision and indigenous strength to the nation’s deep-sea endeavours.

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India Highlights Its BioE3 Policy and Integrated Biorefinery Initiatives at Mission Innovation Annual Gathering 2025 at Seoul, South Korea

Source: Press Information bureau, Dt. 12 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121135>

The Department of Biotechnology (DBT), Government of India - co-leads the Mission Integrated Biorefinery jointly with the Netherlands as part of Mission Innovation (MI) 2.0. The Mission Innovation Annual Gathering-2025, a multilateral platform accelerating clean energy innovation, held at Seoul, South Korea during 9th-11th April 2025 brought together global leaders in clean energy technology. The term “Mission Innovation” was coined by Prime Minister Shri Narendra Modi during COP21, in collaboration with former French President François Hollande. India continues to play an active role under the Mission Innovation initiative.

At the Annual Gathering held in Seoul, the DBT being an integral member of the Indian delegation, participated in discussions on collaborative opportunities among diverse MI missions and platforms. The focus has been to advance the biorefinery approach for fuels, chemicals, and materials. During the event, the DBT presented BioE3 (**B**io**t**echnology for **E**nvironment, **E**nergy, and **E**conomy) Policy and demonstrated its pivotal role in addressing climate challenges and aligning national priorities under the Integrated Biorefinery Mission were extensively discussed at roundtables and reviewed by Mission Innovation members as well as the Technical Advisory Groups associated with the Missions.

The participants highlighted how the BioE3 Policy promotes sustainable and low-carbon manufacturing of fuels, chemicals, and materials. The Policy is designed to develop enabling technologies that foster an innovation-driven manufacturing ecosystem for a low-carbon future. Further, India’s efforts in integrating Carbon Capture, Utilization, and Bioenergy (CCUB) for the biomanufacturing of fuels, chemicals, and materials were shared with the MI community through roundtable discussions.

Deliberations were also focused on opportunities for research, development, and demonstration (RD&D) using biomass-based biomanufacturing approaches. The DBT also participated in focused sessions on Biotechnology and Biomanufacturing priorities during visits to clean energy facilities, preceding meetings at Hanyang University and the Korea Institute of Science and Technology, coordinated by the Indian Embassy in Seoul. It was observed that the Bioinnovations for fuels, chemicals, and materials are the opportunities for Mission Innovation Member countries to accelerate their decarbonization goals.

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Minister-President of the German State of Bavaria, Markus Söder called on Dr. Jitendra Singh, Union Minister of State (Independent Charge) for Science & Technology, Earth Sciences; reiterates strong collaboration between the two nations

Long - standing Indo-German cooperation in Science, Technology and Innovation (STI), underlines the potential for bilateral cooperation, says Dr

Jitendra Singh

India and Germany to Deepen Cooperation in AI, Quantum Tech, Clean Energy, and Biotechnology

Dr. Jitendra Singh Hails Indo-German 2+2 University and Industry Collaboration

Highlights India emergence in Space, Nuclear and Biotech and next generation technologies such as AI, Quantum technologies

Source: Press Information Bureau, Dt. 12 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121439>

In a significant diplomatic and scientific engagement, Minister-President of the German State of Bavaria, Markus Söder called on Dr. Jitendra Singh, Union Minister of State (Independent Charge) for Science & Technology, Earth Sciences, PMO, Personnel, Public Grievances, Pensions, Atomic Energy and Space, and reiterated strong collaboration between the two nations.

One to one bilateral between the two leaders, was followed by high-level delegation level meeting led by the two Ministers

Welcoming the high-level German delegation, Dr. Jitendra Singh emphasized the long-standing Indo-German cooperation in Science, Technology and Innovation (STI), underlining the potential for bilateral cooperation in priority areas including Artificial Intelligence, Quantum Technologies, Biotechnology, Clean Energy, Electric Mobility, Cyber-Physical Systems, and Green Hydrogen.

“India has embarked on mission-mode programs under the visionary leadership of Prime Minister Shri Narendra Modi. We seek economic and sustainable solutions through scientific and technological interventions, and Germany is a natural partner in this endeavor,” stated Dr. Jitendra Singh.

Dr. Jitendra Singh applauded the Indo-German 2+2 collaboration model involving joint efforts between academia and industry from both countries, calling it a landmark step toward creating future-ready, innovation-driven ecosystems. “The 2+2 collaboration is a futuristic model. It brings together universities and industries from both countries to solve global challenges through innovation, co-development, and commercialization,” Dr. Jitendra Singh said.

Dr. Jitendra Singh recalled the Golden Jubilee of Indo-German S&T Partnership celebrated last year, adding that the recent Indo-German S&T Governing Body Meeting in Germany further reinforced the commitment to deepen scientific engagement. He highlighted the shared cultural and intellectual legacy between the two nations, mentioning Max Mueller’s pioneering translation of the Upanishads and the Rigveda, which laid the foundation for Indo-European scholarly ties.

Dr. Jitendra Singh spotlighted India’s remarkable progress in the biotech sector, boasting over 3000 startups and leading globally as the largest vaccine manufacturer. He noted the significance of the recently approved BIOe3 policy, which focuses on Energy, Economy, and Employment to drive the next wave of biotech innovation.

Dr. Jitendra Singh outlined India's emergence as a biotech powerhouse with over 3000 startups and the recent launch of the BIOe3 policy, aimed at driving Energy, Economy, and Employment through biotech innovation.

The Science and Technology Minister states that India's Space-Tech and Nuclear sectors, now open to private players, offer tremendous collaborative opportunities. He further stated that India ranks 3rd globally in startups and unicorns, making it a vibrant destination for tech partnerships.

"India's academic outreach to Germany continues to deepen, with over 50,000 Indian students enrolled in German universities—mostly in STEM disciplines—a number that has tripled in the last seven years", says Dr. Singh

Dr. Jitendra Singh called for a reciprocal increase in German students studying in India, particularly in the areas of Oriental Studies, Indian Culture, and Traditional Knowledge Systems.

"Germany has emerged as a favoured academic destination for Indian youth. Now we hope to see more German students exploring India's intellectual heritage and scientific capabilities," he said.

Dr. Jitendra Singh fondly recalled his recent visit to Berlin, observing the growing popularity of Indian cuisine and culture, with locals enthusiastically embracing Indian flavours in more than a dozen Indian food outlets.

The German side was represented by Dr. Markus Söder, along with Dr. Philipp Ackermann, German Ambassador to India, and other senior delegates. From the Indian side, Dr. Abhay Karandikar, Secretary, Department of Science and Technology (DST); Dr. Praveen Somasundaram, Head of International Cooperation, and Dr. Alka Sharma, Senior Advisor, Department of Biotechnology, also participated in the deliberations.

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Startup selected under NQM develops platform to empower enterprises protect their critical infrastructure

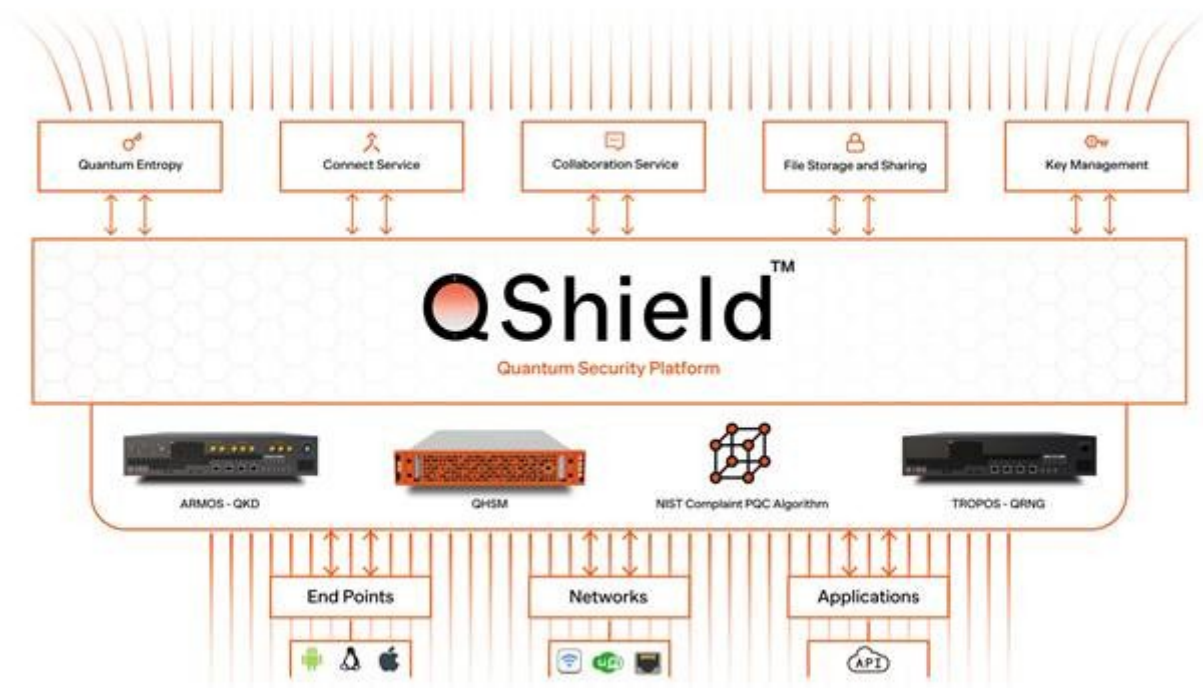
Source: Press Information Bureau, Dt. 14 April 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2121617>

QNu Labs, one of the startups selected by the Department of Science and Technology (DST) under the National Quantum Mission (NQM), has launched world's first and unique platform, QShield that enables seamless cryptography management across any environment — cloud, on-premises, or hybrid on the occasion of World Quantum Day today.

QShield empowers enterprises to protect their critical infrastructure at scale -Built with QNu's patented Quantum Key Distribution (Armos), Quantum Random Number Generator (Tropos), Quantum Hardware Security Module (QHSM) and NIST-compliant Post-Quantum Cryptography (PQC), QShield provides an end-to-end solution for securing sensitive data in transit and at rest.

The launch of this platform adds one more step in India's journey towards global leadership in quantum technology.



QShield enables various services like Qosmos for key generation, QConnect for secured connectivity, QVerse for secured collaboration, QSFS for secure file storage and sharing, and QVault for key management, empowering enterprises a pathway to quantum-safe their critical and diverse infrastructures. With unified management, flexible deployment options, and easy integration with 3rd party services, QShield empowers enterprises to protect their critical data today — making them ready for a quantum-secured future.

Incubated at IIT Madras Research Park in 2016, QNu Labs is revolutionizing cybersecurity with quantum-safe solutions, positioning India as a global leader in quantum cryptography.

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'Orbiting data centre': Axiom Space sets stage for first cloud among the stars by late 2025

Source: The Wion, Dt. 14 April 2025,

URL: <https://www.wionews.com/science/orbiting-data-centre-axiom-space-sets-stage-for-first-cloud-among-the-stars-by-late-2025-8962361>

Axiom Space is set to deploy its first two orbiting data centre nodes in low Earth orbit before the end of 2025. These initial satellites, ODC 1 and ODC 2, will mark the company's entry into the development of in-space cloud computing infrastructure.

The data centre nodes will be integrated with Kepler Communications' upcoming optical relay constellation. Kepler, a Canada-based company, is planning to begin launches for its constellation in late 2025. Each of the 10 planned Kepler satellites will weigh approximately 260 kilograms, with two allocated for Axiom's data centre payloads.

The orbital data centres are designed to process Earth-observation data using artificial intelligence and machine learning directly in space. This approach aims to reduce the latency associated with transmitting data to Earth-based stations for processing and to improve bandwidth efficiency by only transmitting relevant data.

Currently, most satellite data is downlinked to ground stations for analysis, which can introduce delays and raise security concerns. By processing information in orbit, Axiom aims to minimise the risk of data interception and streamline the transfer of essential insights to end users.

The company's orbital data centre concept expands on earlier plans to include such capabilities on its future space station, scheduled for launch in 2027. According to Axiom, the new distributed approach—leveraging hosted payloads on third-party satellites—will support the delivery of cloud services to global clients.

Axiom has previously tested a smaller-scale computing payload, based on Amazon Web Services' Snowcone device, aboard the International Space Station. A larger system, known as Data Centre Unit-1 (AxDCU-1), is due for launch soon, intended to validate hardware and software performance in preparation for the full deployment of ODCs.

Jason Aspiotis, Axiom Space's global director of in-space data and security, stated that the deployment of the first two nodes accelerates the company's broader plan to establish multiple free-flying computing units in orbit to meet increasing global demand.

The data centres will be linked to Kepler's network via high-speed 2.5 Gbps optical links, allowing for communication with other satellites and terrestrial data facilities.

Despite the progress, developers must still address technical challenges, such as protecting electronics from space radiation, which can significantly affect the durability of computing hardware in orbit.

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ESA new short film investigates impact of increasing orbital debris

Source: The Wion, Dt. 14 April 2025,

URL: <https://www.wionews.com/science/esa-new-short-film-investigates-impact-of-increasing-orbital-debris-8962379>

A new short documentary released by the European Space Agency (ESA) raises concerns about the increasing volume of debris orbiting Earth. Titled "Space Debris: Is it a Crisis?", the eight-minute film opens by stating that around 70 per cent of the approximately 20,000 satellites launched since the beginning of the space age remain in orbit. These are joined by hundreds of millions of smaller fragments created through collisions, explosions, and deliberate destruction.

The documentary examines the potential consequences of the rising number of satellite constellations, such as those deployed for global internet services. It notes that the increase in such constellations will likely add to the already growing population of orbital debris, as additional fragments are produced during launches and as non-operational satellites remain in space without retrieval mechanisms.

ESA's film uses data and orbital models to explore how debris can affect active satellites. Even small fragments, due to the high speeds involved in orbit, can significantly damage functioning spacecraft. In the event of a collision between two satellites, the consequences could be severe. The film also acknowledges that some debris re-enters Earth's atmosphere in an uncontrolled manner.

The documentary points out that different orbital zones face different levels of risk, with low Earth orbit—home to satellites used for communication, navigation, and climate monitoring—particularly vulnerable.

While discussing potential mitigation strategies, the film warns against hasty actions. It calls for a more considered approach to ensure that long-term sustainability is not undermined by short-term fixes. ESA underlines the complexity of addressing the debris issue without shifting the burden elsewhere.

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How is spaceflight safety ensured?

Source: The Hindu, Dt. 15 April 2025,

URL: <https://www.thehindu.com/sci-tech/science/how-is-spaceflight-safety-ensured/article69449173.ece>

The recent safe return of NASA astronauts Sunita Williams and Barry Wilmore after a nine-month stay onboard the International Space Station (ISS) underscored the importance of following safety protocols. While these protocols were hidden from view, they allowed NASA to make sure that the astronauts were not harmed physically or mentally in the course of their unpredictable Starliner test mission. The Indian Space Research Organisation (ISRO) is currently putting similar protocols in place as it prepares for its maiden human spaceflight mission, Gaganyaan. In this endeavour, its scientists and engineers are drawing from both the latest in research and incidents and accidents of the past.

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Human spaceflight has three key phases: launch, orbit, and reentry. Let's explore safety protocols in each phase.

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Before and during launch

On the launchpad: In 1967, three members of NASA's Apollo-1 crew met with tragedy when the crew capsule they were testing on a launchpad in Florida — even before the rocket took off — caught fire, killing all of them. Should a similar incident recur today, the crew will need to flee the area quickly. Thus, ISRO has installed ziplines and a fireproof bubble lift at its second launch pad at SHAR in Sriharikota.

After ignition until orbital insertion: A human-rated launch vehicle includes an emergency exit device, like the back door of a bus, to be activated in case a life-threatening incident occurs after the rocket has lifted off. In contrast to the Launch Vehicle Mark-3 (LVM3), ISRO's medium-lift launch vehicle that lifts satellites, the human-rated version will feature a tower-like structure on top.

The crew module is fastened to this tower-like structure. In case of a launch vehicle malfunction, the crew module and its escape mechanism will first disengage from the main rocket, then, the escape tower's solid fuel engines — designed to ignite quickly — will produce a tremendous amount of thrust in a short period of time, propelling the space capsule upwards and away from the rocket.

This is the Crew Escape System. On the human-rated LVM3, it is tractor-type, meaning a powerful engine will pull the crew module away from harm. The SpaceX Crew Dragon capsule utilises a pusher-type system where the system is located beneath the crew module and pushes it away from the main rocket.

During launch: The crew escape mechanism operates in three modes depending on the altitude obtained during the emergency. ISRO's Crew Escape System has two types of motors: the Low-altitude Escape Motor (LEM), which can generate enough thrust to propel the crew module away from the launch vehicle during the initial phase of the flight, and the High-altitude Escape Motor (HEM), which will kick in at high altitude to provide enough pull to yank the crew module quickly to a safe distance from the rocket.

Pad abort: This is when the emergency escape has to take place moments after ignition. Both the HEM and LEM motors of the Crew Escape System are activated to rapidly transport the whole crew escape assembly and capsule to a safe distance in the shortest amount of time. In low-altitude abort scenarios, both motors are triggered; however, now, the crew module will splash down at a designated spot in the sea. In normal conditions, the Crew Escape System is effectively dead weight. Therefore the LEM — which is the pencil-like element of the tower — is jettisoned at a specific height to reduce weight while the HEM remains attached to the crew module.

The Soyuz T-10 rocket caught fire on the launchpad just before liftoff in 1983. The crew could evacuate safely thanks to the Crew Escape System. Similarly, one minute into the Blue Origin New Shepard flight NS-23 on September 12, 2022, a launch engine failed and the launch escape device worked as intended, allowing the capsule to detach and land safely.

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Human spaceflight has three key phases: launch, orbit, and reentry. Let's explore safety protocols in each phase.

Entering and staying in orbit

ISRO's Gaganyaan crew capsule, which will transport humans, consists of a pair of interconnected modules. The crew module serves as the living quarters for the crew and passengers if any while the service module carries the fuel, engines, control systems, etc.

By the time the capsule gets close to its intended orbit, all components of the crew escape systems will have been released into space. In this case, the capsule's onboard propulsion system, in the service module, will launch the crew module onto a sub-orbital trajectory if emergency evacuation is required.

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