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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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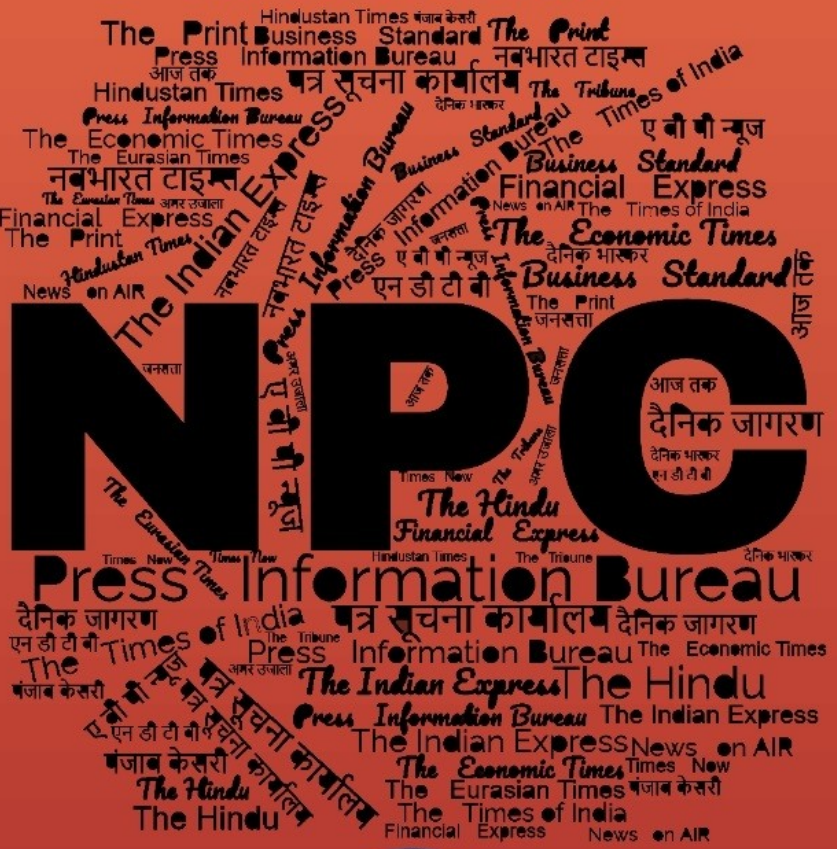

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CONTENTS

DRDO News

Operation Sindoor was also a DRDO and Indian industry success story

Source: The Week, Dt. 18 May 2025,
URL: https://www.theweek.in/theweek/cover/2025/05/17/operation-sindoor-was-also-a-drdo-and-indian-industry-success-story.html

India watched in awe as drones were shot out of the night skies over many of its cities and photographic evidence of precision strikes across the length and breadth of Pakistan emerged. Many never believed we were capable of this modern-age warfare. We not only defended our airspace but also penetrated Pakistan's much touted air defence network, striking at the heart of its terror network and military installations with telling effect.

Operation Sindoor vindicates the need for and indeed the success of atmanirbharta in defence. It was one of the pillars of the Atmanirbhar Bharat initiative and naysayers have been firmly silenced. And BrahMos and Akash have become household terms.

BrahMos, developed and produced with Russian collaboration, has a range of 280km, within Missile Technology Control Regime limit of 300km. Its range could be extended to 400km, and to 800km, if required. BrahMos delivers a massive payload of up to 250kg of explosives with a circular error probability of 10 metres (if the BrahMos missile was fired multiple times, it would hit within 10 metre of the target in 80 per cent of the attempts). A precision strike would thus cause huge destruction. It travels at Mach 3 (thrice the speed of sound), can be launched from land, sea or air and follows random trajectories (sometimes 2 to 5 metres above the earth or water surface) making it difficult to detect, much less intercept. The destruction seen on the runway at the Rahim Yar Khan airfield and the radar near Lahore was most likely caused by BrahMos strikes.

The Akash air defence system showcases atmanirbharta in defence in its truest sense. Its development is fully indigenous and components almost so. It has a range of 25km to 45km and intercepts targets 20km high. Its 60kg warheads explode with proximity fuses, fragmenting to assure destruction on reaching even the vicinity of the intended targets in the air. The sophisticated, DRDO-developed Rajendra radar system detects and tracks 64 targets and guides eight missiles simultaneously. The high kill rate that was on display during the days of hostilities proves Akash's efficacy in battle against drones and aircraft.

Nagastra-1 is the newest inductee into the atmanirbharta hall of fame. These loitering munitions or kamikaze drones hover over targets and attack at the opportune moment. Nagastra, made by Nagpur-headquartered Solar Industries, is 80 per cent indigenous. It can be equipped with cameras, has a range of 30km and a payload capacity of up to 1.5kg (Israeli made SkyStrikers have a range of 2km and 5kg payload capacity). The Nagastra has a recovery mechanism, including a parachute system, in case a target is not detected or a mission is aborted.

The atmanirbharta policy boosted self-reliance, but not 100 per cent self sufficiency, yet, as is evident from the minor levels of imported content. India will achieve niche capabilities such as advanced chips in due course, but cannot be held back from the development of advanced weapon systems for want of these. India's expenditure on defence imports has dropped from 46 per cent of overall procurement to 36 per cent in recent years. It is set to drop drastically in the next five years.

Meanwhile, defence exports have grown steadily. By 2023, exports hit $1.9 billion, a 240 per cent rise compared with 2019. It then grew to $2.54 billion by end of FY24. India has set a defence production target of $25 billion, with exports up to $5 billion in 2025 with the aim to raise it to $6.02 billion by 2028-29. We may now surpass it if we play to our strengths. In the wake of the recent hostilities, these proven weapons systems are likely to be sought by friendly foreign countries.

Atmanibharta in defence is here to stay. Its pace will now receive a boost. Incentives to local developers and manufacturers, particularly MSMEs, is the way forward for the government. Industry players, who till now felt that minimum order quantities by the Indian armed forces was the only way to manage their bottom lines, can capitalise on the battle worthiness that was on show to improve export figures.

The DRDO for its part needs to focus on fundamental research and speedily off-load its technologies to private industry players. Operation Sindoor was as much a DRDO and Indian industry success as it was a military success.

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अमेरिका से खरीदा जाने वाला इलेक्ट्रोलाइट फ्यूल अब IIT BHU में होगा तैयार, पनडुब्बी के बिजली उत्पादन में करेगा मदद

Source: ETV Bharat, Dt. 16 May 2025,
URL: https://www.etvbharat.com/hi/!state/up-varanasi-iit-bhu-electrolyte-fuel-being-prepared-for-naval-submarines-will-help-power-generation-uttar-pradesh-news-ups25051603674

आईआईटी बीएचयू में नौसेना के पनडुब्बियों के लिए इलेक्ट्रोलाइट फ्यूल तैयार किया गया है, जो पनडुब्बी के बिजली उत्पादन में न सिर्फ मदद करेगा, बल्कि भारत के आत्मनिर्भर बनने के सपने को भी मजबूत करेगा. इसे DRDO के जरिए IIT BHU के तहत विकसित किया गया है. इसके बनने से अब पनडुब्बियों को पवार बैकअप के लिए परेशान नहीं होना पड़ेगा.

सेना की पनडुब्बियों को पानी के भीतर लंबे समय तक रहना होता है, जिसके लिए पावर बैकअप जरूरी होता है. पहले पनडुब्बियों में बैटरी चार्ज करके रखी जाती थी, लेकिन कभी–कभी बैटरी डिस्चार्ज होने पर पनडुब्बियों को पानी के ऊपर आना पड़ता था. अब, इस समस्या का समाधान आईआईटी बीएचयू ने ढूंढ लिया है. उन्होंने एक नया इलेक्ट्रोलाइट फ्यूल तैयार किया है, इसे लगाने पर बस इलेक्ट्रोलाइट फ्यूल डालने से पावर सप्लाई शुरू हो जाएगी. खास बात ये है कि पहले यह फ्यूल अमेरिका से मंगाया जाता था, लेकिन अब इसे भारत में ही तैयार किया जा रहा है.

DRDO की तरफ से 2 साल पहले मिला था प्रोजेक्ट : फ्यूल को तैयार करने वाले IIT बीएचयू के प्रोफेसर प्रभाकर सिंह ने बताया कि, अब तक इलेक्ट्रोलाइट के तौर पर नेफ़ियान इलेक्ट्रोलाइट मेंब्रेन का प्रयोग किया जाता रहा है, इसे अमेरिका से मंगाया जाता था, लेकिन अब हमने इसके विकल्प के रूप में इलेक्ट्रोलाइट फ्यूल को तैयार किया है. उन्होंने बताया कि इसे तैयार करने के लिए DRDO की तरफ से हमें 2 साल पहले प्रोजेक्ट दिया गया था. 2 साल के शोध के बाद हमें कामयाबी मिली है. हमने अपने शोध में मेटल ऑक्साइड फ्रेमवर्क पर इलेक्ट्रोलाइट तैयार किया है, जिसकी प्रॉपर्टी नेफ़ियान इलेक्ट्रोलाइट से बेहतर है. नेफ़ियान फ्यूल 100 डिग्री के टेम्परेचर पर काम करना बंद कर देता है, लेकिन अब वह 140 डिग्री में भी अच्छी प्रोडक्टिविटी देगा.

मेक इन इंडिया को मिलेगा बढ़ावा : प्रोफेसर प्रभाकर ने बताया कि उन्होंने मेटल ऑक्साइड फ्रेमवर्क का प्रोटोटाइप बनाया है, जिसमें हाइड्रोजन और ऑक्सीजन को फ्यूल के तौर पर इस्तेमाल किया जाता है. इसके मुख्य पार्ट्स इलेक्ट्रोड और इलेक्ट्रोलाइट हैं. इस फ्यूल से पनडुब्बियों की पानी में रहने की क्षमता बढ़ेगी और भारत में उत्पादन की लागत पर भी असर पड़ेगा.

प्रोफेसर ने बताया कि, हमें अब पावर बैकअप के लिए दूसरों पर निर्भर नहीं होना होगा. पहले चरण में हमने इस फ्यूल को बनाया है जिसे लैब में ट्राई करने के बाद DRDO पनडुब्बियों में प्रयोग करेगा और इसे कमर्शियल स्तर पर लाने की भी तैयारी करेगा.

ग्रीन एनर्जी का है बेहतर विकल्प : प्रोफेसर प्रभाकर ने बताया कि, हम जल्द ही इस क्षेत्र में एक इंडिपेंडेंट पावर यूनिट बना लेंगे, जो कि पनडुब्बी में लगाया जा सके. अगले कुछ सालों में इस क्षेत्र में महारत हासिल कर लेंगे. नेक्स्ट फेज में इस रिसर्च को और मॉडर्न तरीके से तैयार करेंगे और इसकी रियल टाइम टेस्टिंग अपने लैब में करेंगे. उन्होंने बताया कि, पनडुब्बी के अलावा इलेक्ट्रोलाइट फ्यूल का प्रयोग इलेक्ट्रिक व्हीकल चलाने में भी किया जा सकता है. यह न सिर्फ ग्रीन ऊर्जा को बढ़ावा देगा बल्कि पर्यावरण को भी सुरक्षित रखेगा. क्योंकि इसमें किसी भी तरीके के अनवांटेड केमिकल का प्रयोग नहीं किया गया है, बल्कि इसमें ड्रिंकिंग वाटर का प्रयोग किया गया है जो प्रयोग के दौरान भी पीने योग्य होता है.

अब तक ऐसे मिलता है पावर बैकअप : पनडुब्बियों में इलेक्ट्रिसिटी के लिए बैटरी चार्जर, यूएसबी का प्रयोग किया जाता रहा है जो कि पहले से ही चार्ज करके पनडुब्बियों में रखी जाती हैं और डिस्चार्ज होने के बाद पुनः उनको बाहर लाकर चार्ज करना पड़ता है. साथ ही पनडुब्बियों में पावर बैकअप के रूप में नेफियान फ्यूल का प्रयोग किया जाता रहा है, जो कि विदेश से मंगाए जाते हैं. लेकिन अब आईआईटी बीएचयू में तैयार इलेक्ट्रोलाइट फ्यूल के जरिए पनडुब्बियों को पावर बैकअप मिलेगा.

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The ex-DRDO scientist who spent 34 years of his career building ‘Akash’ missile system

Source: The Hindu, Dt. 17 May 2025,
URL: https://www.thehindu.com/news/national/telangana/this-ex-drdo-scientist-spent-his-entire-career-building-akash-missile-system/article69583175.ece

It is no secret that Hyderabad is the base for key DRDO projects and many products developed here have played a stellar role in the recent confrontation with Pakistan during Operation Sindoor. One such was the short range surface-to-air missile ‘Akash’ that turned out to be the bulwark, along with other weapons systems, against the spree of drones and missiles fired from across the border during the tense period.

"Akash, which was indigenously built from scratch, was used in combat zone for the first time and has proved to be robust and effective. The automated missile system caught the other countries by surprise," exults former project director Gaddamanugu Chandramouli, who spent his entire 34 years of career in its development.

The missile, fired from mobile platforms, can neutralise a variety of targets simultaneously, including fighter jets, choppers, UAVs, subsonic cruise missiles, smart bombs with supersonic speed and automated air defence functions irrespective of the altitude or size, says the ex- DRDO's outstanding scientist.

Hailing from Madhira (Khammam, Telangana), Mr.Chandramouli, a mechanical engineering graduate from NIT Warangal and M. Tech. from IIT Delhi, was part of the maiden team of three members, when noted scientist Prahalad Rama Rao, was entrusted with making the Akash missile system by former President A.P. J. Abdul Kalam while heading the Integrated Guided Missile Development Programme.

"Kalam used to say 'first develop technology', the rest will follow. From design to ground based radar system, propulsion and weapon head, it was a 14-year work, throughout the week in the lab. We faced many failures at various stages. But to develop and supply at least something to our armed forces egged us on," explains Mr. Chandramouli.

"Very few were ready to believe that we will come up with a potent missile that would become the mainstay for our country's defence system. There was cynicism all over. We were put up to scrutiny at every stage, yet we were calm, patient and persevering," he recalls.

As a core member of Project Akash in DRDL-DRDO, the scientist led many teams from various organisations contributing towards successful accomplishment of design, development, flight testing and user trials since inception in 1983 till superannuation in 2018.

The first successful flight was in 1994 and final evaluation trials in 2006-07 before Akash was formally inducted both in the Indian Army (2015) and Indian Air Force (2015) under his leadership. Thus, India could become only the second country after Russia to have the capability to design, develop and produce solid ramjet propulsion based supersonic missiles.

"Kalam and other leaders created an ecosystem, where there were no egos, only goals. I learned many things from Kalam, Prahlada Rama Rao, R.R. Panyam, G.N. Rao, Ajit Chaudhary and many others, helping me execute this mega project. There was team work, transparency, support and motivation among us to surmount hurdles," he avers.

After becoming the project director in 2011, Mr. Chandramouli streamlined production, delivery and induction of Akash into the armed forces, coordinating with 13 DRDO labs, nine defence production units and five ordnance factories to transfer complex technologies to local industries for production. The scientist is also getting ready with a book chronicling Project Akash.

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Defence News

Defence Strategic: National/International

India's fight against terrorism is now part of national defence doctrine, we will root out this hybrid & proxy warfare: Raksha Mantri at Bhuj Air Force Station

Source: Press Information Bureau, Dt. 16 May 2025,
URL: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2129052

"India's fight against terrorism is not just a matter of security, it has now become a part of the national defence doctrine, and we will root out this hybrid & proxy warfare," said Raksha Mantri Shri Rajnath Singh while addressing the air warriors at the Bhuj Air Force Station in Gujarat on May 16, 2025. He asserted that the current ceasefire means that India has kept Pakistan on probation on the basis of its behavior. If the behavior improves, it is fine; but if there is any disturbance, harshest punishment will be given, he said.

Raksha Mantri made it clear that Operation Sindoor is not yet over. "Our actions were just a trailer, we will show the full picture, if need be. 'Attacking and eliminating terrorism' is the new normal of New India," he said.

Stating that Pakistan has again started to rebuild its terror infrastructure destroyed by India, Shri Rajnath Singh called upon the International Monetary Fund (IMF) to reconsider its one-billion-dollar assistance to Islamabad and refrain from providing any support in future as well. "Pakistan will spend the tax collected from its citizens to give around Rs 14 crore to Masood Azhar, the head of Jaish-e-Mohammed terrorist organisation, even though he is a UN-designated terrorist. The Pakistan government has also announced financial assistance to rebuild the terror infrastructure of Lashkar-e-Taiba and Jaish-e-Mohammed located in Muridke and Bahawalpur. Certainly, a large part of IMF's one billion dollars assistance will be used to fund the terror infrastructure. Will this not be considered indirect funding by IMF, an international organisation? Any financial assistance to Pakistan is no less than terror funding. The funds India gives to IMF should not be used, directly or indirectly, to create terror infrastructure in Pakistan or any other country," he said.

Raksha Mantri commended the effective role played by the Indian Air Force (IAF) in Operation Sindoor which is being appreciated by the world. Lauding the air warriors for eliminating the terror camps in Pakistan and PoK in just 23 minutes, he said "when missiles were dropped inside the enemy territory, the world heard the echoes of India's valour and might". He added that IAF spearheaded this campaign against terrorism, and during the operation, it not only dominated the enemy, but decimated them.

Shri Rajnath Singh highlighted that India's fighter aircraft are capable of striking every corner of Pakistan without crossing the border. "The world has witnessed how IAF destroyed terror camps and later Pakistan's airbases. IAF gave the proof that India's war policy and technology have changed. They conveyed the message of New India that we are not just dependent on weapons and platforms imported from aboard, but Made in India equipment have become a part of our military power. The weapons manufactured in India are also impenetrable," he said.

Raksha Mantri added that Pakistan has itself accepted the power of the 'BrahMos' missile. This Made in India missile showed Pakistan the light of day in the darkness of night, he said, also lauding India's air defence system, in which Akash and other radar systems made by DRDO have played a tremendous role.

On his interaction with the brave Indian Army soldiers at Badami Bagh Cantt in Srinagar yesterday, and the air warriors & soldiers in Bhuj today, Raksha Mantri stated that he is, once again, convinced that India's borders are completely safe. "I've witnessed the highest level of enthusiasm and patriotism among the soldiers on both the fronts. What our forces did during Operation Sindoor has filled the country with pride," he said.

Raksha Mantri stated that Bhuj has been witness to India's victory over Pakistan in 1965, 1971 and now. He termed Bhuj as a land of patriotism where soldiers stand tall with an unshakable resolve to protect national interests. He expressed gratitude to the air warriors and other brave soldiers of the Armed Forces and BSF for their service to the motherland.

Reiterating the Government's commitment to continuously equip the Armed Forces with latest weapons/platforms and modern infrastructure, Shri Rajnath Singh stated a strong nation respects its military and provides it with resources, technology and every support. He highlighted that, earlier, India was heavily dependent on imports, but today it is indigenously manufacturing equipment such as artillery systems, radar systems, missile shields, drones and counter drones. "We are becoming exporters from importers; and this is just the beginning," he said.

Shri Rajnath Singh stated that the people of India, the Government, the Armed Forces and other security agencies displayed unity and understanding in this fight against terrorism, with every citizen participating like a soldier. He stated that the Government and the people stand shoulder-to-shoulder with its forces at every step, expressing confidence that "Together, we will completely eradicate terrorism from the region, and no one dares to cast an evil eye on the sovereignty of the nation".

Raksha Mantri began his address by paying homage to the innocent lives lost in Pahalgam and the soldiers who made the supreme sacrifice during Operation Sindoor. He wished a speedy recovery to the injured soldiers.

Chief of the Air Staff Air Chief Marshal AP Singh and other senior IAF officials were present on the occasion.

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Raksha Rajya Mantri to lead the Indian delegation at 17th Langkawi International Maritime & Aerospace Exhibition in Malaysia

Source: Press Information Bureau, Dt. 18 May 2025,
URL: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2129394

Raksha Rajya Mantri Shri Sanjay Seth will lead an Indian delegation at the 17th edition of Langkawi International Maritime and Aerospace Exhibition (LIMA 2025), being held at Langkawi, Malaysia from May 20 to 24, 2025. An Indian Pavilion is set up in LIMA 2025, which will be inaugurated by Raksha Rajya Mantri.

Many DPSUs including Mazagon Dock Shipbuilders Limited, Bharat Dynamics Limited, BEML, Hindustan Aeronautics Limited & Gliders India Limited and private defence companies will be participating in the exhibition & showcasing the Indian defence industry prowess. This year, Indian assets including Dornier aircraft and an Indian Naval Ship will also participate in LIMA 2025.

On the sidelines of the exhibition, Raksha Rajya Mantri will also call on Malaysian Minister of Defence Dato' Seri Mohamed Khaled bin Nordin. The visit will further consolidate the bilateral defence coopera

India and Malaysia have a robust and multifaceted relationship which has expanded into several strategic areas, including defence & security. Both the countries are committed to work under the vision of Comprehensive Strategic Partnership established during the visit of the Prime Minister of Malaysia in 2024.

LIMA, established in 1991 and held biennially, is regarded as one of the largest and most significant maritime & aerospace exhibitions in the Asia-Pacific region.

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Op Sindoor displayed "tri-services synergy, strategic depth, technological dominance," says MoD

Source: ANI News, Dt. 18 May 2025,
URL: https://www.aninews.in/news/world/asia/op-sindoor-displayed-tri-services-synergy-strategic-depth-technological-dominance-says-mod20250518221719/

The Ministry of Defence in a statement said on Sunday that Operation Sindoor stands as a bold statement--India is united, future-ready, and resolute against cross-border terrorism.

The MoD in its statement said that with effective Army-BSF coordination on the ground, India showcased seamless multi-domain warfare.

"Jointness is not just a vision--it's India's operational reality. Operation Sindoor, launched on May 07, 2025, marked a turning point in India's defence doctrine--demonstrating tri-services synergy, strategic depth, and technological dominance in response to the Pahalgam terror attack. With

precision airstrikes on key targets like Nur Khan and Rahimyar Khan Air Bases, robust naval posturing through a Carrier Battle Group, and effective Army-BSF coordination on the ground, India showcased seamless multi-domain warfare. The operation was powered by integrated systems like IACCS and Akash Missile, and backed by major reforms: CDS-led DMA, Integrated Theatre Commands, Joint Logistics Nodes, and real-time joint exercises like Prachand Prahar and Desert Hunt. As the Armed Forces execute reforms under the 'Year of Defence Reforms 2025', Operation Sindoor stands as a bold statement--India is united, future-ready, and resolute against cross-border terrorism," the statement said.

Operation Sindoor, initiated on May 7, 2025, in the aftermath of the Pahalgam terror attack, which claimed the lives of 26 innocent civilians showcased a calibrated, tri-services response that embodied precision, professionalism, and purpose, the statement said.

Operation Sindoor was conceived as a punitive and targeted campaign to dismantle the terror infrastructure across the Line of Control and deeper inside Pakistan.

Multi-agency intelligence provided confirmation of nine major camps that were eventually targeted in the operation. India's retaliatory action was based on meticulous planning and an intelligence-led approach, which ensured that the operations were conducted with minimal collateral damage. Operational ethics were central to the mission, and restraint was exercised to avoid civilian harm.

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What is emergency defence procurement power? India approves Rs 40,000 cr to fast-track military purchases amid Operation Sindoor

Source: The Times of India, Dt. 18 May 2025,
URL: https://timesofindia.indiatimes.com/india/what-is-emergency-defence-procurement-power-india-approves-rs-40000-cr-to-fast-track-military-purchases-amid-operation-sindoor/articleshow/121239505.cms

The Indian defence forces are set to make emergency purchases worth Rs 40,000 crore to enhance combat readiness during Operation Sindoor. The defence acquisition council, chaired by senior defence and military officials, have approved the spending to ensure timely procurement of critical equipment.

Key systems being prioritised under the emergency powers include surveillance drones, kamikaze drones, loitering munitions, and various types of missiles and ammunition. Some of these, like the BrahMos and Scalp cruise missiles, have already been deployed against Pakistani targets. The Rampage missile, also used in the strikes, was initially procured under similar emergency provisions.

These emergency powers ensure that the equipment is received within a strict timeline, helping meet immediate operational requirements. This is the fifth such tranche of emergency procurement

since 2019. Procurement teams from all three services will coordinate with defence finance advisers to manage purchases efficiently.

Indian public and private defence firms, including Bharat Electronics and Solar Defence, are expected to receive orders for low-level radars and other high-tech systems. The forces also plan to acquire more Heron Mark 2 drones, which have been instrumental in surveillance during Operation Sindoor.

Given the current conflict and its evolving demands, the Indian government may consider additional funds for defence needs in future budgets.

What is emergency defence procurement power?

- Emergency defence procurement power allows the armed forces to bypass standard procurement timelines for urgent military needs.
- Under it, the equipment must be delivered quickly—often within 3 to 6 months.
- The powers are activated during conflict, tensions, or natural disasters.
- Financial limits are set for each procurement cycle, allowing the military to negotiate directly.
- This mechanism was used in previous border clashes and now during Operation Sindoor.
- According to ministry of defence, for items previously supplied by defence PSUs or ordnance factories, the government can issue Letters of Intent (LoI) to speed up procurement before a full contract is signed.
- To ensure oversight, a high-level defence ministry committee ensures that rules are followed and no irregularities occur in large contracts.

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India's AI-Powered Intelligence Grid: Amit Shah Inaugurates New Multi Agency Centre At North Block In New Delhi

Source: Swarajya, Dt. 17 May 2025,
URL: https://swarajyamag.com/news-brief/indias-ai-powered-intelligence-grid-amit-shah-inaugurates-new-multi-agency-centre-at-north-block-in-new-delhi

Union Home Minister and Minister of Cooperation Shri Amit Shah inaugurated the revamped Multi Agency Centre (MAC) at North Block, spotlighting a major step forward in India's national security infrastructure, a statement from Ministry of Home Affairs said. The MAC, housed within the Intelligence Bureau, has been upgraded into a state-of-the-art intelligence fusion platform connecting all intelligence, security, and law enforcement agencies. Speaking at the launch, Shah emphasised that the new MAC will serve as a seamless and integrated hub to address modern national security challenges such as terrorism, extremism, organised crime, and cyber threats.

The platform integrates cutting-edge technologies, including Artificial Intelligence (AI), Machine Learning (ML), and Geographic Information System (GIS) capabilities, to enhance predictive

analysis and real-time intelligence sharing, the statement read. According to Shah, by connecting intelligence nodes across the country, including island territories, insurgency-affected regions, and remote high-altitude zones, the upgraded MAC ensures last-mile connectivity down to the district SP. The network now offers standalone, secure access for faster and more coordinated responses to security threats. With an investment of over Rs 500 crore, the new MAC is designed to break down data silos, facilitating inter-agency collaboration and centralised data analytics.

Shah outlined the future roadmap, including integration of significant databases from other central agencies to improve operational outcomes such as hotspot mapping, trend analysis, and timeline monitoring. He also linked the effectiveness of MAC to the success of recent operations, such as Operation Sindoor and the anti-Naxal campaign in the Karregattalu Hills, which demonstrated strong inter-agency coordination. Established in 2001, the MAC has now undergone a comprehensive technological transformation under Shah's leadership, positioning it as India's foremost intelligence coordination platform for current and future challenges.

Key Upgradations in the New MAC

- Embedded AI/ML capabilities for advanced data analysis and predictive intelligence.
- GIS integration for real-time mapping and hotspot tracking.
- Standalone, fast, and secure national network ensuring last-mile connectivity.
- Integration-ready architecture for linking databases from multiple central agencies.
- Enhanced data analytics tools for trend, timeline, and operational analysis.
- Nationwide coverage, including remote, high-altitude, and insurgency-affected areas.
- Improved coordination interface for seamless agency collaboration.
- Modern hardware and software infrastructure were completed in record time.
- Support for counter-terror and organised crime intelligence fusion.
- Elevated fusion capability across intelligence, security, and law enforcement domains.

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The inside story of a seamless Operation Sindoor

Source: The Times of India, Dt. 18 May 2025,
URL: https://timesofindia.indiatimes.com/india/the-inside-story-of-a-seamless-operation-sindoor/articleshow/121241911.cms

Wars always generated a fog of claims and counter-claims. Did the Americans deliberately target civilians? Did a cynical Saddam Hussein use hospitals and schools as shields? It was always difficult to sift the truth from the lies, but the problem now has become even more acute with that much more information manipulation by the combatants.

During Operation Sindoor, the same game played out, but one thing has now become abundantly clear: India won the latest round decisively. Indian armed forces have given enough information,

backed by photographs and satellite images, leaving little room for disputes by sceptics and biased pundits masquerading as objective neutral parties. The assertions have been backed by independent military strategists and experts.

TOI, based on accounts from multiple high-level insiders, who obviously spoke on the condition of anonymity, pieced together how India executed Operation Sindoor.

Resolute political will

Prime Minister Narendra Modi was busy with his engagements in Saudi Arabia when news of the attack on tourists in Pahalgam started trickling in. As soon as the magnitude of the massacre — the sheer monstrosity of the act, the fact that only Hindu men were targeted — was clear, Modi made up his mind that this would not go unpunished.

The terrorists had even taunted wailing family members of victims that this was a message to Modi. The PM cut short his visit and on the way back told his colleagues to start preparing for retaliation against terrorists and their patrons.

The consultations in the Cabinet Committee on Security and with the defence and intelligence leadership were not about “if” we should retaliate. It was solely focused on “where and when”, sources told TOI. In 2019, Modi had called Pakistan’s nuclear bluff when he ordered the air strike on the jihadi hub of Balakot in response to the Pulwama attack on a CRPF convoy.

He was determined not to let that be an obstacle this time around as well despite alarmist predictions about Pakistan army chief Gen Asim Munir being a jihadi in olives who had a restless finger on the nuclear button. India also factored in that China and Turkiye were standing by Pakistan, that a large number of Indian troops were stationed along the China border, and also that the West was again getting spooked by Pakistan’s scare-mongering. None of this dimmed India’s resolve which was articulated by the PM in Madhubani.

Choice of targets

The 2016 surgical strikes after the terror attack at an Army camp in Uri signalled the intent not to let the LoC come in the way of India’s pursuit of justice. The govt climbed up a couple of steps in the escalation ladder through the air strike on Balakot — a revered spot in the jihadi imagination.

This time, the message had to be stronger and, hence, the selection of Muridke and Bahawalpur, the headquarters of Lashkar-e-Taiba and Jaish-e-Mohammed, which had been responsible for almost all the major terror attacks on India, beginning with the audacious one on Parliament in 2001 and including the amphibious army-type assault on Mumbai in 2008. The headquarters of Hizbul Mujahideen and other areas in POK, which were the staging ground for attacks, were part of the ‘to-hit’ list drawn up with the help of meticulous intelligence the govt already had.

Forty-odd buildings were priority targets and the objective was to inflict damage that was visible, lethal and served to amplify the message: “We know who you are, where you are and how to get you.

Closing intel gap

Painstaking intelligence gathering over the past 10 years has helped India take care of what has for decades been a major handicap vis-a-vis its hostile neighbour. The success of Operation Sindoor only served to confirm what had been speculated over the past couple of years: that India has closed the intelligence gap.

A combination of humint and techint helped India pin the exact locations, down to the buildings that served as the residential quarters of the leaders of Lashkar and Jaish inside the sprawling complexes at Muridike and Bahawalpur. Ten members of the family of Masood Azhar died. He himself barely escaped an Indian missile. Such was the extent of the losses that the Pakistan army had to depute its senior ranks to attend their funeral: an act of solidarity which blew apart the fiction of jihadi outfits being non-state actors.

They knew it was coming

Uri and Balakot had left little room for doubting the Modi govt's intent. Right after the Pahalgam attack, speculation was rife that India would target terror hubs, especially the jihadi universities at Muridke and Bahawalpur. It was also certain that Pakistan, caught napping twice, would have ramped up defences around its "prized assets", thus eliminating the room for India to spring a surprise. Yet, two weeks after the Pahalgam massacre, India decided to hit the very same targets. Sources refused to confirm if it was because our intelligence had signalled that Pakistan had lowered its guard. It certainly created a "bol ke mara, jo kaha so kiya" moment for the govt and the forces.

Choice of weapons

Intelligence also helped India exploit a chink in Pakistan's air defence. The Rawalpindi GHQ and their Chinese handlers had designed a shield to defeat any attack that involved planes and missiles. But they did not take into account India's stock of loitering munitions (a type of drone). A deadly addition to the inventory, loitering munitions fly at low altitude to dodge regular air defence, hunt and hover over the target with exact coordinates fed into it, before striking with precision.

Over the past few years, India has built an impressive arsenal of the stealth weapon, largely sourced from overseas through the Emergency Purchase route, but now increasingly being produced domestically too. Combined with longrange Made-in-India drones, they took a heavy toll on the nine terror targets. Once they had got the "free hand" from the PM, defence and intelligence officers started working on the execution of Operation Sindoor.

What helped them were multiple simulations the three Services had run, enabling near-perfection in the implementation. The four-day operation saw them work together: a perfect example of the muchaspired-for "jointness" that India has sought to achieve in recent years. There is speculation that some of the most ferocious strikes were achieved through weapons fired by Navy personnel.

Air defence held firm

The destruction near Lahore of the HQ-9 missile defence system, a copycat version of the Russian S-300, and a strategic gift from China, marked a major blow to Pakistan, both materially as well as psychologically. But this was only a prelude to the major unravelling of Pakistan's air defence.

Their air bases, including strategic ones, which are home to F-16s and Chinese-made J-10s, and those located next to the headquarters of Strategic Plans Division that handles their nukes, became vulnerable. Open to missile and drone attacks, it exposed the hollowness of Bunyanum Marsoos, the 'wall of lead' that Pakistanis had claimed to have built. As against this, India's own air fortification remained intact.

A combination of the legacy antiaircraft guns, surface-to-air missiles, particularly the portable ones, battle-proven Pechoras, indigenously developed Akash, and S-400 that India acquired from Russia in 2018 in defiance of US's threat of sanctions, turned out to be "the wall". In another example of jointness, the capabilities of the Indian Air Force and the Army were supplemented by those of the Navy.

As a result, all our air bases remained safe and operational. Pakistan's claims about the destruction of the Adampur air base were proven to be fiction on Tuesday when Modi landed there on his special plane to address the jawans, with S-400 Triumph batteries forming a defiant backdrop. The military success announced India's fullscale readiness for new-age warfare and will go a long way in enhancing confidence of the armed forces in "Make-in-India" weapons.

Threat within Pakistan

Pakistan had limited options of widening the theatre of war by opening a front on the land border. With the Baloch insurgency developing into a front within, Gen Asim Munir could have withdrawn the Chaklala-headquartered X Corps — tasked with defending Pakistan-Occupied Kashmir — from Balochistan, but only at a huge risk. Attacks by Balochistan Liberation Army, even during the hostilities with India, only further shrank the space for manoeuvre.

The vulnerability of Pakistan's skies and the high possibility of Baloch snipers aiming at long convoys meant that the 26 division — the mechanised division based in Bahawalpur — could not be brought to the border either.

Missing 'strategic depth'

Pakistan had wanted to turn Afghanistan into a client state, hoping that its control over its neighbour would give it strategic depth in any confrontation with a conventionally superior India. The retreat of the US and the installation of a Taliban regime was supposed to be the fulfilment of the dream of the planners at Rawalpindi GHQ.

Unfortunately for them, the new regime in Kabul has refused to be pliant and an accessory, leading Islamabad to ironically accuse them of not controlling Tehreek-e-Taliban Pakistan. It has also made it necessary for Pakistan to deploy a sizeable number of its troops in the Khyber Pakhtunkhwa province bordering Afghanistan. Staunch solidarity of the majority in KP with jailed former PM Imran Khan and the fear that his supporters would erupt in the streets against the Pakistan army further tied Islamabad's hands.

Navy, the amplifier

It did not join the action as such. But its offensive posture clearly signalled India's intent and readiness to respond to any escalation. Ships resorted to aggressive manoeuvres on a night when Indian missiles had hit targets in Karachi's immediate vicinity.

The message was that India was more than willing to broaden the theatre to cover all domains, and Pakistan got the message. As Vice Admiral AN Pramod said, the Indian Navy ensured that the enemy's air force remained "bottled up" on the Makran coast.

Staying the course

Stoking the West's fears of a nuclear conflagration and capitalising on it has for decades been Pakistan's playbook. The tactic was deployed again and it worked, with Western capitals offering unsolicited counsel to New Delhi to de-escalate. The Modi govt, however, refused to flinch and maintained that terrorists needed to be made accountable and India has the right to defend its citizens. The message, in its most stark form, was conveyed by the PM to US vice-president J D Vance on the evening of May 9. Vance had called to convey "intelligence" about Pakistan planning a massive retaliation.

"They can do whatever they are planning to, but India's response will be even stronger," Modi is learnt to have told Vance. That Modi really meant "goli ka jawab gole se" became evident in hours. After the IAF humiliated Pakistan by hitting its prized air bases, external affairs minister S Jaishankar got a call from US secretary of state Marco Rubio on Saturday morning, saying that Pakistan was ready to discuss a ceasefire.

India's first response was to escalate the strikes on Pakistan's air bases before its Director General of Military Operations Lt General Rajiv Ghai decided to connect with his counterpart Maj Gen Kashif Abdullah. The biggest takeaway for Pakistan and the world at large: Since the global community is unable or unwilling to force Pakistan to change its behaviour, India is ready to execute the task on its own, despite significant risks. And it is sure the people will back a govt that is ready to go to the farthest lengths.

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Op Sindoor exposed pattern of failures, underperformance by Chinese weapons systems: Report

Source: The Times of India, Dt. 18 May 2025,
URL: https://timesofindia.indiatimes.com/india/op-sindoor-exposed-pattern-of-failures-underperformance-by-chinese-weapons-systems-report/articleshow/121251371.cms

Operation Sindoor not only marked a decisive military and strategic victory for India but also exposed critical vulnerabilities within Pakistan's armed forces, particularly those stemming from their heavy reliance on Chinese-supplied military hardware.

With nearly 82% of Pakistan's defence imports originating from China, the conflict provided a real-world test for Chinese technology against a combination of Indian and Western platforms.

During the operation, Indian forces successfully targeted and neutralised key Pakistani military and terror infrastructure, often overcoming or bypassing Chinese-origin air defense systems such as the HQ-9, which failed to intercept Indian missile strikes, including those delivered by the BrahMos missile.

Reports indicate that other Chinese systems-ranging from PL-15 air-to-air missiles to J-10C fighter jets and naval frigates-also underperformed or malfunctioned, leaving Pakistani defenses compromised and unable to deter or effectively respond to India's offensive.

These operational failures have had repercussions beyond the immediate battlefield.

The inability of Chinese weapons to deliver under combat conditions has damaged China's reputation as a global arms exporter, reinforcing longstanding concerns about the quality and reliability of its military equipment.

Analysts note that such failures validate earlier skepticism about Chinese systems and are likely to accelerate the decline in China's arms exports, which had already been shrinking due to quality issues.

The credibility gap exposed by Operation Sindoor provides a strategic opening for other arms manufacturers including India, who can now emphasise their own reliability and combat-proven performance.

Key observations and incidents of failure

Air Defense systems (HQ-9, HQ-16/LY-80)

- Numerous reports indicate the complete failure of Pakistan's Chinese-made HQ-9 air defense system to effectively intercept Indian aircraft or missiles during the conflict.
- Indian forces successfully bypassed and jammed Pakistani air defense systems, including those deployed near critical military installations.
- The ineffectiveness of the HQ-9 and other Chinese air defense units has raised questions about their detection and response capabilities, especially against advanced Indian and Western systems.
- Chinese nationals reportedly voiced criticism on social media, attributing the HQ-9's failure to inadequate training and operational inefficiencies on the Pakistani side.

Air-to-air missiles (PL-15)

- The Chinese-made PL-15 beyond-visual-range air-to-air missile, touted as a rival to Western counterparts like the American AIM-120D, reportedly failed to hit intended targets or malfunctioned mid-flight.
- Indian military officials displayed fragments of a recovered PL-15 missile in Hoshiarpur, which had landed without hitting anything, further discrediting claims of its effectiveness.
- While some initial reports from pro-Chinese media attempted to claim PL-15 successes, these claims lacked verifiable proof and were largely considered propaganda.

CM-400AKG air-to-surface missile

- The CM-400AKG is a Chinese air-to-surface missile, often marketed as a "carrier killer," designed for high-speed, precision strikes against ground and naval targets.

- It was detected early by Netra and AWACS. Despite its speed, it lacks stealth features and has limited terminal maneuverability. Susceptible to spoofing and jamming.

Fighter jets (J-10C, JF-17)

- Despite Pakistan deploying Chinese-made J-10C and JF-17 Block III fighter jets, equipped with PL-15 missiles, they were unable to significantly impede or deter Indian airstrikes.
- Claims by Pakistani and Chinese propaganda of J-10C aircraft shooting down multiple Indian jets, including Rafales, remain unsubstantiated and unverified by independent sources. No debris of Indian aircraft has been presented by Pakistan.
- The overall performance of these Chinese jets in actual combat against Indian aircraft (a mix of Russian and Western platforms) was deemed ineffective by many analysts.

Radar systems

- An Indian Air Force strike reportedly destroyed a Chinese-supplied YLC-8E anti-stealth radar located at the Chunian Air Base in central Punjab, further highlighting vulnerabilities in China's air defense offerings to Pakistan.

AR-1 guided missile (Deployed via Wing Loong-II Drones)

- Overview: The AR-1 is a Chinese laser-guided air-to-surface missile, typically deployed from unmanned aerial vehicles like the Wing Loong-II drone.
- Deployment in Pakistan: Pakistan utilized Wing Loong-II drones armed with AR-1 missiles for precision strikes.
- Performance during Operation Sindoor: Indian air defense systems successfully intercepted or neutralized AR-1 missiles before they could reach their targets.
- Analysis: The failure of AR-1 missiles to penetrate Indian defenses highlights deficiencies in their effectiveness against well-established air defense networks.

Chinese-origin drones

- Overview: Pakistan employed various Chinese-origin drones for reconnaissance and offensive operations during the conflict.
- Performance During Operation Sindoor: Indian forces intercepted and neutralized multiple Chinese-origin drones, with wreckage displayed during official briefings.
- Analysis: The inability of these drones to evade Indian air defenses raises concerns about their stealth capabilities and overall effectiveness in contested airspace.

Overall reliability and quality concerns

- The conflict has exposed fundamental vulnerabilities in the reliability and combat effectiveness of Chinese military technology, despite China's aggressive push to position itself as a credible alternative to Western and Russian arms suppliers.

- Reports indicate that Chinese-supplied equipment often suffers from defective critical components, poor quality control, and inadequate after-sales service.
- Previous instances of malfunctioning and defective military equipment sold by China to various countries (e.g., faulty frigates for Pakistan Navy, issues with fighter jets for Nigeria and Myanmar) underscore a recurring problem with the quality of Chinese defense exports.

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Operation Sindoor: How homegrown deftech mount a near-impregnable air defence

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/opinion/et-commentary/operation-sindoor-how-homegrown-deftech-mount-a-near-impregnable-air-defence/articleshow/121253137.cms?from=mdr

By all counts, India's comprehensive takedown of Pakistan's military in the 4-day face-off was enabled by its ability to mount a near-impregnable air defence, while simultaneously undertaking devastating precision strikes on multiple enemy targets. Remarkably, this capability was inspired by a homegrown deftech stack. The standout air defence weapon, Akash, a short-range surface-to-air missile, shielded vulnerable installations and cities. It's entirely configured on mobile platforms, making it very versatile. Similarly, deployment of an array of UAVs, a hybrid constellation of homegrown and foreign drones, boosted India's offensive repertoire.

Unlike other air defence systems like Israel's Iron Dome, India's air defence required integration of both foreign and domestic hardware and software systems. This is a big capability, given that technology evolves so rapidly, making it almost impossible for a country to achieve end-to-end indigenisation. The piece de resistance, though, was BrahMos cruise missile, which decapitated Pakistan's prime airbases, including Nur Khan and Rahim Yar Khan. At present, BrahMos is 3x faster than other cruise missiles - achieving almost 3x speed of sound - and is considered the best in the world.

In turn, the surgical precision of these strikes was achieved by using NavIC (Navigation with Indian Constellation), India's homegrown satellite navigations system put together by Isro. It is the equivalent of GPS (US), GLONASS (Russia), Galileo (EU), and BeiDou (China). The accuracy of NavIC's footprint over the subcontinent is within a metre. While this is laudable, it begs the question: why is such world-class tech capability not replicated across other sectors? Worse, this proficiency masks more than it reveals about India's strategic dependency on foreign sourcing.

The uncomfortable answer is that both deftech and spacetech are bankrolled by GoI and, hence, derisked. In contrast, most other sectors, dominated by the private sector, are still struggling under the dual burden of regulatory and tax overreach, a hangover from the licence raj days India is unable to shed. On July 1, India will celebrate the 8th anniversary of GST. It was the biggest piece of tax reform, which economically united the country under the idea of 'One Nation, One Tax'. GST created this architecture by collapsing 36 tax jurisdictions into one tax, subsuming 17 taxes and 13 cesses levied by Union and state governments. It led to doubling of registered taxpayers to

1.40 cr, and created an unprecedented surge in buoyancy. In April, GST collections topped a record ?2.37 lakh cr.

Despite these impressive stats, regulatory overreach and red tape are threatening to trip up this marquee tax reform. It emerges that the same commodity can be taxed at multiple rates. GST rate on popcorn mixed with salt and spices is 5%, 12% on pre-packaged and labelled popcorn, and 18% on caramelised popcorn. Ironically, share of popcorn in GST collections is in decimal points. Worse, this iterative interpretation smacks of the sales tax era that preceded GST's rollout. Similarly, GST Council, which has oversight of the tax rollout, has been dragging its feet on shrinking tax slabs.

The larger worry is that unchecked red tape is also taking its toll on strategic interests. This isn't immediately apparent given our focus on successes notched up in deftech and spacetech. The best defence is a strong Indian economy. In turn, this is predicated on the country's ability to rein in red tape and foster domestic and foreign entrepreneurs.

This plays into the hands of global vested interests who are systematically creating strategic gaps in India's bid to build military capability domestically. Centre for Digital Economy Policy president Jaijit Bhattacharya and principal additional director general Ranjan Khanna recently pointed out that dumping by China is jeopardising domestic capacity to manufacture TDQ (trimethyl dihydroquinoline), PX-13 (pilflex 13) and insoluble sulphur, required in the production of off-road tyres used in military-grade trucks.

Two decades ago, similar dumping of penicillin G by China had forced the shutdown of four domestic companies manufacturing this antibiotic critical for treating bacterial infections, especially of combat personnel. Acknowledging the strategic challenge, GoI has now extended PLI to restart domestic production of pencillin G. Yes, while India's recent display of its deftech capability was spectacular, it is, unfortunately, an island of excellence. There is a clear imperative to extend this capability across sectors. The solution to achieve this lies within, not outside.

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No expiry date in Indo-Pakistan understanding on cessation of hostilities: Army

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/no-expiry-date-in-indo-pakistan-understanding-on-cessation-of-hostilities-army/articleshow/121249741.cms

There is "no expiry date" to the understanding reached between Indian and Pakistani Director Generals of Military Operations (DGMOs) on cessation of hostilities nearly a week back, the Indian Army said on Sunday. The clarification came following reports that the arrangement between the two militaries on stopping the hostilities is ending this evening.

The Director Generals of Military Operations (DGMOs) of India and Pakistan on May 12 decided to continue with the understanding of halting all military actions. The arrangement was originally reached for two days when the DGMOs held a conversation over the hotline on May 10. "As far as

continuation of break in hostilities, as decided in DGMOs interaction of May 12 are concerned, there is no expiry date to it," the Indian Army said in a brief clarification. It also made it clear that there are no "DGMO talks" scheduled for Sunday as reported in a sector of the media.

The arrangement reached on May 10 came after four days of intense hostilities that saw the two sides targeting each other's military installations with drones, missiles and long-range weapons that raised fears of a wider military conflict. The DGMOs of India and Pakistan on May 12 again deliberated on ways to avoid "inimical" military actions and agreed on considering immediate steps to reduce troops of the two militaries from the borders and forward areas.

In the conversation, the two officers focused on continuing the commitment that both sides must not fire a "single shot" or initiate any "aggressive and inimical" action against each other.

Under Operation Sindoor, India carried out precision strikes on terror infrastructure early on May 7 in response to the April 22 Pahalgam terror attack. Following the Indian action, Pakistan attempted to attack Indian military bases on May 8, 9 and 10. The Pakistani attempts were strongly responded to by the Indian side, inflicting heavy damage to a number of key Pakistani military installations, including air bases, air defence systems, command and control centres and radar sites.

Foreign Secretary Vikram Misri on May 10 evening announced that India and Pakistan reached an understanding to stop all firings and military actions on land, air and sea, with immediate effect. On May 15, Pakistan Foreign Minister Ishaq Dar told the country's Senate that the DGMOs of Pakistan and India talked over the hotline on May 14 to discuss the "ceasefire".

However, the Indian military chose not to comment on Dar's claim. Dar said the two DGMOs in their conversation on May 10 had firmed up the "ceasefire" till May 12.

"When the DGMOs spoke again on May 12, the ceasefire was extended until May 14. Further talks on May 14 led to the ceasefire being extended until May 18," the Pakistan foreign minister was quoted as saying by Geo News. Following Dar's comments, the Indian Army said it will pursue confidence-building measures to reduce the "alertness level" in line with the May 10 understanding.

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Dragon’s shadow near Siliguri? China aids revival of WW2-era Bangladeshi airbase near India’s ‘Chicken’s Neck’

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/dragons-shadow-near-siliguri-china-aiding-revival-of-ww2-era-bangladeshi-airbase-near-indias-chickens-neck/articleshow/121246761.cms

China is reportedly aiding Bangladesh in reviving an old World War II airbase at Lalmonirhat, just 12-15 kilometres from the Indian border. The airfield, currently controlled by the Bangladesh Air Force but inactive for decades, lies only 135 kilometres from the Siliguri Corridor—India’s crucial ‘Chicken’s Neck’ connecting the northeast to the rest of the country. Chinese officials recently visited the site, signalling Beijing’s growing interest. Although the precise purpose—civilian or

military—is unclear, a Chinese presence so close to this narrow passage could increase India's strategic vulnerability.

Lalmonirhat airbase: A legacy from the past

Originally built by the British in 1931, Lalmonirhat served as a forward base for Allied forces in Southeast Asia during World War II, explains the Kolkata-based Centre for Research in Indo-Bangla Studies. After Partition, Pakistan briefly reopened it in 1958 for civilian use. Since then, it has been largely abandoned, despite its sprawling 1,166 acres and facilities including a four-kilometre runway and large tarmac.

In 2019, Bangladesh's Sheikh Hasina government announced plans to develop an aviation and aerospace university there, which is now operational under the Bangladesh Air Force. Recently, the interim administration led by Mohammed Yunus proposed reviving Lalmonirhat and five other British-era airports to boost the economy. The other airports include Ishwardi, Thakurgaon, Shamshernagar, Comilla, and Bogra.

Strategic implications for India's Northeast

The Siliguri Corridor, also known as the 'Chicken's Neck,' is a mere 22 kilometres wide at its narrowest point. It connects India's eight northeastern states to the mainland. This corridor's security is vital. "Reports suggest potential Chinese involvement in developing the airbase, possibly as a civilian airport, though fears persist it could serve dual military purposes. This could enable China to monitor Indian military movements or gather intelligence near the [Siliguri] corridor," says Sriparna Pathak, China Studies professor at OP Jindal Global University, as reported by TOI.

Any disruption to this lifeline could threaten India's territorial integrity. China's expanding military presence near the India-Bhutan-China tri-junction has already heightened tensions. The 2017 Doklam standoff exposed the corridor's vulnerabilities, pushing India to strengthen defences.

The Military-Economic angle

China's growing footprint in Bangladesh includes not just military interests but economic projects too. Chinese companies are building factories and a solar power plant near Rangpur, and a satellite city is planned. According to a Dhaka-based journalist who spoke anonymously, "These factories are operated almost entirely by Chinese personnel, with minimal involvement from local workers." Chinese firms are also deeply involved in regional infrastructure and connectivity efforts close to India's border.

As told to TOI, Kalpit Mankikar, a China-Taiwan Studies fellow at Observer Research Foundation, views the airbase revival as "the natural consequence of two things." He explains, "One thing is China has definite plans for that region. All this while those plans may have been dormant because [deposed Bangladesh PM] Sheikh Hasina was more accommodative towards India's interests. Now, with the regime change and Mohammed Yunus' open offer that Bangladesh can serve as a fountainhead against India, China would definitely be tempted to take up the offer [the airport project]."

Mankikar adds, “We don’t know yet what are China’s plans for the project. But this could be used to monitor civilian and military movement to Northeast from the rest of India and vice versa.”

Pakistan’s shadow looms large

India is also watching Bangladesh’s warmer ties with both China and Pakistan with concern. Before Chinese officials visited Lalmonirhat, a Pakistani military-intelligence delegation inspected some border areas of Bangladesh.

Army Chief General Upendra Dwivedi remarked: “I had used the word epicentre of terrorism for a particular country [Pakistan]. Now those countrymen, if they go to any other place and they happen to be our neighbour, as far as I am concerned, I should be concerned about it. That they should not be able to use that soil to send terrorists to India.”

Historically, the Pakistani spy agency, ISI, had close links with armed separatist groups in India’s Northeast, many operating from Bangladesh until a crackdown launched by the Awami League government in 2009.

China’s expanding air power along the Himalayan Frontier

This airbase development ties into a broader pattern of Chinese military expansion. As reported by NDTV, since 2024, China has upgraded six new airbases near the Line of Actual Control (LAC) with improved aprons, engine test pads, and support infrastructure. Bases in Tingri, Lhunze, Burang, Yutian, and Yarkant have all seen significant improvements, with drones also spotted on the tarmac.

As told to NDTV, Damien Symon, geospatial intelligence researcher, said, “These near-simultaneous infrastructure enhancements across multiple Chinese airbases along the Line of Actual Control suggest a deliberate strategy to increase operational reach and readiness in border-adjacent zones.”

Former Indian Air Force (IAF) Vice Chief Air Marshal Anil Khosla (retired) highlights the threat: “Airbases like Tingri, Lhunze, and Burang are located close to the Line of Actual Control (LAC), within 25-150 km. This proximity allows for the quick deployment of PLA Air Force (PLAAF) assets to forward positions and shorter response times in case of a border escalation.” He adds, “These bases offer greater depth, logistics, and density. The PLAAF can now deploy fighter squadrons and drones rapidly into forward bases.”

China is also overcoming altitude challenges in Tibet by investing in more powerful engines and advanced technologies such as drones, airborne early warning aircraft, and air-to-air refuelling. “China’s concept of ‘airbase clusters’ means that even if one is targeted, others nearby can support operations, enhancing tactical flexibility, survivability, and redundancy,” says Khosla.

India’s response and the emerging balance of power

The Indian Air Force has upgraded several bases, including Ambala and Hasimara, enhancing infrastructure, radar systems, and cybersecurity. But China’s rapid induction of new-generation fighters, including around 195 fifth-generation J-20 stealth fighters, puts it at a qualitative advantage. India has yet to roll out its own stealth aircraft.

In December 2024, China revealed two new stealth fighters, dubbed J-36 and J-50 by Western analysts, designed for AI-supported operations alongside drones. “With new airbases meant to support such platforms, China may be signalling intent beyond temporary or contingency utility for the Chinese Air Force,” says Symon. “The scale and depth indicate preparations for sustained deployments, rapid mobility and persistent presence near the LAC.”

The revival of Lalmonirhat airbase near India’s vulnerable ‘Chicken’s Neck’ corridor fits into this larger strategic picture — underscoring the complex military and geopolitical challenges facing India in the region.

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Operation Sindoor is a lesson Pakistan won’t forget: Indian Army shares new video, says ‘justice served’

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/operation-sindoor-is-a-lesson-pakistan-wont-forget-indian-army-shares-new-video-says-justice-served/articleshow/121246359.cms

On Sunday, the Indian Army shared a new video on X, showcasing Operation Sindoor—the retaliatory campaign launched earlier this month after the brutal terror attack in Pahalgam. The video, posted by the Army’s Western Command, carried the caption: “Planned, trained & executed… Justice served.”

The clip features voices of security personnel, capturing the raw emotions and resolve that drove the operation. One voice says, “It all began with the Pahalgam terrorist attack. The anger was like molten lava. There was only one thought in mind – this time, we will teach such a lesson that their generations will remember.” Another emphasises the intent behind the strikes: “It wasn’t an act of revenge, it was justice.”

"Yeh shuruate Pahalgam aantki hamle se hui, gussa nahi lava tha. Dimaag me bas ek hi baat, abki bar aisa sabak sikhanege ki inki peedhiya yaad rakhegi. (It all began with the Pahalgam terror attack, the rage was like lava. There was only one thought: this time, we will teach such a lesson that their generations will remember)."

The footage then displays visuals of blasts and non-stop firing, with a voiceover stating, "9 May raat ko takriban 9 baje, jis bhi dushman ki post ne yudh viraam ka ulanghan kiya un sabhi poston ko bharatiya sena ne mitti me mila diya. Dushman apni post chhod bhagta nazar aaya. Op sindoor keval ek kaarwahi nahi, Pakistan ke liye woh sabak tha jo usne dashakon se nahi sikha. Jai Hind! (On the night of May 9, around 9 pm, the Indian Army destroyed all enemy posts that violated the ceasefire, forcing the enemy to flee. Operation Sindoor is not just an action, but a lesson for Pakistan that it has not learned for decades)."

Operation Sindoor: Targeting terror across borders

Operation Sindoor was launched on 7 May, targeting nine terror-linked sites in Pakistan and Pakistan-Occupied Kashmir (PoK). This action came as a direct response to the Pahalgam attack in

Jammu and Kashmir, one of the deadliest incidents in the region in recent years. According to the Army, any enemy post violating the ceasefire was destroyed during night operations on 9 May, around 9 PM. The video states, “On the night of May 9, around 9 PM, any enemy post that violated the ceasefire was destroyed by the Indian army.”

The operation was carefully planned and executed with a clear message: “Operation Sindoor was not just an action; it was a lesson for Pakistan, one it had not learned for decades.” Following India’s strikes, Pakistan responded with heavy shelling across the Line of Control (LoC) and other areas in Jammu and Kashmir. There were also drone attacks attempted along the border, escalating tensions further.

India then launched a coordinated second wave of strikes, targeting radar systems, communication centres, and airfields at 11 Pakistani airbases. This was a precise and strategic move to dismantle key military infrastructure. Despite the sharp escalation, both countries agreed to halt hostilities on 10 May. Since then, no fresh reports of violence have emerged. The video concludes with a firm statement reinforcing the Army’s position: “It wasn’t an act of revenge. It was justice.” This reflects the larger sentiment among Indian forces following the tragic Pahalgam attack.

The Pahalgam attack, which claimed 26 civilian lives, was a significant and sorrowful event in Jammu and Kashmir. It triggered a strong reaction from India’s security forces. Operation Sindoor was conceived as a direct, measured response aimed at disrupting terror infrastructure and sending a clear message to those behind the violence.

The swift escalation and subsequent ceasefire highlight the fragile nature of peace along the Line of Control and the heavy toll such attacks exact on both sides. Earlier in the day, the Indian Army said that no talks were scheduled between the Directors General of Military Operations (DGMO) of India and Pakistan. The Army further made it clear that the continuation of a break in hostilities, as decided in the DGMOs interaction of May 12, has no expiry date to it.

The clarification comes after some media houses reported that the ceasefire between India and Pakistan is ending on May 18."No DGMO talks are scheduled today. As far as the continuation of a break in hostilities as decided in the DGMOs interaction of 12th May is concerned, there is no expiry date to it," the Indian Army said.

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CDS Gen Anil Chauhan to represent India at May 30 Shangri-La Dialogue

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/cds-gen-anil-chauhan-to-represent-india-at-may-30-shangri-la-dialogue/articleshow/121243944.cms

India's Chief of Defence Staff Gen Anil Chauhan will be present at this year's Shangri-La Dialogue (Asias premier security dialogue) to be held in Singapore between May 30-June 1 in what would be his maiden engagement abroad since Op Sindoor and will give the Indian military an opportunity to present its case during its military conflict with Pakistan.

Gen Chauhan is expected to meet military leaders of several countries and conversations may focus on Op Sindoor and India's military success, it has been learnt. Experts said that this will be an another opportunity to bust myth created by Pakistan military about its recent military success.

Widely recognised as Asia's premier defence summit, the IISS Shangri-La Dialogue is a unique meeting where ministers debate the region's most pressing security challenges, engage in important bilateral talks and come up with fresh approaches together.

The Dialogue brings together defence ministers, military leaders and senior defence officials, as well as business leaders and security experts, from across the Asia-Pacific, Europe, North America and beyond to discuss critical security challenges. The dialogue brings Ministers and senior officials of USA and China every year and act as a CBM.

Last year's Keynote Address was delivered by President of the Philippines Ferdinand R. Marcos Jr. Other previous keynote speakers have included Singapore's Prime Minister Lee Hsien Loong, India's Prime Minister Narendra Modi, Japanese Prime Minister Kishida Fumio and Australia's Prime Minister Anthony Albanese.

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AI warfare is here: How intelligent drones Harop and Heron fronted India's Operation Sindoor

Source: The Economic Times, Dt. 17 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/ai-warfare-is-here-how-intelligent-drones-harop-and-heron-fronted-indias-operation-sindoor/articleshow/121239839.cms

As we enter the age of artificial intelligence (AI), even wars seem to be becoming AI-first. India's Operation Sindoor onslaught was fronted by intelligent drones, with high-tech Harops and Herons having the ability to loiter, manoeuvre and choose their targets intelligently. Ukraine has managed to stay in the game against powerful conventional Russian forces through jerryrigged autonomous and AI-guided drones, with small, first-personview (FPV) attack drones, guided by algorithms, destroying more Russian armour than any other weapon category.

Meanwhile, in Gaza, the Israelis have used advanced algorithms, code-named The Gospel and Lavender, to sift intelligence and suggest targets in real time. In 2020, a Turkish-made Kargu-2 attack drone may have autonomously hunted down fighters in Libya without human orders—possibly the first lethal strike by a truly autonomous weapon. In our imagination, AI warfare is about ar mies of futuristic Terminator robots marching in tandem as they go to war; in reality, the age of AI warfare has already begun. As with everything with war and AI, this kind of warfare using lethal autonomous weapons (LAWs) poses disconcerting questions. LAWs are machines that can identify, select and kill targets without human intervention. Unlike nuclear weapons, these systems are relatively cheap, scalable and hard to control once unleashed.

The level of human control can vary, from "human-in-the-loop" systems requiring authorisation for engagement , to "human-on-the-loop" where a human can override autonomous actions, and

finally “humanout-of-the-loop” systems operating without any human involvement post-activation. This possibility of a new kind of war, where a machine makes lifeand-death decisions, has spurred further calls at the UN to ban such weapons.

There are fears among ethicists and human rights bodies of accidental escalation, loss of accountability, or full-scale “drone wars” with no human restraint. Clearly, nations are not on the same page, as furious development continues among major powers that see military gains in letting AI take the reins. AI warfare has gone beyond tactical advantages to established policy, with the Chinese military doctrine explicitly mentioning “intelligentised warfare” as its future. While the notion of LAWs and AI warfare is horrific, this article deliberately steps beyond the familiar “ban or regulate” discourse to explore a few contrarian and counterintuitive views that argue AI could perhaps make war more humane.

Can it save human lives?

One counterintuitive argument is that outsourcing war to machines could save human lives. If robots can shoulder the most dangerous tasks, human soldiers stay out of harm’s way. Maybe it is better to send a disposable machine into a kill-zone to fight another machine, than a young soldier trying to kill another?

Recent conflicts hint at this lifesaving potential: Azerbaijan’s victory over Armenia in the 2020 Nagorno-Karabakh war, for example, was achieved largely through superior drones, greatly reducing its own casualties. This could potentially usher in an era of “boutique wars” or persistent, low-intensity conflicts waged primarily by AI systems, flying below the threshold that typically triggers major international intervention. This sounds tempting but has the downside of making war “risk-free” for the side that has more of these killer machines, making leaders grow more willing to launch military adventures.

Can it make warfare more ethical & precise?

A second contrarian idea is that AI might make warfare more ethical by improving precision. Most militaries already try to minimise collateral damage, as India has been trying to do in Operation Sindoor. AI tools could make “surgical” strikes even sharper. Human soldiers, despite their valour, are prone to error, fatigue and emotion. AI systems, theoretically, can be trained to avoid civilian zones, assess threats more accurately and stop operations when rules of engagement are violated.

Theoretically, an autonomous AI system can be programmed to never fire at a school or a hospital, and it will emotionlessly obey this every single time. Imagine an AI drone that aborts a strike mid-flight because an ambulance enters the frame, something a human pilot might miss in the fog of war. Even the Red Cross has acknowledged that AI-enabled decision support systems “may enable better decisions by humans… minimising risks for civilians”.

The notion of a “clean war” enabled by AI precision can be a doubleedged sword. The same Israeli AI system that identified militants in Gaza also churned out algorithmic killlists with minimal human review. If flawed data or biased algorithms mislabel a civilian as a threat, an AI could kill innocents with ruthless efficiency. AI can enhance compliance with the laws of war, but it cannot substitute for human judgment.

Can it make war transparent?

Operation Sindoor has highlighted the danger of misinformation and deepfakes being peddled by mainstream media. AI could change this. Autonomous systems log everything—location data, video footage, target decisions—opening up the possibility of "algorithmic accountability", with every strike audited, and every action justified, or condemned.

Can it be a new deterrent?

Perhaps the most novel contrarian view is expressed in a recent paper "Superintelligence Strategy: Expert Version" by Eric Schmidt and others, where they borrowed from the Cold War nuclear deterrent of MAD or Mutually Assured Destruction, to propose the concept of MAIM or Mutual Assured AI Malfunction.

The idea is that as AI becomes core to military systems, nations may hesitate to strike each other, because attacking one AI system could cause unpredictable ripple effects across both sides. The inherent vulnerability of complex AI systems to sabotage—through cyberattacks, degradation of training data, or even kinetic strikes on critical infrastructure like data centres—creates a de facto state of mutual restraint among AI superpowers. MAIM flips the script on dystopia: instead of AI dooming us, the mutual fear of runaway AI could keep rival powers' aggressive instincts in check. It does seem surreal to discuss how AI could actually make war more humane, if there is such a thing, rather than making it even more horrific than ever.

The contrarian perspectives above challenge our instincts, and many would recoil at the idea of killer robots marching in. However, with so much of it becoming reality, we can no longer avoid these questions. We can choose to look at this with horrific pessimism or take a glass half-full approach that technology guided by human values might make future wars less inhuman. Everything, they say, is fair in love and war, and that everything might soon include artificial intelligence.

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Operation Sindoor: How India's private sector is arming our military, and why it could transform the future of defence

Source: The Economic Times, Dt. 17 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/operation-sindoor-how-indias-private-sector-is-arming-our-military-and-why-it-could-transform-the-future-of-defence/articleshow/121228836.cms

Operation Sindoor has put a spotlight on India's growing defence strength, especially the rising role of private companies in military technology. A decade ago, India mostly depended on public sector undertakings (PSUs) and foreign imports for defence needs. But now, private firms are leading innovation and becoming key partners in building modern systems for warfare.

Firms like Tata Advanced Systems (TAS), Alpha Design Technologies (ADTL), Paras Defence & Space Technologies, ideaForge, and IG Drones are no longer just supporting players, they are

helping shape India's military future. TAS, for example, is working with Airbus Spain to make C-295 military transport aircraft at the country's first private aircraft factory in Vadodara.

Paras Defence is known for its work in electronic warfare, optics, and drone systems. Alpha Design provides everything from radars to tank parts and satellite equipment. Other big players such as Larsen & Toubro (L&T), Adani Group, and Bharat Forge are also growing their presence in defence. For instance, L&T won contracts worth over Rs 13,000 crore to supply radar and weapon systems. Adani recently opened two new plants to make ammunition and missiles in Uttar Pradesh, aiming to meet 25% of India's small-calibre ammunition needs.

Leading the drone revolution

One of the biggest success stories of the private sector has been in drone technology. In the 1990s, India began using Israeli drones like the Heron and Searcher. But the 1999 Kargil War showed how much India needed real-time intelligence from its own systems. Since then, DRDO and private firms have worked to develop Indian drones.

By May 2025, India's armed forces were using many home-grown drones. ideaForge's SWITCH UAV and NETRA V2, made with DRDO, have already been deployed. Alpha Design teamed up with Israel's Elbit Systems to build the SkyStriker, a drone that can carry out precise attacks. Solar Industries' Nagastra-1 added to India's strike options, while NewSpace Research provided drone-swarm capabilities for the Air Force.

What's coming next?

The development of drones is not slowing down. New platforms are being built for logistics and high-altitude missions, such as Garuda Aerospace's Jatayu and SkyPod for regions like Siachen. Drones like Throttle Aerospace's Raven and AI-based swarm systems from 114AI and NewSpace show how startups are driving the next wave of military technology.

The Drone Federation of India, with over 550 companies and 5,500 pilots, is aiming to make India a global drone hub by 2030. IG Drones, which works with the Indian Army and government agencies, is a good example of how private firms are providing services, research, and manufacturing for defence.

Big numbers, bigger goals

India's defence exports touched nearly Rs 24,000 crore ($2.9 billion) in FY25, and private firms played a huge role. The government wants to double this to Rs 50,000 crore by 2029. The Indian drone market alone could be worth $11 billion by 2030, making up over 12% of the global share.

Earlier this month, defence stocks jumped by up to 4% after Prime Minister Narendra Modi praised Operation Sindoor and said India must lead in defence innovation with its own technology. "We have proven our strength in modern warfare," he said.

Policy support fuels growth

The success of Operation Sindoor was made possible by government policies that supported private defence production. Since 2021, India has banned imported drones and launched a Production Linked Incentive (PLI) scheme with Rs 120 crore to boost local manufacturing. In

FY24, India's home-grown defence production hit Rs 1.3 lakh crore, and the share of private companies is rising steadily.

Initiatives like iDEX (Innovations for Defence Excellence) and SRIJAN (import substitution) are helping startups and companies enter the defence space.

Looking ahead: Space is the next frontier

The future of defence will involve more AI-powered and autonomous systems, and private firms are well-suited for this challenge. Operation Sindoor showed how a strong partnership between private companies, the public sector, and the military can help India become a high-tech power.

Space will be a big part of this journey. India still lags behind countries like the US and China in military satellites, but it is catching up. Companies like Digantara, Pixxel, Dhruva Space, and Ananth Technologies are working on satellite systems and space tech.

Earlier this year, three South India-based private firms were chosen to co-develop 31 satellites under the Space-Based Surveillance-3 (SBS-3) programme. This marks the first time private firms are building satellites for strategic military use. With 52 new satellites planned, 21 by ISRO and 31 by the private sector, India's space surveillance capability is set to grow quickly.

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Operation Sindoor: Indian air defence units thwarted more than 600 Pakistani drones

Source: The Economic Times, Dt. 17 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/operation-sindoor-indian-air-defence-units-thwarted-more-than-600-pakistani-drones/articleshow/121228543.cms

More than 600 drones launched by Pakistan were destroyed along the western borders during Operation Sindoor on May 7 and the following days, senior officers told TOI.

To achieve this, more than 1,000 air defence gun systems and 750 short and medium range surface-to-air missile systems were deployed and mobilised in quick time. This led to a multi-layered air defence network transformed from a peace posture to full operational readiness to defend against the multiple drone waves unleashed by Pakistan during the four days of hostilities last week.

"The operation not only safeguarded vital military and civilian infrastructure but also shattered the myth of drone supremacy. It has shown that Indian boots on the ground, backed by indigenous technology and rigorous training, can defend the skies with unmatched precision," a senior Army Air Defence (AAD) officer told TOI.

Pakistan launched a series of drones with arms to map and test India's AD radar network and to deplete the volume of India's ammunition and missiles designed to take on aerial threats. However, the Indian defence establishment was ready with adequate ammo reserves through regular and emergency procurements over the last five years due to the military confrontation with China in eastern Ladakh.

“Pakistan’s strategy was to overwhelm India’s integrated air defence grid, gather real-time intelligence, and target population centres, military assets and places of worship. But it failed spectacularly,” another officer said. “We neither open up all our radars, nor keep them open round-the-clock, to ensure the adversary does not pick up electronic signatures. One also does not use the top-end Russian S-400 (interception range 380km) or Barak-8 MR-SAM (70km, jointly produced with Israel) AD systems against low-value targets like small drones,” he added.

'Legacy' AD systems like L-70 anti aircraft guns, ZU-23 mm twin-barrel guns and upgraded Schilka are often underestimated in the era of high-tech warfare. However, it were these systems that stood the test of time

“They emerged as highly effective point defence systems against low-flying, hard-to-detect drone swarms,” he said. The indigenous Akash AD missile systems, which has an interception range of 25km, also played a major role in working against bigger threats like aircraft, armed UAVs and the Turkish Byker Yiha III kamikaze drones. The Indian Army also used six nodes of its new indigenous Akashteer air defence control and reporting systems, which were fully plugged into IAF’s larger IACCS (integrated air command and control system) for a real-time composite air situation picture available to all commanders on the ground.

“Akashteer’s digital backbone offered unmatched situational awareness and real-time command-and-control capabilities, enabling commanders to neutralise threats swiftly without risking friendly aerial platforms,” the officer said. The “sheer scale” of engagement, speed of deployment, and level of integration between sensors, shooters & networks across the Services is “a turning point” in India’s AD preparedness, he added.

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Akashteer neutralised barrage of Pakistani missiles, drones

Source: The Economic Times, Dt. 16 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/akashteer-neutralised-barrage-of-pakistani-missiles-drones/articleshow/121217667.cms

India's indigenously-developed Akashteer air defence control and reporting system played a pivotal role in neutralising waves of Pakistani aerial attacks including drones and missiles during the four-day military confrontation with Pakistan. While Pakistan relied on imported HQ-9 and HQ-16 systems that failed to intercept Indian strikes, Akashteer showcased India's dominance in automated air defence, the defence ministry said on Friday.

Manufactured by state-run Bharat Electronics Limited (BEL), Akashteer was inducted into the Indian Army around a year ago. "In the dark skies, a new kind of warrior awakened. It did not roar like a fighter jet or flash like a missile. It listened. It calculated. It struck," the defence ministry said. "This invisible shield, Akashteer, is no longer a concept confined to defence journals. It is the sharp edge of India's air defence, the unseen wall that stopped a barrage of missiles and drones on the night of May 9 and 10, when Pakistan launched its deadliest attack on Indian military and civilian areas," it said.

Under Operation Sindoor, India carried out precision strikes on terror infrastructure early on May 7 in response to the April 22 Pahalgam terror attack. Following the Indian action, Pakistan attempted to attack Indian military bases on May 8, 9 and 10. The Pakistani attempts were strongly responded to by the Indian side by inflicting heavy damages to a number of key Pakistani military installations including air bases, air defence systems, command and control centres and radar sites. Foreign Secretary Vikram Misri on May 10 announced that India and Pakistan reached an understanding to stop all firings and military actions on land, air and sea, with immediate effect.

In sharing the role played by Akashteer, the defence ministry said it is India's fully indigenous, automated air defence control and reporting system, that intercepted and neutralised every inbound projectile. "Akashteer has demonstrated that it sees, decides, and strikes faster than anything the world has fielded," the ministry said in a statement. Explaining the air defence system's features, the system reduces the possibility of friendly fire, allowing rapid engagement of hostile targets while ensuring the protection of aircraft in contested airspace. "Akashteer is not about brute force, it is about intelligent warfare. The system provides a common, real-time air picture to all involved parties (control room, radars and Defence Gun), enabling coordinated air defense operations," the ministry said.

"It is a system designed to automate detection, tracking and engagement of enemy aircraft, drones and missiles," it added. The ministry said the air defence system integrates various radar systems, sensors and communication technologies into a single operational framework. Akashteer gathers data from multiple sources, processes it and allows for automated, real-time engagement decisions, it added. The air defence system is part of the broader C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) framework, working in coordination with other systems. It is vehicle-based which makes it mobile and easier to handle in hostile environments.

"Unlike traditional air defence models that rely on ground-based radars and manual decisions, Akashteer enables autonomous monitoring of low-level airspace in battle zones and efficient control of ground-based air defence weapon systems," the ministry said. "This marks a clear shift in India's strategic principle- from passive defence to proactive retaliation. Its seamless integration with India's larger C4ISR ecosystem allows the Army, Navy and Air Force to operate with unmatched synergy," it added.

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India will become self-reliant in fighter jet manufacturing in next few years: Ex-chief designer of LCA Tejas

Source: The Economic Times, Dt. 16 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/india-will-become-self-reliant-in-fighter-jet-manufacturing-in-next-few-years-ex-chief-designer-of-lca-tejas/articleshow/121209880.cms

India will become self-reliant in manufacturing fighter jets in a few years, said Kota Harinarayana, the former programme director and chief designer of India's Light Combat Aircraft (LCA) Tejas.

Harinarayana, a Padma Shri awardee, added that the ecosystem of manufacturing an aircraft has been developed in the country. He said that India will make a series of fighter jets of all categories to address the need of the Indian Air Force (IAF) with the improvement in technology for the production of iindigenous aircraft. "I hope that in the next few years, India will make all fighter jets required for defence and will also start exporting these to our friendly countries," Harinarayana said.

The former director and chief designer Tejas said that the country had developed the aircraft from small- to medium-sized and unmanned aircraft. "Time will come, not very long, India will become the exporter of defence products...the country is now procuring some of these products from Russia and France," said the 82-year-old aviation scientist who was here to attend the convocation of a private university on Thursday.

The increased use of Tejas by the IAF has proven the significance and importance of the indigenously built aircraft, he said. Harinarayana said that India has displayed its capabilities in the defence sector by successfully defnding against Pakistani attacks after Operation Sindoor that was launched against terror camps in Pakistan and Pakistan-occupied Kashmir.

The former professor at the Defence Research and Development Organisation (DRDO) said that the development and successful utilisation of defence products clearly showed the country's capabilities in the operation, terming it as only the first phase. Harinarayana also praised India's successful trial of 'Bhargavastra', an indigenous, budget-friendly counter-drone system, in Gopalpur in Odisha's Ganjam district on Wednesday.

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AI in the battlefield: How India leveraged new age warfare to thwart Pakistan’s aerial attacks

Source: The Indian Express, Dt. 16 May 2025,
URL: https://indianexpress.com/article/business/ai-india-pakistan-conflict-aerial-attacks-10009639/

In the four-day military conflict between India and Pakistan, which began on the intervening night of May 6 and May 7, defence sources said that New Delhi managed to hit multiple military installations in the neighbouring country and thwarted a barrage of attacks from them due to a successful integration of the country’s “space know how”, “electronics” and “computing expertise using artificial intelligence (AI)”. Sources said that India having its indigenous navigation systems, air defense ability to intercept enemy objects through both hard and soft kill techniques and its deeper and precise penetration ability to strike strategic locations in Pakistan demonstrated the country’s growing capabilities to use technological advances as a strategic advantage.

AI for situational awarenessThe Indian armed forces used AI cloud-based integrated air command and control systems to detect and position any hostile objects in the sky. “From detecting a radar picture of an enemy object in the sky, or taking a strategic position to shoot it down from land, sea and air was demonstrated using AI cloud-based state of the art integrated air command and control systems,” a defence source said. Many of the country’s integrated technology capabilities were

deployed towards creating an impenetrable shield against incoming aerial threats from Pakistan during the military conflict of the past week. The use of these technologies found its roots more than half a decade ago, when the armed forces began the thought work to utilise AI in their defensive and offensive capabilities.

AI roadmap

In 2018, the Ministry of Defence (MoD) had set up a multi-stakeholder task force to study issues around the strategic implications of AI from a national security perspective. Based on the recommendations of this task force, the MoD created the Defence AI Council (DAIC) and Defence AI Project Agency (DAIPA) for providing necessary guidance to enable the development of an operating framework, policy level changes and structural support for AI adoption in the armed forces. In 2022, the government also finalised a roadmap for defence public sector companies under which 70 defence specific AI projects were finalised, of which 40 had been completed. Until 2026, a total of 129 AI-based projects have been greenlit in the defence sector of which 77 have been completed. As of 2022, Rs 100 crore was allocated by each defence service for AI implementation.

Bharat Electronics Limited, for instance, has developed an AI-based system for enemy aircraft activity recognition and classification which enables the armed forces to automatically recognise and identify enemy aircraft's plans, leading to improved situational awareness. This solution is likely to be available in India's Integrated Air Command and Control System (IACCS). The PSU has also developed the Indian Air Force's IACCS that integrates data from all air defence assets to give the armed forces comprehensive situational awareness during air operations, allowing them to respond to a wide range of aerial threats.

The Indian Army has developed an AI-Based Intercept Management System (IMS) to analyse and automate intercepts of an adversary in Western Theatre. The software makes use of visualisation techniques and AI to interpret op-critical data, generating an accurate intelligence picture. The IMS can carry out automated analysis and interpretation using AI, and categorise and visualise intercepts using data science tools. The Centre for Artificial Intelligence & Robotics (CAIR) under the Defence Research & Development Organisation (DRDO) has also developed a Air Defence Control and Reporting System (ADC & RS), which is used to detect all aerial targets and neutralise the threat well away from vulnerable areas by effective integration of all air defence weapon systems.

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1971 to Operation Sindoor, a paradigm shift in warfare

- Arun Prakash, a former chief of naval staff

Source: Hindustan Times, Dt. 18 May 2025,
URL: https://www.hindustantimes.com/opinion/1971-to-operation-sindoor-a-paradigm-shift-in-warfare-101747586821947.html

The news of Indian Air Force (IAF) missiles striking Pakistan Air Force (PAF) base Nur Khan with pinpoint accuracy during Operation Sindoor took me back to the morning of December 4, 1971.

Serving with an IAF squadron, I had led a section of two fighter-bombers to strike the same target then known as PAF Base Chaklala. Located just a few miles northeast of the Pak army headquarters in Rawalpindi, it was a heavily defended base, but my wingman and I returned home safely, after attacking some transport aircraft on the ground.

Separated by 54 years, Operation Sindoor, launched by India on May 7, 2025, in response to a terror attack in Pahalgam, and the 1971 India-Pakistan War are completely distinct events with vastly dissimilar contexts, objectives, and scales. However, a brief comparison of operations may be informative for the lay reader to grasp how radically the nature of warfare has changed over the half century separating these two conflicts. The proximate cause for outbreak of hostilities in 1971 was the pre-emptive strike by over 100 Pakistan Air Force (PAF) fighters on 12 Indian Air Force (IAF) bases in north India at dusk on December 3, 1971. This was followed by an extensive night offensive by PAF bombers. By midnight, India declared war. The IAF mounted a powerful counter-air response, and this provides the first major difference between then and now.

Most of the participating aircraft in 1971 were sub-sonic, second-generation fighters and bombers. The pilot's primary sensor was his eyeball, and since GPS had not yet arrived, navigation was by compass and clock. Armed with bombs, rockets and cannon (all of them "dumb" or un-guided), the attacking aircraft had to approach the target, enter a dive and release/fire weapons from a range of 800-1500 yards, before making a high-speed exit. During approach and departure, the attackers would be exposed to intense fire from anti-aircraft guns of various calibres, and occasionally, from surface-to-air missiles (SAM), inflicting heavy attrition. Operation Sindoor, on the other hand, saw the deployment of fourth and fifth generation supersonic aircraft equipped with advanced sensors and smart, guided weapons. The long-range bombs and missiles had stand-off ranges of 50 to 250 miles, and ground targets could, therefore, be attacked from within own territory, without risking exposure of pilot and aircraft to adversary ground fire or SAMs.

Another major threat to attacking aircraft in 1971 was the enemy CAP or combat air patrol mounted over vulnerable points/areas. When threatened by a CAP, the attacker could either flee or join combat after jettisoning weapons and auxiliary fuel tanks. During close (within visual-range) combat, both pilots manoeuvred with full engine-power under high gravity-loading, trying to close-in to less than 200 yards, before opening cannon fire for the kill. The few aircraft equipped with close-combat air-to-air missiles could engage targets at ranges of two to five miles.

The aircraft deployed in Operation Sindoor were not only equipped with powerful, electronically scanned radars that could detect small targets at vast distances but could also engage them with air-to-air missiles of beyond-visual-range (BVR) capability. Thus, pilots on both sides had the ability to detect and, if required, launch missiles on targets at ranges of 60-100 miles or more without ever sighting each other. With both air forces operating high-flying airborne warning and control system (Awacs) aircraft, the complete air picture could be monitored and aircraft control exercised by the Awacs crew. The Awacs could also pass target information to a fighter via datalink without the latter having to transmit on its own radar. It is presumed that radio communication on both sides was electronically encrypted and could not be monitored by the adversary.

Unprecedented in earlier conflicts, both India and Pakistan employed unmanned aerial vehicles (UAVs) or drones which reduced the need for manned incursions, offering low-risk high-impact

options for strikes and reconnaissance. UAVs, designated loitering munition also known as suicide or kamikaze drones, are weapons that can hover/loiter silently for hours in the vicinity of a target before striking either autonomously or on command. The drone threat had fortuitously triggered a whole ecosystem of Indian public and private sector companies developing innovative anti-drone technologies. Thus, there were adequate indigenous soft and hard-kill measures in place to neutralise drone swarms launched by Pakistan to attack our critical infrastructure.

Unlike in the 1971 war, Operation Sindoor involved no ground troop movements across borders. The Indian Army focused on defensive postures and retaliatory fire from Indian territory. This shift reflected a strategic choice as ground invasions run the risk of an expanded conventional conflict and uncontrolled escalation, especially, in a nuclear environment. In this context, an inference could, cautiously, be drawn that Operation Sindoor has further expanded the space for conventional operations below the nuclear threshold.

In 1971, the Indian Navy (IN) had played a key role in the outcome of operations, in both theatres of war, waging missile warfare in the west and mounting a carrier-borne air offensive in the east. In Operation Sindoor, the IN played a silent but, nevertheless, crucial role. An aircraft carrier task force was deployed in the north Arabian Sea, ready to undertake aircraft or missile strikes if ordered. In the lexicon of maritime operations, a robust naval presence has by itself numerous strategic implications. Given Pakistan’s small coastline, with just 3-4 usable ports, considerable economic and psychological pressure could be built up by an IN taskforce exercising control over its maritime lifelines, carrying trade, energy and food.

While providing a brief insight into the changed nature of warfare, Operation Sindoor also raises some questions about the future. Will technology-driven, non-contact warfare, which minimizes escalation become the preferred option, replacing boots on the ground? Will autonomous weapons with lethality and range become more important than platforms like manned combat aircraft? While the success of Operation Sindoor does highlight a paradigm shift in warfare, can we assume that territorial transgressions are obsolete and that political imperatives will never again demand traditional war?

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How India used unmanned dummy aircraft to fool Pakistan during Operation Sindoor

Source: Hindustan Times, Dt. 17 May 2025,
URL: https://www.hindustantimes.com/india-news/how-india-used-unmanned-dummy-aircrafts-to-fool-pakistan-during-operation-sindoor-101747463017133.html

Operation Sindoor, India's coordinated military retaliation following the deadly Pahalgam terror attack on April 22, delivered a strong message against terrorism by striking nine terror targets in Pakistan and Pakistan-occupied Kashmir. But it wasn’t just the Indian Armed Forces' firepower that caught the Pakistan military off guard, it was the well-planned deception.

According to an ANI report, which cites highly placed defence sources, the Indian Air Force (IAF) used dummy aircraft disguised as fighter jets to bait and disable Pakistan's Chinese-supplied air

defence systems during Operation Sindoor. On the night of May 9–10, India struck 11 out of 12 key Pakistani air bases. However, before launching its wave of missile attacks, the IAF first sent in unmanned target aircraft camouflaged to mimic real fighter aircraft.

This led to Pakistani radars scrambling to knock down what they believed were India's incoming fighter jets, resulting in the activation of their HQ-9 missile systems, revealing their locations and exposing them to attack.

The Pakistan Air Force mobilised its entire set of HQ-9 air defence missile system launchers and radars to different locations, and some of them were deployed at new locations but were detected after being activated, ANI reported.

The Indian Air Force then followed up with the long-range missile attacks on the Pakistani air bases, which included the BrahMos and Scalp missiles. Around 15 BrahMos missiles and Scalp, Rampage and Crystal Maze missiles were launched in the offensive.

These strikes disabled airstrips, hangars, and communication infrastructure across Pakistan’s air force network, reportedly damaging an airborne early warning aircraft and several long-endurance drones in Sindh. According to defence sources, this is the first known operational use of the BrahMos missile system in active conflict.

Sources told ANI that the strikes on its air bases were so intense that the Pakistani side dropped all plans for a counter to the capitulation of their air defence system and urgently requested DGMO talks to arrive at an 'understanding' with India to put a pause to all military action going forward.

The aircraft packages for the missions were controlled mainly from the Western Air Command and the Southwestern Air Command area of responsibility.

The aerial attacks launched by the Pakistani Air Force using land attack ballistic missiles, air-launched cruise missiles, and unmanned combat aircraft were mainly thwarted by the combination of the Russian S-400, MRSAM, and Akash air defence missile units, along with other old systems.

India-Pakistan ceasefire understanding

Both India and Pakistan last week announced an immediate ceasefire of all hostilities across land, air, and sea. However, just hours after the ceasefire understanding, a series of drone sightings and explosions rocked Jammu and Kashmir, triggering air defence responses by Indian security forces to neutralise the aerial threats.

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Inside India's SEAD mission: How 'dummy aircraft' was used to lure Pakistan radars before precision strikes

Source: The Week, Dt. 17 May 2025,
URL: https://www.theweek.in/news/defence/2025/05/17/inside-indias-sead-mission-how-dummy-aircraft-was-used-to-lure-pakistan-radars-before-precision-strikes.html

The precision strikes by India against key Pakistani air bases during the recent military stand-off involved the use of "dummy pilotless aircraft" disguised as real fighter jet to hoodwink Pakistan's

China-supplied air defence systems. Suppression of Enemy Air Defenses (SEAD) missions, using decoy aircraft, to confuse, saturate, and exhaust enemy air defence systems, is an integral part of modern warfare and India too appears to have made use of the tactic to target Pakistan's airbases. SEAD missions typically aim to neutralise threats from enemy air defences and allow friendly aircraft to operate safely. SEAD can be achieved either by physically destroying the defence systems or by electronic warfare techniques that jam or deceive enemy radars and communications.

According to news agency ANI, when Pakistan's radars and defence network were activated to bring down the decoy aircraft which mimicked an actual aircraft, India launched its loitering munitions high to target the command and control systems of the country. Pakistan's HQ-9 air defence missile system launchers and radars which were mobilised to thwart the Indian attacks were detected by India.

India used long-range missile systems to launch the likes of BrahMos and SCALP missiles. BrahMos supersonic cruise missiles appear to have caused the most destruction to Pakistani airfields. Indian Air Force fired around 15 BrahMos missiles to target the Pakistani air force base to disrupt their ability to launch aircraft and other operations, ANI quoted defence sources as saying.

“This was the first time the BrahMos missile system was used in an active conflict...Its performance exceeded expectations, delivering high-precision strikes that crippled key Pakistani air assets and defence networks,” sources told ANI.

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ड्रोन के युग में भारत की तरफ से महंगे F-35 फाइटर प्लेन खरीदना मूर्खता होगी? समझ लीजिए कैसे

Source: NavBharat Times, Dt. 18 May 2025,
URL: https://navbharattimes.indiatimes.com/india/india-pakistan-war-does-india-need-pricey-f35s-in-the-drone-age-as-defence-experts-on-war-lesson/articleshow/121244020.cms

दुनिया भर के डिफेंस एक्सपर्ट्स भविष्य के युद्धों के लिए सबक लेने के लिए भारत–पाक के बीच होने वाले युद्ध के डिटेल की जांच कर रहे हैं। अधिकांश विश्लेषण रूस–यूक्रेन युद्ध से मुख्य सबक की पुष्टि करते हैं कि सस्ते ड्रोन और लोइटरिंग हथियार अरबों की लागत वाले फैंसी विमानों और टैंकों की तुलना में बहुत सस्ते और अधिक प्रभावी हैं। लोइटरिंग हथियार ऐसे ड्रोन होते हैं जो कुछ समय के लिए लक्ष्य के ऊपर मंडराते हैं, हमले की सबसे बेस्ट लाइन को कैलकुलेट करते हैं और फिर हाई प्रिसिजन के साथ टारगेट को मारते हैं। भविष्य के युद्ध ड्रोन के जरिये ही संचालित होंगे। इनकी लागत पारंपरिक हथियारों का एक छोटा सा हिस्सा है।

ऑपरेशन सिंदूर के तुरंत बाद कई तथ्य विवादित थे, लेकिन अब दूसरे देशों के विश्लेषकों ने पहले और बाद की तस्वीरों की विस्तृत जांच के बाद अपने विचार दिए हैं। वे पुष्टि करते हैं कि भारत के ऑपरेशन सिंदूर में ड्रोन और क्रूज मिसाइलों का इस्तेमाल करके पाकिस्तानी क्षेत्र में अंदर तक लक्ष्य को निशाना बनाया गया। वे पाकिस्तान की डिफेंस सिस्टम से बच गए क्योंकि वे रडार से बचते हुए पेड़ की चोटी की ऊंचाई पर उड़े।

तस्वीरें पाकिस्तानी एयर डिफेंस सिस्टम पर बाद में भारतीय हमले से हुए नुकसान की भी पुष्टि करती हैं। पाकिस्तान ने दावा किया कि उसने पांच भारतीय विमानों को मार गिराया है, जिनमें तीन राफेल भी शामिल हैं। कुछ विदेशी विश्लेषकों का मानना है कि ये दावे सही हो सकते हैं, क्योंकि पाकिस्तान को अमेरिकी F-16 की तुलना में सस्ते J-10 चीनी लड़ाकू विमानों से अधिक फायदा हो रहा है। भारत ने जेट विमानों के गिराए जाने की खबरों का खंडन करते हुए कहा है कि वह उचित समय पर विवरण देगा।

टैंक पर भारी पड़ रहे ड्रोन!

सबसे ठोस सबक वे हैं जो यूक्रेन युद्ध से पहले से ही ज्ञात बातों की पुष्टि करते हैं। सबसे पहले, यूक्रेनी तहखानों और अस्थायी प्रयोगशालाओं में प्रशिक्षित गैर-इंजीनियरों के जरिये बनाए गए सस्ते ड्रोन की कीमत 350 डॉलर से अधिक नहीं है, लेकिन उन्होंने रूसी ठिकानों को भारी नुकसान पहुंचाया है। रक्षा विशेषज्ञ जॉन थॉर्नहिल की रिपोर्ट है कि अब फूलवाले और बेकर भी कीव में बेसमेंट कारखानों में ड्रोन बना रहे हैं।

1,000 डॉलर की कीमत वाले तीन ड्रोन लाखों डॉलर की कीमत वाले रूसी टैंक को ध्वस्त कर सकते हैं। लाभ-लागत अनुपात बहुत बड़ा है। यूक्रेनी इंजीनियर लगातार इन ड्रोन को रूसी ड्रोन विरोधी उपायों से निपटने के लिए तैयार कर रहे हैं। रूस भी ड्रोन को बहुत कारगर मानता है और अब बड़े पैमाने पर इनका उत्पादन कर रहा है। इसका मतलब यह नहीं है कि लड़ाकू विमान और टैंक पूरी तरह से अप्रचलित हो गए हैं, जैसा कि चीनी जे-10 लड़ाकू विमानों के साथ पाकिस्तान की सफलता से पता चलता है। लेकिन वे कम महत्वपूर्ण हैं, और अब युद्ध में हावी नहीं होंगे। युद्धक टैंक अब ज़मीनी लड़ाई में मुख्य हथियार नहीं रहेंगे।

ड्रोन खरीदने के लिए लगेगी लाइन

थॉर्नहिल का कहना है कि यूक्रेन ने प्रति वर्ष दस लाख ड्रोन उत्पादन की क्षमता का लक्ष्य रखा था, लेकिन निजी क्षेत्र के निर्माण के कारण यह पहले ही पांच मिलियन तक पहुँच सकता है। रूस भी उतनी ही तेज़ी से आगे बढ़ रहा है। एक बार यूक्रेन युद्ध समाप्त हो जाने के बाद, देश रूस और यूक्रेन दोनों से ड्रोन खरीदने के लिए कतार में लग सकते हैं। लेकिन तैयार खरीद केवल शुरुआत हो सकती है – हर देश को यूक्रेन की तरह ड्रोन इलेक्ट्रॉनिक्स में इनोवेशन और अपग्रेड करने की क्षमता विकसित करनी होगी।

भारत में भी ड्रोन पर काम

रूस द्वारा यूक्रेनी ड्रोन को जाम करने के कारण बाद वाले ने इलेक्ट्रॉनिक तरंगों के बजाय ऑनबोर्ड स्पूल से ऑप्टिक फाइबर द्वारा सिग्नल ले जाने वाले केबल ड्रोन विकसित किए, और इसलिए उन्हें जाम नहीं किया जा सकता। भारतीय ड्रोन निर्माता भी ऐसे लचीले कौशल विकसित करने के लिए काम कर रहे हैं। यूक्रेन के डिजिटल परिवर्तन मंत्री के सलाहकार जियोर्जी त्स्कैकिया कहते हैं कि यूक्रेन ने चार ड्रोन उत्पादकों के साथ शुरुआत की थी, लेकिन अब इसकी संख्या 500 हो गई है। यह तेज़ी से बढ़ रहा है। उन्होंने कहा किहमने लालफीताशाही को काफी हद तक कम कर दिया है। हमने हर उस चीज को नियंत्रण मुक्त कर दिया है जो बाजार के विकास में बाधा बन रही थी। हमने स्पेयर पार्ट्स के आयात पर लगने वाले टैक्स को समाप्त कर दिया है...हमने एक प्रतिशत से 25 प्रतिशत तक लाभ का मार्जिन बढ़ा दिया है।

डिफेंस प्रोडक्शन को लेकर सबक

एक स्पष्ट सबक है कि किसी को यह नहीं सोचना चाहिए कि सरकार अकेले डिफेंस प्रोडक्शन कर सकती है। उचित प्रोत्साहन के साथ, यूक्रेनी प्राइवेट सेक्टर ने आश्चर्यजनक परिणाम हासिल किए हैं। कांग्रेस ने लंबे समय से रक्षा उत्पादन, अंतरिक्ष और परमाणु ऊर्जा को सार्वजनिक क्षेत्र के लिए आरक्षित रखा था। लेकिन बीजेपी सरकार ने तीनों को निजी कंपनियों के लिए खोल दिया है।

प्रतिक्रिया सभी उम्मीदों से बढ़कर रही है। भारतीय कंपनियां सबसे बेहतर तरीके से रक्षा क्षेत्रों में आगे बढ़ी हैं। आज भारत में इस क्षेत्र में लगभग 200 कंपनियां हैं। कई स्टार्टअप ने पूंजी–गहन क्षेत्रों में सफल होने के लिए पर्याप्त निजी पूंजी आकर्षित की है, जिन्हें कभी केवल सरकारी समर्थन वाली सार्वजनिक क्षेत्र की कंपनियों के लिए ही संभव माना जाता था।

F-35 फाइटर प्लेन खरीदना मूर्खता!

भारत–अमेरिका व्यापार वार्ता में अमेरिकी F–35 लड़ाकू विमानों की संभावित भारतीय खरीद को शामिल किया गया है। इनकी कीमत 10 करोड़ डॉलर प्रति विमान हो सकती है। यह मूर्खता होगी। टेस्ला और स्पेसएक्स के सीईओ एलन मस्क ने अपने सोशल प्लेटफॉर्म एक्स पर एक वीडियो शेयर किया, जिसमें समन्वित ड्रोन झुंड दिखाया गया है और लिखा है कि इस बीच, कुछ बेवकूफ अभी भी F–35 जैसे मानवयुक्त लड़ाकू विमान बना रहे हैं। मस्क को ऐसे मामलों के बारे में एक–दो बातें पता हैं। भारत को केवल अमेरिका के साथ अपने ट्रेड सरप्लस को कम करने के लिए F–35 नहीं खरीदना चाहिए। कृपया दूसरी चीजों को देखें।

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Adani partners with Sparton to develop anti-submarine warfare solutions

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/adani-partners-with-sparton-to-develop-anti-submarine-warfare-solutions/articleshow/121249355.cms

Billionaire Gautam Adani's group has signed a deal with a US undersea warfare company Sparton to develop electronic sensors and navigation systems that could be used for anti-submarine warfare, the conglomerate said on Sunday. Adani Defence & Aerospace has signed a binding collaboration agreement with Sparton (DeLeon Springs LLC) to assemble anti-submarine warfare (ASW) solutions for the Indian Navy, it said in a statement.

The partnership aims to localise the assemblage of sonobuoys and other ASW systems in India under the 'Aatmanirbhar Bharat' initiative. It will be the first private company in India to offer indigenous Sonobuoys solutions to the Indian Navy. Headquartered in De Leon Springs, Florida, Sparton develops, produces and supplies electronic systems to support undersea warfare for the US Navy and allied military forces. The firm was, in December 2020, acquired by Israeli defence electronics company Elbit Systems Ltd. Prior to the current deal, the Adani Group had in 2018 set up a joint venture partnership with Israeli weapons giant Elbit Systems to manufacture lethal Hermes 900 drones. In 2020, Adani-Elbit announced 'mini' drone missile weapons production.

Adani Group has also partnered with Israel Weapon Industries to manufacture assault weapons, sniper rifles and machine guns. In a statement on Sunday, Adani Defence & Aerospace said it "has signed a binding collaboration agreement with Sparton (DeLeon Springs LLC), a group company of Elbit Systems and a leading provider of advanced anti-submarine warfare systems. This partnership marks a significant step toward localising the assembly of complex electronic systems and advanced Anti-Submarine Warfare (ASW) solutions for the Indian and global markets".

The partnership will combine Sparton's pioneering ASW technology with Adani Defence's established expertise in development, manufacturing, and sustenance for the Indian Navy.

Sonobuoys are mission-critical platforms for enhancing Undersea Domain Awareness (UDA), providing an effective means to detect, locate, and track submarines and other underwater threats. Playing a key role in anti-submarine warfare (ASW) and other naval operations, they support in maintaining naval security and protecting carrier strike groups. Sparton manufactures electronic sensor systems, navigation systems, and undersea warfare delivery systems.

"For decades, India has been importing this critical naval capability from global markets, increasing our dependence on foreign OEMs. Aligned with the 'Aatmanirbhar Bharat' and 'Make in India' initiative, Sparton's ongoing relationship with the Indian Navy will now facilitate Adani Defence to indigenise the delivery of these solutions that are made in India, for India," the statement said. Jeet Adani, Vice President of Adani Enterprises, remarked, "In an increasingly volatile maritime environment, strengthening India's undersea warfare capabilities is not merely a strategic priority but an imperative for safeguarding sovereignty and national interests. The Indian Navy requires integrated, mission-ready ISR and anti-submarine warfare capabilities, including critical systems like sonobuoys, that are indigenously developed, swiftly deployable, and globally competitive.

"Through this partnership with Sparton, Adani Defence & Aerospace becomes the first private company in India to offer indigenised sonobuoy solutions, enabling access to advanced technologies while fostering a future-ready, self-reliant defence ecosystem. This initiative reflects our Group's vision of empowering India's armed forces with world-class capabilities that are designed, developed, and delivered in India, for India and the world."

Adani Defence is a unit of Mumbai-listed Adani Enterprises Ltd.

Ashish Rajvanshi, CEO, Adani Defence & Aerospace, said: "For decades, India has been dependent on imports for such critical technology. This partnership to bring world-class sonobuoy technology and integrate it with India's defence ecosystem is a step towards building self-reliant capabilities in this critical domain". Donnelly Bohan, President and CEO, Sparton DeLeon Springs LLC, added, "Sparton has a long legacy for problem solving, advanced engineering and manufacturing of America's best maritime defence solutions. We are proud to partner with Adani Defence & Aerospace to bring our proven anti-submarine warfare (ASW) technologies to India. This partnership will enable us to localise assemblage, create high-technology skill sets, and deliver reliable ASW solutions tailored to the India Navy's needs".

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BEL signs contract with Army for Indigenous Counter-Drone System, secures orders worth Rs 572 crore

Source: The Economic Times, Dt. 16 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/bel-signs-contract-with-army-for-indigenous-counter-drone-system-secures-orders-worth-rs-572-crore/articleshow/121218438.cms

Bharat Electronics Limited (BEL) and the Indian Army Air Defence have signed a contract for the Integrated Drone Detection and Interdiction System (IDDIS) on Friday. The system, developed

jointly by the Defence Research and Development Organisation (DRDO) and BEL, marks a significant milestone under the Government of India's Make in India initiative. The IDDIS is designed to detect, track, and neutralise hostile drones, providing a crucial layer of protection against evolving aerial threats.

"Navratna Defence Public Sector Undertaking, Bharat Electronics Limited (BEL), has secured additional orders worth Rs 572 Crores since the last disclosure on 07th April 2025. Major orders received include Integrated Drone Detection and Interdiction System (IDDIS), Software Defined Radio (SDR) and Data Communication Unit (DCU) for attack guns, AI based solutions for ships, simulators, communication equipment, jammers, spares, services etc," said the press statement from BEL. Apart from this, Bharat Electronics Limited (BEL) manufactured and indigenously designed air defence system, Akashteer, has demonstrated its power during Pakistan's drone attacks, neutralising the threats as soon as they enter India's airspace and making it "hell for Pakistan's air adventures."

Akashteer intercepted numerous drones, missiles, micro UAVs, and loitering munitions, emerging as a globally actionable defence asset. Lauding its effectiveness in real-world conflict, significantly enhancing India's air defence capabilities during recent tensions with Pakistan, BEL on Wednesday stated that the system had performed beyond its expectations, providing robust Air Defence to India during the current conflict.

"BEL is proud to announce that our in-house designed & manufactured Air Defence System, Akashteer, has proved its mettle in the war field. Ground-based Defence Systems integrated with Akashteer made it hell for Pakistan's air adventures," the Navratna Defence PSU stated on X. "The system performed beyond users' expectations, providing robust Air Defence to India during the current conflict. Akashteer ensures a seamless & unified air situation picture accessible to the lowest operational units of Army AD, enhancing situational awareness across the force," it added.

The Akashteer system, developed under a Rs 1,982 crore contract signed in March 2023, integrates surveillance assets, radar systems, and command units into a unified network, providing seamless situational awareness to the Indian Army's Air Defence units. Akashteer enables monitoring of low-level airspace over the Indian Army's battle areas and effectively controls Ground-Based Air Defence Weapon Systems. During the recent conflict following India's 'Operation Sindoor' on May 7, which targeted nine terror camps in Pakistan and Pakistan-occupied Kashmir (PoK), Akashteer neutralised numerous Pakistdrone and missile attacks, ensuring zero casualties and minimal material losses.

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Kirana Hills nuclear site: Pak nukes are under the scanner

Source: The Economic Times, Dt. 16 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/kirana-hills-nuclear-site-pak-nukes-are-under-the-scanner/articleshow/121208839.cms

Operation Sindoor has put a sensitive issue back in the spotlight -- what to do with Pakistan's nuclear weapons? With massive strikes on Pakistan's terror sites and air bases, India has surely

called Pakistan's nuclear bluff. Never has one nuclear power struck so hard at another nuclear power. The speculation about India hitting Kirana Hills nuclear site in Pakistan, which many claim houses Pakistan's nuclear command or tactical nuclear weapons, did not fade despite the Indian military's denial. Sighting of a US nuclear emergency aircraft flying near the area fuelled the chatter that India's strike must have led to fears about radioactive leakage. Days later, the International Atomic Energy Agency (IAEA) stated that there was no radiation leak or release from any nuclear facility in Pakistan.

A recent statement by defence minister Rajnath Singh has brought the issue of Pakistan's nuclear weapons into public discourse. Calling Pakistan a rogue nation with nukes, Rajnath Singh said Thursday its nuclear arsenal should be placed under the watch of the IAEA, and stressed that Islamabad’s nuclear blackmail failed to deter India’s response to terrorism under Operation Sindoor. Singh’s comments came soon after the PM drew a new red line, stressing that Pakistan’s nuclear blackmail will no longer work and India would continue to give cross-border kinetic responses to terror attacks.

While India has settled the issue of nuclear blackmail by Pakistan, the risk of a nuclear clash between the two countries can never be ruled out. India follows a no-first-use principle while Pakistan intends its nukes as purely a deterrent against India.

An ironic comment from an Indian military official too fuelled the speculation about India striking Kirana Hills. Air Marshal A K Bharti, director general of air operations for the Indian Air Force, when asked at a press briefing if India had struck Kirana Hills, said, “Thank you for telling us that Kirana Hills houses nuclear installations. We didn’t know about it. We have not hit Kirana Hills and whatever is there.”

Many think American intervention must have come due to India's strike at Kirana Hills as previous statements by President Donald Trump and V-P JD Vance indicated the US was not interested in intervening in Operation Sindoor.

Did India make a signal strike at Pakistan's nuclear facility as a warning?

Kirana Hills has been linked to Pakistan’s nuclear ambitions since the 1980s, a period when the country was actively developing its nuclear capabilities in response to regional security dynamics, particularly India’s nuclear advancements. Between 1983 and 1990, Pakistan conducted a series of "cold tests" or subcritical nuclear tests at Kirana Hills. These tests, which simulate nuclear explosions without triggering a fission reaction, were critical for Pakistan to refine its nuclear warhead designs without the need for large underground test sites. The Bulletin of the Atomic Scientists, in a 2023 report, identified Kirana Hills as a subcritical nuclear test site, noting its use in developing Pakistan’s nuclear program during this period. If India indeed hit Kirana Hills, it will indicate India's readiness to take out Pakistan's nuclear weapons if it fears during a conflict that Pakistan is about to use them against India.

Can America intervene?

The US intervened in Operation Sindoor after Pakistan felt helpless in the face of massive missile attacks that disabled its air bases. India halted the operation only after Pakistan called India and requested it to do so. Will the US intervene if there is a risk of Pakistan launching a nuclear strike?

There is no certainty if the US will be able to do so but it certainly has been planning for a long time to take out Pakistan's nukes in case a risk, even during an India-Pakistan war, arises.

It was reported by NBC News in 2011 that the US has a contingency plan to "snatch-and-grab" Pakistan's nuclear weapons, if and when the US President believes they are a threat to either America or its interests. Plans had been drawn up for dealing with worst-case scenarios in Pakistan, NBC news reported quoting several US officials, who said that ensuring security of Pakistan's nuclear weapons had long been a high US security priority even before 9/11 terrorist attacks.

Among the scenarios drawn by the report were Pakistan plunging into internal chaos, terrorists mounting a serious attack against a nuclear facility, hostilities breaking out with India, or Islamic extremists taking charge of the government or the Pakistan army.

In 2021, a Brookings article mentioned the American plan to capture Pakistan's nukes: "Indeed, since the shock of 9/11, Pakistan has come to represent such an exasperating problem that the U.S. has reportedly developed a secret plan to arbitrarily seize control of Pakistan’s nuclear arsenal if a terrorist group in Pakistan seemed on the edge of capturing some or all of its nuclear warheads," wrote Marvin Kalb. "When repeatedly questioned about the plan, U.S. officials have strung together an artful, if unpersuasive, collection of “no comments.”

An American snatch-and-grab plan may not seem feasible today when Pakistan has grown in military strength. However, India must have devised a secret plan to counter Pakistan's nuclear weapons during a war because without such a plan India would not have struck so deep inside Pakistan at so many of its air bases, a big enough provocation to trigger a nuclear war. The speculation about India's strike at Kirana Hills got wings because such a strike would signal India's capability to disable Pakistan's nukes and deter it from any impulsive action.

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Science & Technology News

US firm Vast keen to collaborate with ISRO on Bharat Antariksh Station

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/news/science/us-firm-vast-keen-to-collaborate-with-isro-on-bharat-antariksh-station/articleshow/121249048.cms

US-based space habitation company Vast has offered to collaborate with ISRO for the Bharat Antariksh Station that the Indian space agency plans to set up by 2035. Vast CEO Max Haot held discussions with Indian Space Research Organisation (ISRO) officials earlier this month for a possible collaboration in the field of space technology and offered to host Indian scientists and engineers on the space station his company plans to send to orbit next year.

The California-based company plans to launch Haven-1, a single-module space station, on a SpaceX Falcon 9 rocket in May 2026. With a mission life of three years, Haven-1 is a precursor to

Haven-2, which Vast hopes would qualify as a successor to the International Space Station that will be retired in 2031.

The International Space Station is a collaborative effort of the US, Russia, Canada, Japan and the European Space Agency. China also launched its space station, 'Tiangong', in 2021 and has maintained human presence in space.

"Some of the ideas that were being discussed is, you know, maybe we can offer access to our space station but also get access to that space station and share capacity or share size," Haot told PTI here. India plans to launch the first module of the Bharat Antariksh Station in 2028 and complete it by 2035.

"We definitely see a lot of opportunities if obviously India and ISRO welcome it to collaborate, especially (given) that our two countries are politically very friendly," Haot said.

"Right now, the other two human spaceflight-capable countries (Russia and China) are not in the same acceptable region for current US politics. So, that creates a unique situation where we might have two human spaceflight-capable countries that can work together," he added.

In 2023, the National Aeronautics and Space Administration (NASA) signed a five-year, unfunded Space Act Agreement (SAA) with Vast, with the stated purpose of helping the company's "concept maturation and eventual implementation of space station modules".

The Haven-1 spacecraft has a 45-metre-cubed volume and is designed to support up to four crew members for missions of an average of two weeks in length. It consists of four crew quarters for sleeping, several mid-deck lockers for science modules, a common area with a deployable table and multiple crew interfaces.

"Right now, we are solely focused on the SpaceX offering, but we are interested to hear whether there will be a competitive, reliable, safe option that we can use to bring our customers using the Gaganyaan vehicle to our space station," Haot said.

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ISRO’s PSLV-C61 EOS-09 launch aborted midway; ISRO Chief V. Narayanan explains why

Source: The Economic Times, Dt. 18 May 2025,
URL: https://economictimes.indiatimes.com/news/science/isro-eos-09-launch-aborts-midway-isro-chief-v-narayanan-explains-why/articleshow/121244429.cms

Sriharikota: ISRO chairman V Narayanan addresses media after PSLV-C61 rocket carrying Earth Observation Satellite (EOS-09) lifted off from the first launch pad, in Sriharikota. After a precise liftoff, Chairman V Narayanan said that the mission could not be accomplished as planned. (PTI Photo/R Senthilkumar)

India's 101st space mission from Sriharikota suffered a major setback early Sunday when the Indian Space Research Organisation (ISRO) failed to complete the launch of its Earth observation satellite EOS-09. The mission lifted off as scheduled at 5:59 AM from the Satish Dhawan Space

Centre but encountered an anomaly in the third stage of the Polar Satellite Launch Vehicle (PSLV-C61).

“Today we targeted the 101st launch from Sriharikota, the PSLV-C61 EOS-09 mission. The PSLV is a four-stage vehicle and up to the second stage, the performance was normal. The third stage motor started perfectly but during the functioning of the third stage we are seeing an observation and the mission could not be accomplished,” ISRO Chairman V Narayanan said in a post-launch statement.

He added, “...and the motor pressure—there was a fall in the chamber pressure of the motor case and the mission could not be accomplished. We are studying the entire performance, we shall come back at the earliest.”

ISRO PSLV-C61 EOS-09: Third stage falters after smooth lift-off

Though the PSLV-C61 launched without delay and performed reliably through its first two stages, the solid-fuel third stage failed to maintain the required pressure. This disruption halted the progress of the 1,696.24 kg EOS-09 satellite, which was designed for all-weather, day-and-night Earth observation.

The rocket, towering at 44.5 metres and weighing 321 tonnes, was carrying the high-performance Synthetic Aperture Radar (SAR) payload, intended to support sectors like agriculture, disaster response, urban planning, forestry and national security.

The mission was also structured to be debris-free, with fuel reserved for de-orbiting the satellite after its operational life to prevent long-term space debris.

ISRO’s track record and the significance of EOS-09

This mission was the 63rd overall flight of the PSLV and the 27th using its heavier-lifting XL configuration. PSLV failures are rare. Since its first flight in 1993, ISRO has recorded just three setbacks, including Sunday’s mission.

The previous failures were PSLV-D1 in 1993 and PSLV-C39 in 2017, the latter due to a faulty heat shield that prevented satellite deployment. The current failure is expected to prompt an internal review as well as the formation of a Failure Analysis Committee.

The EOS-09 satellite, similar to the EOS-04 launched in 2022, was developed to enhance the frequency and reliability of remote sensing data. The SAR payload inside the satellite could have delivered high-resolution images even in cloudy or dark conditions—key for precision-based resource management.

Failure Analysis Committee to investigate

ISRO has confirmed that a detailed review will be undertaken to assess what went wrong. “Today 101st launch was attempted, PSLV-C61 performance was normal till 2nd stage. Due to an observation in 3rd stage, the mission could not be accomplished,” ISRO stated on its official X handle.

Sources told CNN-News18 that a Failure Analysis Committee (FAC) will be set up to probe the issue. The FAC will include ISRO experts and members from the academic sector, and is likely to

be headed by a former ISRO Chief or a senior retired scientist. The committee will comb through flight data, launch preparations, and all associated systems. While ISRO has not yet released its final technical report, Chairman Narayanan's assurance suggests the agency will soon regroup for another attempt. "After analysis we shall come back," he said.

Despite Sunday's setback, ISRO maintains a strong reputation for dependable launch missions. The EOS-09 failure may delay upcoming plans temporarily, but it also offers the opportunity to reinforce technical rigour. For now, the space agency turns inward to evaluate its systems and regain momentum. India's ambitious space programme—marked by achievements like the Chandrayaan and Mars missions—remains undeterred. The mission may have failed, but the resolve remains intact.

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Launch of mission carrying Indian astronaut Shubhanshu Shukla to ISS likely on June 8

Source: The Indian Express, Dt. 19 May 2025,
URL: https://indianexpress.com/article/india/indian-astronaut-shubhanshu-shukla-june-launch-axiom-4-mission-10013661/

The Axiom-4 mission, which will carry Indian astronaut Shubhanshu Shukla and three others to the International Space Station, will fly no earlier than June 8, NASA has said in a recent statement.

The exact date of the launch has still not been announced though the countdown on the Axiom's website also indicates June 8 as the possible date. The mission was earlier scheduled to fly in the last week of May. A few days ago, Indian Space Research Organisation (ISRO) Chairman V Narayanan had said that the mission was expected to be launched in the first week of June.It is not clear what has delayed the launch of the Axiom-4 mission from its original schedule. In a statement a few days ago, NASA indicated that the rescheduling was caused because of logistical reasons.

"After reviewing the International Space Station (ISS) flight schedule, NASA and its partners are shifting launch opportunities for several upcoming missions. The schedule adjustments provide more time to finalise mission plans, spacecraft readiness, and logistics," it said.

The dates of two other missions to the ISS have also been affected, NASA said.Festive offerThe Axiom 4 mission is being operated by private US space company Axiom Space, in partnership with NASA and SpaceX. Apart from Shukla who will be piloting the mission, three other astronauts, one each from the United States, Poland and Hungary, would be travelling to the ISS. The Indian participation in this mission is a result of an agreement between ISRO and NASA.

The astronauts will travel in a new Dragon spacecraft built by SpaceX. It will be launched by Falcon 9 rocket, also of SpaceX. There have been some reports that suggest that the rescheduling could be a result of delays in operational readiness of the new Dragon spacecraft.

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Vast hydrogen reserves discovered in Earth's crust could power the planet for 170000

Source: The Times of India, Dt. 17 May 2025,
URL: https://timesofindia.indiatimes.com/science/vast-hydrogen-reserves-discovered-in-earths-crust-could-power-the-planet-for-170000-years/articleshow/121227605.cms

A groundbreaking study has uncovered staggering reserve of natural hydrogen hidden deep within the Earth's continental crust, a potential energy jackpot that could power humanity for the next 170,000 years. Researchers from the University of Oxford, Durham University, and the University of Toronto have found that this naturally occurring hydrogen could be tapped as a clean, long-term energy source. As the world races to replace fossil fuels and reduce carbon emissions, this discovery could revolutionise global energy systems and mark a major turning point in the quest for sustainable power.

What makes hydrogen so important

Hydrogen is a clean-burning fuel that emits only water when used, making it a key component in global climate strategies. It's already critical in industries like fertiliser production, and its role is expanding into transportation, electricity, and energy storage. However, most of today's hydrogen is made from fossil fuels, which cancels out its green potential. That is why naturally occurring hydrogen, also called "white hydrogen," is such a game-changer. It skips the emissions and could be harvested with minimal environmental impact.

Where exactly is this hydrogen hiding

The hydrogen isn't sitting in obvious gas pockets like oil or natural gas. It's trapped within the Earth's continental crust and slowly released over time by reactions between water and iron-rich rocks. Scientists have now mapped out regions, such as the Canadian Shield, where hydrogen naturally seeps to the surface. The new study suggests such areas could be far more widespread than previously thought, opening up the possibility of finding similar hydrogen sources across the globe.

Can we really use it as a fuel source

Yes, but it's not as simple as drilling and pumping. Tapping into natural hydrogen requires a new kind of exploration strategy that includes understanding how the gas forms, where it migrates, and how it stays trapped underground. Scientists are now developing methods to locate and safely extract it, similar to how we already extract helium. The potential is huge, but success depends on identifying areas where hydrogen accumulates in amounts that are economically viable.

What's stopping us from using it right now

One surprising challenge is bacteria. Some underground microbes actually consume hydrogen as food, which means these natural gas pockets can vanish over time. To keep the hydrogen usable, explorers must find places where it is protected from microbial life. There is also the need for technology, investment, and regulation to support this emerging energy frontier. While the science is promising, the path to large-scale use will require significant development and testing.

Could this solve the global energy crisis

Potentially, yes. If these underground hydrogen stores can be reliably located and harvested, they offer a low-carbon, long-term energy supply that could help replace fossil fuels. According to the study, this source alone could meet global hydrogen demand for hundreds of thousands of years. With global hydrogen use projected to grow sixfold by 2050, natural hydrogen could fill a major gap in the clean energy transition.

Who is leading the charge

The research team behind this discovery has already formed a company, Snowfox Discovery Ltd., to begin the search for usable hydrogen reserves. Combining geological expertise and satellite data, their mission is to find viable hydrogen accumulations that can be developed commercially. Their efforts represent a promising new chapter in the global search for clean energy.

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Our bodies perform a kind of mRNA editing and we don't know why

Source: The Hindu, Dt. 19 May 2025,
URL: https://www.thehindu.com/sci-tech/science/our-bodies-perform-a-kind-of-mrna-editing-and-we-dont-know-why/article69423396.ece

The noted geneticist and evolutionary biologist Theodosius Dobzhansky (1900-1975) published an essay in 1973 in the journal American Biology Teacher, titled 'Nothing in biology makes sense except in the light of evolution'. The title became wildly popular in scientific circles. It was even engraved in the Jordan Hall of Science of the University of Notre Dame in the US.

Recently, an article in the Journal of Molecular Evolution by Qiuhua Xie and Yuange Duan from China Agricultural University, Beijing, posited that even in evolution's light it is not easy to make sense of the widespread persistence of A-to-I RNA editing in animals and fungi.

A-to-I RNA editing had not yet been discovered in Dobzhansky's time.

Cooking a protein

The DNA is basically a book of recipes. Each recipe tells the cells in our bodies how to make specific proteins by combining 20 ingredients, called amino acids, in different ways.

Sometimes a recipe is for a single protein, sometimes it's for multiple. Either way, each recipe is called a gene. The recipes are written in the gene's own language, which uses an alphabet consisting of four 'letters': A, T, G, and C. For example, the ingredient alanine can be written as GCA, glycine can be written as GGT, and so on.

A cell transcribes the recipe to make a protein from a gene in the DNA to an mRNA. Then the cell moves the mRNA from the nucleus to the ribosome, where the mRNA is 'read' to make the protein.

Sometimes, after the cell copies a recipe to the mRNA, it switches particular letters in it — specifically, the 'A' in the mRNA language above (standing for adenosine) to 'I' (inosine). This conversion is called A-to-I mRNA editing. Proteins in the cell called ADAR are responsible for it.

And when a ribosome reads from this mRNA to make the protein, it reads inosine as though it was guanine. Thus, A-to-I mRNA editing results in a protein with an amino acid coded by, say, AXX to be manufactured as the protein with the amino acid encoded by GXX instead.

This can be dangerous.

Why so complicated?

Some letters in the recipe tell a ribosome where the recipe ends. They're called stop codons. Two examples are UAG and UGA. When the ADAR proteins act on either of them, the ribosome reads them as UGG instead, which is the instruction to insert the amino acid tryptophan. So instead of stopping at that point, the protein under construction receives tryptophan and the ribosome continues until it hits the next stop codon.

The funky part is that while we know ADAR-mediated A-to-I mRNA editing exists, we have no idea why.

mRNA, easy to customise, is the next frontier for personalised medicineFor example, if the goal was for a cell to instruct a ribosome to see UGG instead of UAG, it would have been simpler for the DNA to say UGG to begin with. But the ADAR-mediated way is for some unknown reason more complicated: the DNA says UAG, followed by the ADAR proteins intervening to change it to UGG later.

Making sense

In a January 2024 study, researchers from the Northwest A&F University in Yangling, China, posed this question to a fungus called Fusarium graminearum, which infects wheat and barley crops.But instead of finding another reminder of the mystery, they found a glimpse of a clue.

When F. graminearum grows on an infected plant, i.e. in its vegetative growth stage, its cells don't do any A-to-I mRNA editing. But when the fungus enters its sexual stage, more than 26,000 sites transcribed from its DNA into mRNA undergo A-to-I mRNA editing.

Why?

The team focused on 71 F. graminearum genes whose coding sequence was interrupted by a UAG stop codon that the ADAR proteins had scrambled. Since the pre-scrambled mRNA version of all these genes contained a premature stop codon, the team called the genes PSC.

When they deleted any one of the PSC genes from the genome, F. graminearum wasn't affected in its vegetative growth stage. But when they started deleting PSC genes in its sexual stage, there were observable effects.

This proved A-to-I mRNA editing was essential for the proper function of the PSC genes during sexual development.

They also found that the unedited version of two genes (PSC69 and PSC64) helped the fungus resist environmental stresses during the vegetative growth stage. This meant that mutating the A to a G in the DNA would be disadvantageous during asexual growth. These findings together explained why evolution didn't replace the A in the DNA sequence of these two genes with a G at the beginning of their lives.

Never so easy

Of the 71 genes the team examined, only two seemed to benefit from A-to-I mRNA editing. But what about the other 26,000 sites in the fungus's genome? It's possible that over time, the genes that benefit from A-to-I mRNA editing will increase and mRNA editing by ADARs will become an essential component of the gene-expression pathway. At that point, it's conceivable that more G-to-A mutations will begin to accumulate in the genome, sheltered by the ADAR-based editing machinery.

King Alfonso X (1221-1284) of Spain reputedly grumbled, "If the Lord Almighty had consulted me before embarking upon his creation, I should have recommended something simpler."

The Beijing researchers seem to have shared this lament but were more prosaic in their articulation. Explaining the net benefit of A-to-I mRNA editing "is far more difficult than revealing its function," they wrote in their paper.

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Cause of pesky failure mode in solid state Li-ion batteries found

Source: The Hindu, Dt. 18 May 2025,
URL: https://www.thehindu.com/sci-tech/science/cause-of-pesky-failure-mode-in-solid-state-li-ion-batteries-found/article69563675.ece

Scientists have reported in Science that the key to fixing solid-state battery (SSB) failures may lie in well-documented mechanical laws, paving the way for longer operational lifetimes.

A battery consists of an electrolyte sandwiched between the positive cathode and the negative anode. "In most batteries, including lithium-ion batteries in your cell phone, this electrolyte is a liquid solution, very similar to salt in water, that allows ions to move back and forth from the electrodes," said Naga Phani B. Aetukuri, an associate professor at the Indian Institute of Science, Bengaluru, not involved in the new study. His team is among the top groups in India developing SSBs.

In a battery, ions move freely through the electrolyte while electrons flow from the cathode to the anode via an external circuit, charging the battery. In the reverse process, the electrons given up by the lithium (Li) anode travel to the cathode via the external circuit, powering it. Inside the battery, the corresponding lithium ions scurry to the cathode through the electrolyte during discharge.

'Hairy roots'

In an SSB Li-ion battery, a ceramic block is the electrolyte. Solid electrolytes last longer, can store more energy, and are neither volatile nor flammable. Their solid structure separates the two electrodes well, reducing the need for bulky safety equipment and their weight. Currently, pacemakers and smartwatches use SSBs.

On the flip side, solids can crack, so solid electrolytes are inhospitable to volume changes or higher stress. This causes a persistent problem called dendrite growth. Li ions shuttle to the anode while charging and are deposited there, forming lithium filaments at the anode.

“Have you ever seen hairy roots growing from a central root? This occurs in plants to maximise their ability to receive nutrients,” Aetukuri said. Like a plant root, the anode tries to absorb as many ions as it can. “The dendritic growth of Li in SSBs maximises the anode’s ability to receive the most Li ions coming its way.” But like roots penetrate rocks, the dendrites pierce the electrolyte layer and reach the cathode, creating a short circuit.

Operando microscopy

Scientists don’t know the actual physical mechanism that causes such a failure. Now, researchers from Tongji University in Shanghai and other institutions have said the answer may lie in a known mechanical problem.

Metallic materials undergo fatigue due to cyclic loading and unloading. Cracks and fractures from fatigue account for over 80% of engineering failures. The researchers surmised that, as a metal, the Li anode in a battery could suffer similar damage from multiple charge-discharge cycles.

Dendrites “are microscopic features, meaning you need a microscope to visualise them. And you need to see while they are growing — that is when the cell is under operation,” Aetukuri said. For this, scientists use a technique called operando scanning electron microscopy: “a special microscopy technique where electrons are the light that lets you see what is happening at small dimensions.”

The researchers observed the anode-electrolyte interface under this microscope, monitoring its evolution as they charged and discharged the coin cell. The cell was initially stable, but after 30 minutes microscopic voids broke out, swelled, and snowballed into each other. The electrolyte finally snapped and the cell was short-circuited at the 145th cycle even though the amount of current was just a tenth of the maximum the cell could tolerate.

Bent back and forth

“Applying a small current in one direction may not lead to failure, but repeated cycles of charging and discharging can form structural defects, such as cracks, slip bands and voids,” a commentary published alongside the paper noted. As the battery underwent charge-discharge cycles, Li was stripped away from the anode before being plated back onto it, altering the amount of force exerted on the anode.

“You can cut a wire by using a cutter in a single go. … If you don’t have a cutter, you could bend the wire back and forth multiple times and the wire just breaks after a few times due to fatigue,” Aetukuri said. “This work shows that cycling the cell at low rates, equivalent to applying a low stress multiple times, can also lead to cell failure.”

“While not a lot might change in manufacturing, battery models that predict SSB failures will be a lot more sophisticated and likely more accurate due to this work,” Aetukuri said. The researchers wrote that future studies should investigate how Li’s stress-strain relationship varies with cycling rate and temperature.Unnati Ashar is a freelance science journalist.

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