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समाचार पत्रों से चयनित अंश
Newspapers Clippings

डीआरडीओ समुदाय को डीआरडीओ प्रौद्योगिकियों, रक्षा प्रौद्योगिकियों, रक्षा नीतियों, अंतर्राष्ट्रीय संबंधों और विज्ञान एवं प्रौद्योगिकी की नूतन जानकारी से अवगत कराने हेतु दैनिक सेवा

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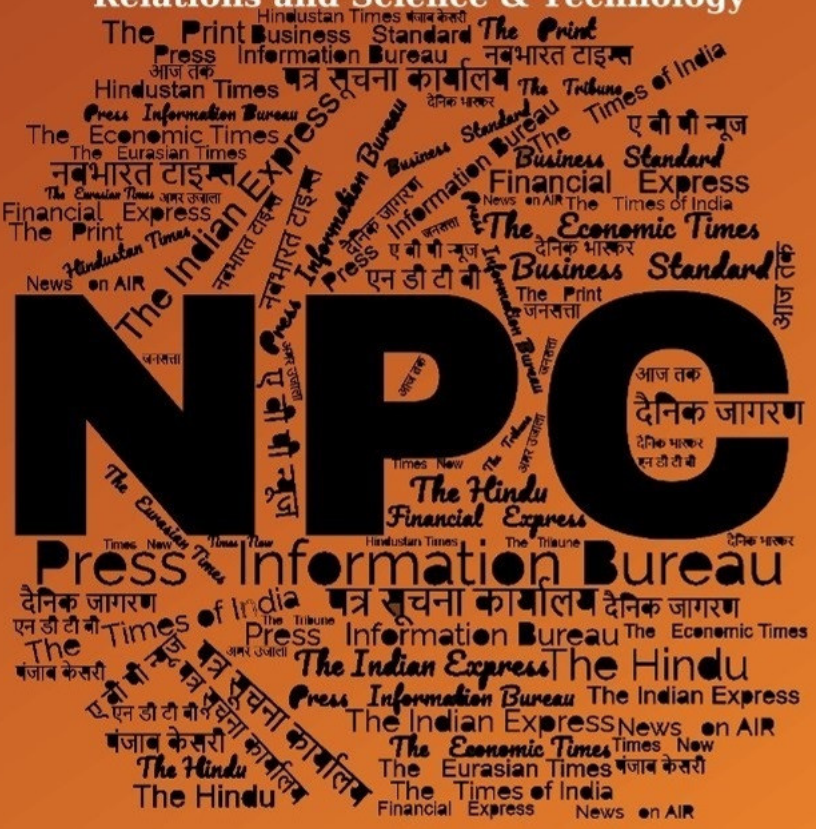

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DRDO News

National Seminar on “Advancing Defence Excellence through Quality Assurance” held at DRDO Bhawan

Source: Press Information Bureau, Dt. 18 Nov 2025

A National Seminar on the theme “Advancing Defence Excellence through Quality Assurance” was held at Dr D S Kothari Auditorium, DRDO Bhawan, New Delhi, on November 18, 2025 under the aegis of Department of Defence Production. It was jointly conducted by the Directorate General of Quality Assurance (DGQA) and the Society of Indian Defence Manufacturers (SIDM). Delivering the keynote address, Secretary (Defence Production) Shri Sanjeev Kumar emphasised the critical importance of quality in military equipment, noting that it directly impacts soldier safety and mission success. He urged Quality Assurance (QA) agencies to function as facilitators and enablers for the indigenous defence industry, thereby strengthening India’s march towards Aatmanirbharta in defence manufacturing.

Shri Sanjeev Kumar highlighted key initiatives, including the ongoing Industry 4.0 / QA 4.0 project being implemented in DPSUs to align with global best practices. He also outlined measures undertaken to streamline and rationalise QA requirements. Stressing the need for deeper trust between industry and QA agencies, he called for enhanced engagement, greater automation and simplified processes to ensure faster delivery of quality defence stores.

Shri N Manoharan, Director General, DGQA, outlined several initiatives of the ministry for facilitating Ease of Doing Business, including the revised Green Channel and Self-Certification policies. Lt Gen Amardeep Singh Aujla, MGS, IHQ (MoD), and Shri Rajinder Singh Bhatia, President, SIDM, also addressed the gathering, presenting the perspectives and expectations of key stakeholders across the defence ecosystem.

The seminar also featured multiple interactive sessions, including one chaired by Dr Garima Bhagat, Joint Secretary (Land Systems), which focused on strengthening Quality Assurance and Testing Infrastructure. The discussions were highly engaging and contributed significantly to

advancing the shared vision of defence excellence through robust and modernised quality assurance frameworks. The seminar witnessed the participation of more than 500 representatives from the Indian defence industry, Defence Public Sector Undertakings (DPSUs), senior officers from the Armed Forces and various government agencies.

https://www.pib.gov.in/PressReleasePage.aspx?PRID=2191469

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Defence News

भारतीय सेना का अरुणाचल में अभ्यास

Source: Punjab Kesari, Dt. 19 Nov 2025

ईटानगर, (पंजाब केसरी): भारतीय सेना ने अरुणाचल प्रदेश में नागरिक-सैन्य तैयारी अभ्यास किया, जिसका उद्देश्य सहयोग और प्रतिक्रिया क्षमताओं को मजबूत करना था। एक रक्षा अधिकारी ने मंगलवार को यह जानकारी दी। उन्होंने कहा कि नामसाई जिले के लोहितपुर और निचली दिबांग घाटी जिले के रोइंग के नागरिक प्रशासन के साथ निकट समन्वय में आयोजित 'अभ्यास समन्वय' में सुरक्षा प्रबंधन, संसाधन अनुकूलन और संयुक्त परिचालन तत्परता के लिए एकीकृत दृष्टिकोण विकसित करने पर ध्यान केंद्रित किया गया। रक्षा प्रवक्ता लेफ्टिनेंट कर्नल महेंद्र रावत ने बताया कि इस कार्यक्रम में भारतीय सेना की स्पीयर कोर, पुलिस, अर्धसैन्य बलों, नागरिक प्रशासन और अन्य आवश्यक एजेंसियों के प्रतिनिधि विस्तृत विचार-विमर्श और व्यावहारिक समन्वय गतिविधियों के लिए एकत्रित हुए। उन्होंने कहा कि ये सत्र तैयारियों को बढ़ाने, प्रतिक्रिया तंत्र को कारगर बनाने तथा पूरे क्षेत्र में महत्वपूर्ण बुनियादी ढांचे की सुरक्षा सुनिश्चित करने के लिए आयोजित किए गए थे। उन्होंने कहा कि यह भविष्य की आकस्मिकताओं के प्रबंधन के लिए सहयोगात्मक योजना और

फाइल फोटो

समग्र सरकारी दृष्टिकोण के प्रति भारतीय सेना की प्रतिबद्धता की भी पुष्टि करता है। रावत ने बताया, अभ्यास समन्वय नागरिक-सैन्य एकीकरण को मजबूत करने, क्षेत्र की सुरक्षा संरचना को बढ़ावा देने और विभिन्न क्षेत्रों में परिचालन प्रभावशीलता को बढ़ाने की दिशा में एक बड़ा कदम है।

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Army invites commercial bids for fast patrol boats, landing craft assault

Focus on operations in Sir Creek, Brahmaputra river basin, eastern Ladakh

Source: The Indian Express, Dt. 19 Nov 2025

OVER A year after it first projected the need to procure fast patrol boats and Landing Craft Assaults to be used for deployment in Sir Creek, the Brahmaputra river basin and in eastern Ladakh, the Army recently went a step further towards these acquisitions and floated two Request for Proposals (RFPs) from vendors for the purchase of the two platforms.

Last week, the Army invited technical and commercial proposals to procure eight Landing Craft Assaults for employment at sea as well as in shallow creek areas — the Brahmputra River, the Sunderban Delta of West Bengal and Eastern Ladakh. Similarly, last month, it floated an RFP for the purchase of six fast patrol boats that will be primarily used for small team insertion for surveillance and reconnaissance, patrolling and domination of waterbodies, deployment for intervention operation of high-speed craft, in support of direct action and operations in shallow and muddy waters.

The boats will help facilitate amphibious operations. Both should have a minimum 60% indigenous content and should have a service life of 10 years or 10,000 hours of operation, whichever is earlier, according to the two RFPs. The step forward in the procurement of the two platforms also assumes significance in the wake of the defence establishment's increased focus on the Sir Creek area. Last month, the Armed Forces kicked off a mega tri-service military exercise along the western border with Pakistan, including the desert and Sir Creek areas, called Trishul. Defence Minister Rajnath Singh, in September, had warned Pakistan and said that a route to Karachi passes through Sir Creek. He had said any aggression in the Sir Creek area would be met with a response that would "change both history and geography".

According to the RFP, the Landing Craft Assaults are to be deployed for the transportation of vehicles and materials, and for random boat patrol and limited search and rescue in the Sir Creek Area, the Brahmaputra River Basin and Eastern Ladakh. It is to be designed for high speed with good sea-keeping features and soft riding hull characteristics even at maximum speed, the RFP noted, adding that they would be designed to ensure the safety of occupants, reduction of operator fatigue whilst achieving the desired standards for rugged military use.

The RFP mandates them to have a minimum 60% indigenous content and should be able to achieve a maximum speed of 20 knots. The boats should be able to accommodate 35 troops or one Tata Storme/equivalent class vehicle and 12 men with a total weight of 3,990 kg, as well as ammunition, troops' equipment, and a crew of five with a total payload of Rs5,255 kg.

The Landing Craft Assaults is designed to ensure the safety of occupants, reduce operator fatigue while achieving the desired standards for rugged military use. The fast patrol boats, on the other hand, would be employed to carry out patrolling and surveillance of conflict zones, aside from its other designated duties. The fast patrol boat should have endurance of at least six hours of continuous operation without refuelling at the speed of 25-30 knots with eight people on board, including crew. They will have a capacity to carry eight people on board, including crew, with a total payload of 1,000 kg, the RFP states.

The significance of Sir Creek

Sir Creek, originally Ban Ganga, is a fluctuating 96-km tidal estuary along the India-Pakistan border. To its east lies the Rann of Kutch in Gujarat, and to its west, the province of Sindh in Pakistan. It has long been at the centre of an unresolved border dispute between India and Pakistan. The region is strategically and economically important for both the countries as it is said to hold untapped oil and gas reserves.

https://indianexpress.com/article/india/army-invites-commercial-bids-for-fast-patrol-boats-landing-craft-assault-focus-on-operations-in-sir-creek-brahmaputra-river-basin-eastern-ladakh-10373304/

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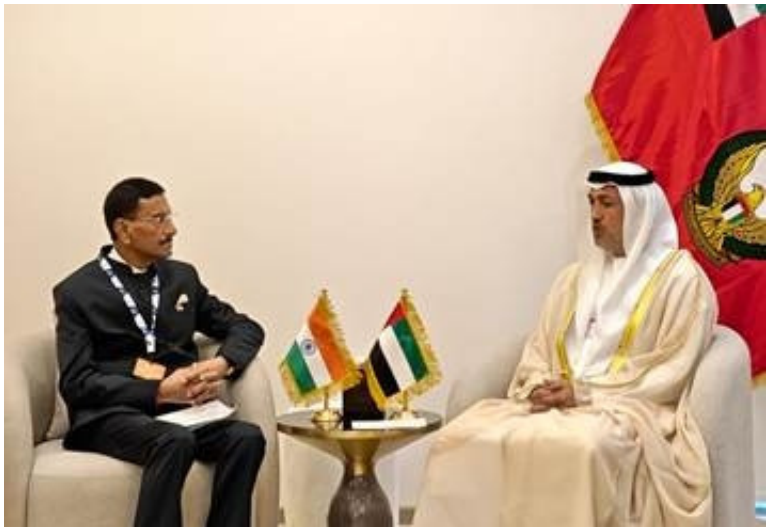
Raksha Rajya Mantri chairs Industry Roundtable on Day-2 of his Dubai visit

Source: Press Information Bureau, Dt. 18 Nov 2025

Raksha Rajya Mantri Shri Sanjay Seth chaired an Industry Roundtable on the theme 'Defence Technology Collaboration and Manufacturing in India' on the second day of his visit to Dubai on November 18, 2025. A total of 50 global and Indian industries participated in the event. In his address, Raksha Rajya Mantri highlighted the strength of Indian defence manufacturing capabilities and expanding defence ecosystem. He encouraged the global and Indian companies to explore joint ventures and emerging opportunities for collaborations in India.



On the first day of his visit, Raksha Rajya Mantri held a bilateral meeting with his UAE counterpart Mr Mohammed Mubarak Al Mazrouei on the sidelines of the Dubai Air Show. He emphasised the importance of interaction between the two sides through institutional mechanisms, participation in defence exhibitions and training cooperation. He urged the two sides to explore joint research and co-development & co-production in the defence sector.

Shri Sanjay Seth, later, inaugurated the India Pavilion where DPSUs and private industries like Hindustan Aeronautics Limited (HAL), DRDO, Corel Technologies, Dantal Hydraulics, Image Synergy Ekxplor, SFO Technologies and several defence start-ups have put up their stalls. He visited the stalls and was apprised of the modern technology and equipment on display.

Raksha Rajya Mantri also witnessed the performance of India Air Force's Surya Kiran Aerobatic team and Tejas in the Air Show. Raksha Rajya Mantri also interacted with the diverse Indian community of UAE in Dubai. He commended the important contribution made by them as brand ambassadors of India. The Dubai Air Show is a biennial event held in UAE. This year, over 1,500 leading exhibitors and more than 1.48 lakh industry professionals from 150 countries are participating in the event. The continued high-level participation from the Indian side demonstrates the growing strength of India-UAE bilateral relations.

https://www.pib.gov.in/PressReleasePage.aspx?PRID=2191433

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India-Germany High Defence Committee meeting emphasises strengthening defence partnership, industry collaboration

Source: The Tribune, Dt. 19 Nov 2025

The India-Germany High Defence Committee meeting on Tuesday underscored the need for a closer defence partnership and deeper industry collaboration between the two nations, particularly in the area of defence technology, as per an official release.

During the discussions co-chaired by Defence Secretary Rajesh Kumar Singh and State Secretary of the German Ministry of Defence, Jens Plotner, the two sides explored a wide range of bilateral security and defence issues, including priority areas for the co-development and co-production of defence equipment. The co-chairs reiterated their shared commitment to enhancing military-to-military cooperation, marking defence ties as a vital pillar of the Strategic Partnership between India and Germany.

The meeting also provided an opportunity to discuss the regional security environment and future collaborations, including the institutionalisation of joint military exercises. Germany's participation in the upcoming TARANG SHAKTI (multinational air combat exercise) and MILAN (multinational naval exercise) in 2026 was confirmed, further deepening defence ties between the two countries.

India's role as the 'First Responder' and 'Net Security Provider' for countries in the Indian Ocean Region (IOR) was a key point of discussion. Defence Secretary Rajesh Kumar Singh informed the

German delegation about India's vision of MAHASAGAR (Mutual and Holistic Advancement of Security and Growth Across Regions), which guides India's approach to regional security. He outlined the country's ongoing work with IOR nations on maritime security, defence cooperation, capacity building, and humanitarian assistance, the release stated.

The German side acknowledged India's critical role in the region and recognised the country's leadership in fostering stability and security in the IOR. A significant portion of the meeting was dedicated to the importance of closer industry collaboration between India and Germany. According to the release, the two sides emphasised connecting their respective defence industries, particularly to advance niche technologies. Both leaders agreed that such collaboration would benefit both countries in developing cutting-edge defence solutions.

India and Germany are celebrating 25 years of their 'Strategic Partnership' this year, and the discussions reaffirmed the mutual trust and shared values that underpin their long-standing relationship. With an increased focus on strengthening defence and security cooperation, both nations are poised to enhance their partnership in the years ahead. The meeting concluded with a shared commitment to further enhance bilateral defence ties, ensuring greater regional stability and security through ongoing collaboration and joint initiatives.

https://www.tribuneindia.com/news/world/india-germany-high-defence-committee-meeting-emphasises-strengthening-defence-partnership-industry-collaboration/

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Mitra Shakti-2025: Troops train in Obstacle Course, Urban Combat and IED response

Source: The Statesman, Dt. 19 Nov 2025

The Battle Obstacle Course was conducted during the ongoing Joint Military “Exercise Mitra Shakti-2025” between India and Sri Lanka, at Foreign Training Node, Belagavi, Karnataka, today. As part of Joint exercise, soldiers from both contingents participated with enthusiasm, demonstrating endurance, agility and overall combat preparedness.

The Indian contingent, of 170 personnel, is being represented mainly by troops from the RAJPUT Regiment. The Sri Lankan side is being represented by 135 personnel, mainly by troops from the GAJABA Regiment. 20 personnel from Indian Air Force and 10 personnel from Sri Lankan Air Force are also participating in the exercise. This was followed by a comprehensive lecture and demonstration on Fighting in Built-Up Areas (FIBUA).

The session showcased the use of drones for reconnaissance, light specialist and all-terrain vehicles for rapid induction, and robotic mules for room-to-room reconnaissance. A slithering practice was also conducted aş part of the Joint Exercise. Subsequently, a detailed lecture and demonstration on Improvised Explosive Devices (IEDs) was conducted, covering route-clearance drills, actions after detecting IEDs, preparation of charges, and Render Safe Procedures.

https://www.thestatesman.com/india/mitra-shakti-2025-troops-train-in-obstacle-course-urban-combat-and-ied-response-1503513949.html

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The Threat of Space Terrorism is real, but we're ill-prepared to combat it

Source: The Statesman, Dt. 19 Nov 2025

ANNA MARIE BRENNAN

As satellite technology surges ahead and space becomes increasingly accessible to private and state actors alike, the new and unsettling threat of space terrorism looms above Earth's atmosphere.

Once the domain of science fiction, the idea of terrorist activity in outer space is now a growing concern among experts.

The democratisation of space has not only opened the door to innovation but also to vulnerability. The current legal frameworks may not be equipped to respond.

Over the past decade, the proliferation of commercial space ventures and the reduced costs of developing satellite technology have dramatically lowered the barriers to entry for 'spacefaring".

This shift has empowered not only governments but also private corporations and, alarmingly, non-state actors.

Groups and individuals once considered insignificant in the realm of space security are now capable of launching cyber attacks on satellites and ground stations.

In March 2022, Network Battalion (NB65), a group affiliated with Anonymous, allegedly hacked the Russian civilian space agency Roscosmos in protest of Russia's invasion of Ukraine.

The group claimed control over several satellites, prompting Roscosmos chief Dmitry Rogozin to declare that disabling another country's satellites could be considered a 'casus belli' – a cause for war.

While causing minimal damage, the incident underscores a broader trend: the increasing capability of non-state actors to disrupt space infrastructure. It also raises urgent questions about accountability, jurisdiction and the adequacy of international law.

Legal vacuum in the cosmos

International space law, anchored by the 1967 Outer Space Treaty, was crafted in an era when only a handful of states had access to orbit.

The treaty emphasises peaceful exploration and cooperation, stating that activities in space must align with the UN Charter and promote international peace. However, it lacks explicit provisions addressing terrorism or the actions of non-state entities.

Article VI of the treaty does hold states responsible for national activities in space, whether conducted by government agencies or private entities. But it fails to define 'non-governmental entities' or outline mechanisms for enforcement.

This ambiguity leaves a gaping hole in the legal architecture, especially as private companies increasingly take on roles once reserved for national space agencies.

The Liability Convention of 1972 offers some recourse for damage caused by space objects. But it too focuses on state actors and does not contemplate ideologically motivated attacks by rogue groups or individuals.

One of the most pressing challenges in addressing space terrorism is the lack of a coherent definition.

Traditional definitions of terrorism emphasise the intent to coerce a state into action or inaction through violence. But how does this translate to the orbital realm?

Some experts propose defining space terrorism as ideologically motivated destruction targeting the space industry. Their definition captures the economic dimension but omits the national security aspects unique to space.

Without a comprehensive definition, acts ranging from cyber intrusions to physical attacks on satellites risk being misclassified or overlooked entirely.

Historical precedents and emerging threats

Though under-reported, space terrorism is not a new phenomenon. In 1999, the UK's Skynet military satellite was allegedly targeted by hackers demanding ransom.

While the Ministry of Defence remained tight-lipped, reports suggested communication channels were compromised, hinting at a sophisticated breach of national security.

More recently, Russia has been accused of persistently jamming UK satellites. This tactic disrupts communications and poses serious risks to both civilian and military operations.

These incidents have intensified concern that satellite attacks – whether through hacking, jamming, or physical destruction – will become more frequent and sophisticated in the coming years.

As space systems become more integrated with Earth-based infrastructure, supporting everything from telecommunications to navigation, the stakes grow exponentially. Experts warn the next decade could see a surge in ideologically motivated attacks on satellites, with devastating consequences for global security and commerce.

The UN Office for Outer Space Affairs (UNOOSA) has only recently begun to address space security threats. But without a dedicated legal framework, efforts remain fragmented.

One avenue would be to develop transparency and confidence-building measures to cultivate trust and cooperation among state and non-state actors. But data-sharing agreements remain difficult to negotiate due to national security concerns.

Space terrorism is no longer a theoretical concern. It is a tangible threat with real-world implications. As the line between state and non-state actors blurs, and as private companies take on greater roles in space exploration, the need for a robust, adaptable legal framework becomes critical.

The question is no longer whether space terrorism occurs, but how the international community responds when it does. Without clear rules, accountability mechanisms, and cooperative strategies, humanity risks turning the final frontier into the next battlefield.

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THIS ARTICLE WAS PUBLISHED ON WWW.THECONVERSATION.COM.

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Science & Technology News

Learnings from my ISS mission being used for Gaganyaan planning: Shubanshu Shukla

Source: The Times of India, Dt. 19 Nov 2025

India's celebrated astronaut Group Captain Shubhanshu Shukla said with a smile on Tuesday that the "homework given by PM Narendra Modi 'pura hua hai, chal raha hai, aur badta hi ja raha hai' (has been completed, yet it is still going on as the scope of the homework is increasing by the day)". On a serious note, Shux said that results of the seven Isro-devised microgravity experiments conducted by him on ISS during his 18-day stay there are being analysed after samples of his work have come back to Earth in batches, and that learnings from his ISS mission are being used for Gaganyaan planning.

Speaking on the sidelines of India International Space Conclave organised by Indian Space Association (ISpA) here, Shukla told TOI, "For me, bigger learning from the seven experiments has been how to conduct these tests in space because it is easy to conduct such experiments on Earth, but difficult to do them there. Whatever experience I gained on ISS, we have made a template of that. We are now comparing what we were doing earlier (in Gaganyaan programme) with what is happening now, to identify the gaps."

On progress on India's spaceflight mission, Shux said, "Gaganyaan is a developmental programme — training and development are happening together. As per my knowledge, Gaganyaan-G1 (uncrewed mission) will be conducted early next year and Gaganyaan-G2 (uncrewed mission with humanoid Vyommitra) will be in early 2027."

Shux said he has shared his ISS experiences with three other Indian astronaut-candidates — Prashanth Balakrishnan Nair, Ajit Krishnan and Angad Pratap — as they have been training together. Shux, who is also a seasoned IAF test pilot, said, "As part of our training, I have to go back to flying fighter jets, which I will do in December."

He said, "When you cross the boundary of space (Karman line), you are given a number, and I was No. 634, which is not a top number to remember". But when I came back, kids told me: "We didn't know that there was an ISS in space before you went. We cared because you were there."

Urging the youth to dream big, he added, “We are in the golden age as far as space exploration is concerned. I want all youngsters to be focused and contribute to the space sector actively. Every boy or girl of India who dreams of becoming an astronaut can realise their dream in today's India. We have established extremely ambitious goals — Bharatiya Antariksh Station by 2035, human landing on Moon by 2040 and Viksit Bharat by 2047 — but for us to achieve that, all of us have to be active participants. Sky was never the limit. Not for me, not for you and not for Bharat.”

Space minister Jitendra Singh, who was the chief guest at the conference, said, “Space reforms in the last five years have been a turning point. Earlier, our space economy was dispersed and was not even considered a part of the economy. Today, the Indian space economy is worth $8 billion and the pace at which it is moving, the projection is that in the next 10 years, it will go up to $44-45 billion. In times to come, space is going to be an important contributor to the growth of India's economy as we move up the ranks.”

https://timesofindia.indiatimes.com/india/learnings-from-my-iss-mission-being-used-for-gaganyaan-planning-shubhanshu-shukla/articleshow/125421306.cms

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Indian scientists helped rewrite a 50-Year-Old biological rule

Source: Press Information Bureau, Dt. 18 Nov 2025

A new study overturns a central textbook model of bacterial gene regulation and unveils new paths for understanding bacterial gene regulation and its evolution. This can help in designing better antibiotics or regulatory inhibitors that block infection mechanisms.

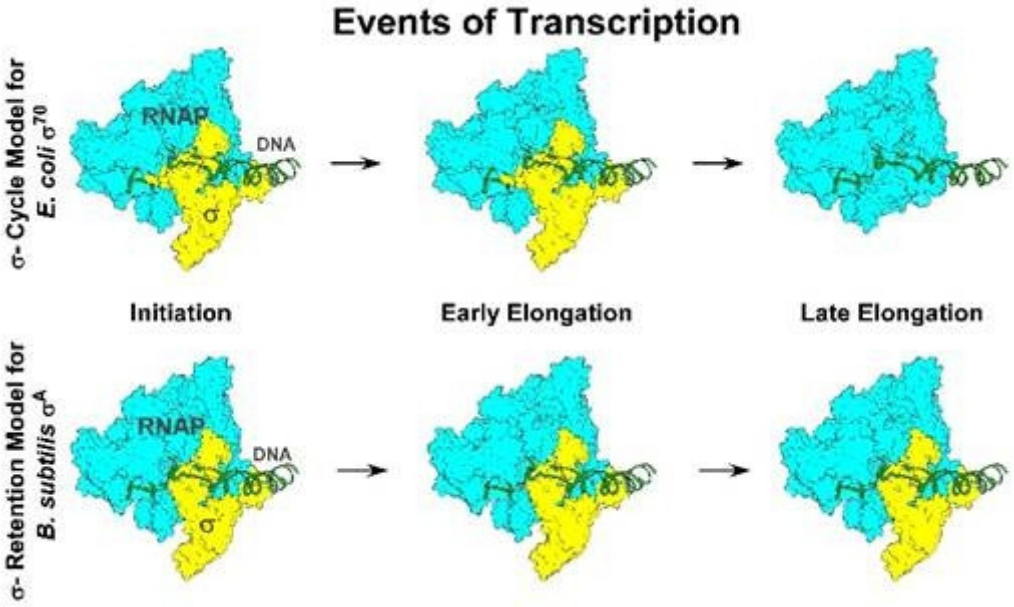
The understanding of how bacteria control their genes, affects our concept of everything from how microbes respond to stress to how we design antibiotics that stop them in their tracks. If the basic mechanics of gene regulation differ between species, it could mean new strategies for fighting infections, or even for harnessing bacteria to produce useful compounds. For nearly 50 years, biology has related the story of how bacteria turn their genes on with the help of the so-called “σ (sigma) cycle” – factors that bind RNA polymerase to initiate transcription and then dissociate to allow elongation. This concept was built largely on observations of bacterial strain E. coli σ70.

However, Researchers from the Bose Institute, an autonomous institute of the Department of Science and Technology (DST) and Rutgers University reveal that the cycle is not a universal phenomenon. In a study published in the Proceedings of the National Academy of Sciences (PNAS) they have reported that, contrary to decades of scientific belief, the principal transcription initiation factor in Bacillus subtilis—σA—and a modified version of the Escherichia coli σ70 factor remain bound to RNA polymerase throughout transcription, rather than being released after initiation.

“Our work shows that in Bacillus subtilis, the σA factor stays attached to RNA polymerase all the way through the transcription process,” said Dr. Jayanta Mukhopadhyay, corresponding author from the Bose Institute. “This fundamentally changes how we think about bacterial transcription and gene regulation,” he added.

Using a combination of modern techniques like biochemical assays, chromatin immunoprecipitation, and fluorescence-based imaging — the researchers watched the sigma factor’s behaviour in real time. They found that Bacillus subtilis σA and an E. coli σ70 variant

lacking a part called 1.1 remain stably associated with transcription complexes. This is in stark contrast to full-length E. coli σ70, which is released stochastically during elongation.



“These findings provide compelling evidence that the long-accepted σ cycle does not apply to all bacteria,” added co-author Aniruddha Tewari of Bose Institute. “It opens new avenues for understanding bacterial gene regulation and its evolution.” The discovery has broad implications for microbiology, potentially influencing how researchers approach bacterial physiology, stress response, and the development of antibiotics targeting transcription.

By controlling gene regulation, scientists can design microorganisms that produce biofuels, biodegradable plastics, or therapeutic compounds efficiently. Besides, Dr Tewary and Dr Mukhopadhyay, Shreya Sengupta, Soumya Mukherjee, Nilanjana Hazra from Bose Institute, Kolkata and Yon W. Ebright, Richard H. Ebright from Rutgers University, USA contributed in the study.

Publication link: doi:10.1073/pnas. 2503801122

https://www.pib.gov.in/PressReleasePage.aspx?PRID=2191262

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Breakthrough in rare-earth magnetism promises more efficient quantum technologies

Source: Press Information Bureau, Dt. 18 Nov 2025

Scientists have discovered a new kind of magnetism in a rare-earth compound that can be used in quantum and spintronic technologies. It envisions a new class of materials that can be tuned to design faster, more energy-efficient magnetic and quantum devices.

Rare-earth materials play a crucial role in modern technology, powering everything from electric vehicles and smartphones to wind turbines and defence systems. Among these, neodymium-based permanent magnets are indispensable due to their strong magnetic performance. However, until now, the magnetism in such materials was largely understood as being driven by the electron’s spin, the intrinsic property responsible for conventional ferromagnetism.

The study led by Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), for the first time, demonstrated that single-crystalline grown thin films of neodymium nitride (NdN), exhibit ferromagnetism arising from the orbital angular momentum of electrons, marking a fundamental departure from conventional magnetic behaviour.

This landmark finding, published recently in ACS Nano (American Chemical Society), opens new possibilities in the emerging field of “orbitronics”, which aims to harness the orbital motion of electrons for future quantum and spintronic technologies.

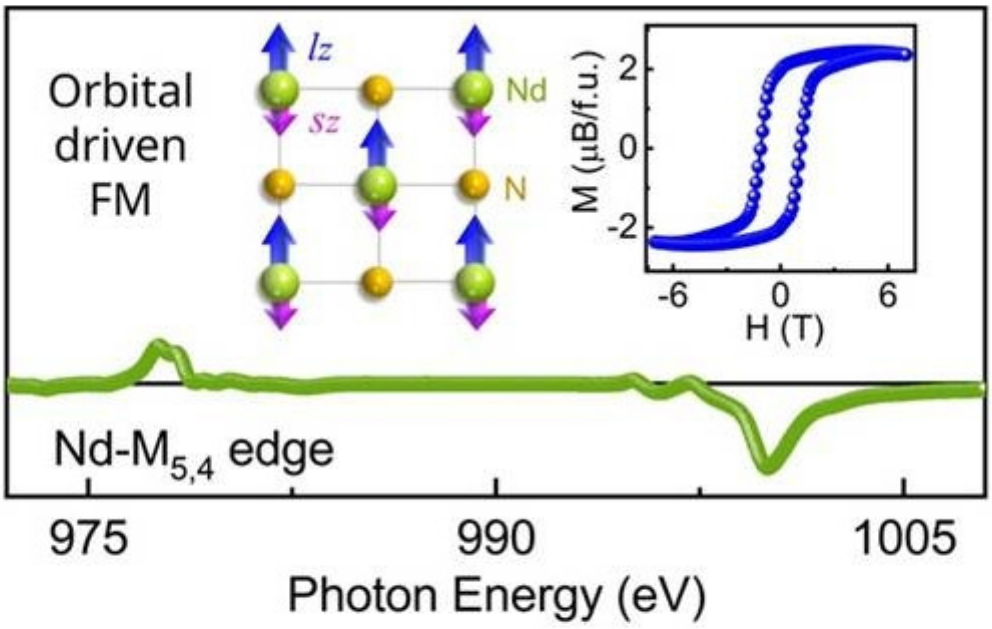

Fig: *NdN rock-salt crystal structure highlighting both spin and orbital angular momentum contributing significantly to magnetism, Magnetization-vs.-applied magnetic field measurement showing ferromagnetic hysteresis loop of an NdN thin film. X-ray magnetic circular dichroism at the Nd-$M_{5,4}$ edges, demonstrating an orbital-driven net magnetic moment in NdN.*

The team led by Prof. Bivas Saha from the JNCASR, Bengaluru, an autonomous institute of the Department of Science and Technology (DST) employed advanced thin-film growth and characterization techniques. This was complemented by electronic structure analysis, to reveal how crystal symmetry, electronic hybridization, and rare-earth orbital states together stabilize this unique orbital-driven magnetism.

“This discovery represents a paradigm shift in our understanding of magnetism,” said Prof. Bivas Saha, the corresponding author. “By controlling the orbital degrees of freedom, we can envision a new class of materials where both spin and orbital moments can be tuned to design faster, more energy-efficient magnetic and quantum devices.”

The study also highlights the magnetic anisotropy and electronic band structure of NdN, providing a fundamental framework for designing materials with strong orbital contributions to magnetism. The concept of orbitronics, much like spintronics, could pave the way for next-generation information and memory technologies that go beyond the limits of spin-based devices.

The discovery is particularly timely as global competition over rare-earth materials intensifies. Neodymium, a key component in high-performance magnets, is among the most strategic materials in the clean-energy and defence sectors. India, with nearly 8% of the world’s rare-earth reserves, is well positioned to contribute to this critical area of materials innovation.

In addition to JNCASR, researchers from IISER Thiruvananthapuram and the Raja Ramanna Centre for Advanced Technology, Indore, as well as from DESY (Germany) and ALBA (Spain), contributed to this collaborative effort. The other researchers involved include Renuka Karanje, Anupam Bera, Sourav Rudra, Debmalya Mukhopadhyay, Souvik Banerjee, Manisha Bansal, Kiran Baraik, Sourav Chowdhury, Weibin Li, Manuel Valvidares and Tuhin Maity.

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