जून
June
2025

खंड/Vol. : 50 अंक/Issue :107

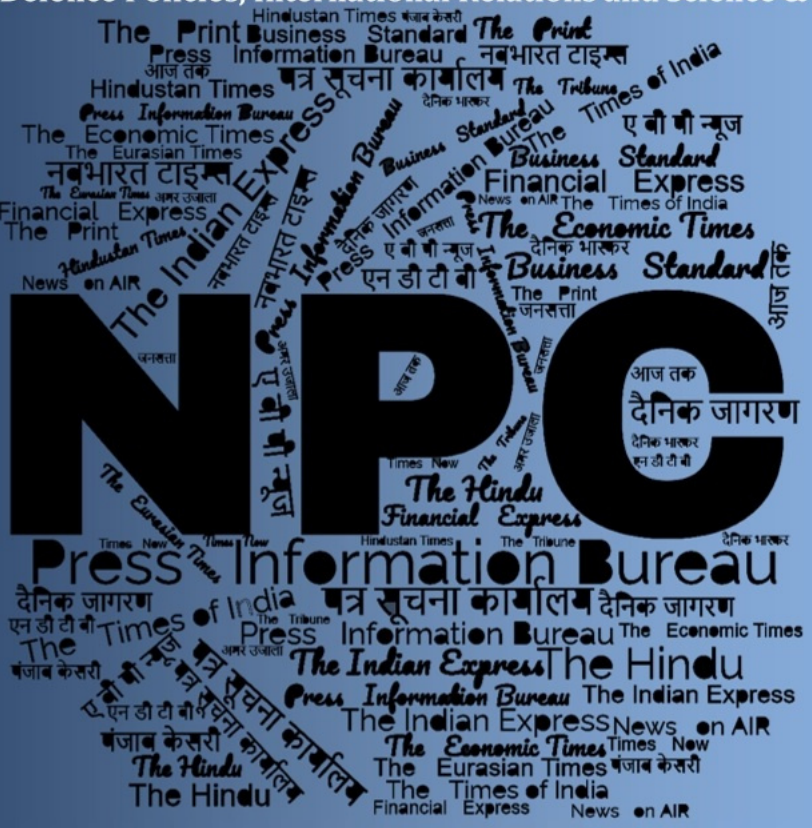
12 /06/2025

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

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology



रक्षा विज्ञान पुस्तकालय
Defence Science Library
रक्षा वैज्ञानिक सूचना एवं प्रलेखन केंद्र
Defence Scientific Information & Documentation Centre
मेटकॉफ हाउस, दिल्ली - 110 054
Metcalfe House, Delhi - 110 054

CONTENTS

Defence News

Lieutenant General BKGM Lasantha Rodrigo, Commander of the Sri Lanka Army Arrives on a visit to India

Source: Press Information Bureau, Dt. 11 Jun 2025

Lieutenant General BKGM Lasantha Rodrigo, Commander of the Sri Lanka Army, has arrived on an official visit to India from 11th to 14th June 2025. This visit is set to enhance bilateral military cooperation and explore new avenues for collaboration, particularly in the areas of training and capability enhancement. It underscores the continued efforts of both nations to further strengthen and deepen their longstanding defence partnership.

The first day of the visit began with a solemn wreath-laying ceremony at the National War Memorial in New Delhi. Lieutenant General BKGM Lasantha Rodrigo paid tribute to the brave soldiers who made the ultimate sacrifice in service to the nation.

Following the wreath-laying, Lieutenant General BKGM Lasantha Rodrigo was given a formal Guard of Honour in the South Block Lawns. The ceremonial event, attended by senior officials of the Indian Army, marked a significant gesture of respect and a symbol of the enduring friendship between the two nations.

The Guard of Honour was followed with a series of high-level meetings beginning with an in-depth interaction with Lieutenant General NS Raja Subramani, Vice Chief of the Army Staff of the Indian Army. Both the military leaders discussed wide ranging issues including aspects of bilateral defence cooperation and regional security concerns. Later, Lieutenant General BKGM Lasantha Rodrigo was briefed on Op Sindoor and India’s security perspective. He was also briefed by other senior officers of the Indian Army on matters of mutual interest.

Lieutenant General BKGM Lasantha Rodrigo thereafter met with Admiral Dinesh K Tripathi, Chief of the Naval Staff, Air Chief Marshal Amar Preet Singh, Chief of Air Staff and Shri Rajesh Kumar

Singh, Defence Secretary. These meetings provided an opportunity for the exchange of views on broader defence and security issues, focusing on matters of mutual interests.

Lieutenant General BKGM Lasantha Rodrigo also planted a tree at the Manekshaw Centre, symbolising time-tested relation of Indian and Sri Lanka Army.

On 12th June 2025, Lieutenant General BKGM Lasantha Rodrigo is scheduled to visit Jaipur and meet Lieutenant General Manjinder Singh, General Officer Commanding-in-Chief, South Western Command.

The General Officer will grace the Passing Out Parade at the Indian Military Academy (IMA), Dehradun, as the Reviewing Officer on 14th June 2025. This visit will mark a poignant return to his alma mater, where he was commissioned in December 1990, with the 87th Course of the IMA-an experience that laid the foundation of his illustrious military career. His presence at the Academy will rekindle memories of his formative years, now brought full circle as he would review a new generation of officers. Adding a personal and emotional dimension to the ceremony, Brigadier RMSP Rathnayake of Sri Lanka Army, will also be in attendance to witness his son, Foreign Officer Cadet RMNL Rathnayake, being commissioned with the current course. This confluence of legacy and leadership underscores the enduring spirit of camaraderie and leadership connect between the two Armies.

Lieutenant General BKGM Lasantha Rodrigo's visit to India is marked by a series of productive engagements, aimed at furthering the defence relationship between Sri Lanka and India. The visit not only highlights the commitment of both nations to strengthening their military ties but also underscores their shared focus on regional security and peace.

https://www.pib.gov.in/PressReleasePage.aspx?PRID=2135712

*

India briefs Sri Lankan army chief on Operation Sindoor

Source: The Tribune, Dt. 12 Jun 2025

The top military leadership of India on Wednesday briefed Sri Lankan Army Chief, Lieutenant General BKGM Lasantha Rodrigo, on Operation Sindoor, launched against terrorist camps in Pakistan.

"India's security perspective was shared with him," the Ministry of Defence said.

The visit comes just two months after India and Sri Lanka signed an ambitious defence cooperation pact in April, following talks between Prime Minister Narendra Modi and President Anura Kumara Dissanayake.

Lieutenant General Rodrigo is on a four-day visit to India. He met the Vice-Chief of the Indian Army, Lieutenant General NS Raja Subramani, and the two discussed a wide range of issues, including bilateral defence cooperation and regional security concerns.

Later, Lieutenant General Rodrigo held meetings with Navy Chief Admiral Dinesh K Tripathi, Air Chief Marshal Amar Preet Singh and Defence Secretary Rajesh Kumar Singh.

"These meetings provided an opportunity for the exchange of views on broader defence and security issues, focusing on matters of mutual interest," the ministry said.

The visit is expected to enhance bilateral military cooperation and explore new avenues for collaboration, particularly in training and capability enhancement.

On June 14, the visiting General will review the passing-out parade at the Indian Military Academy (IMA) in Dehradun — a poignant return to his alma mater, where he was commissioned in December 1990.

Tomorrow, General Rodrigo is scheduled to visit Jaipur and meet Lieutenant General Manjinder Singh, Commander of the Indian Army's South Western Command.

Today, he laid a wreath at the National War Memorial in New Delhi and was accorded a formal Guard of Honour at the South Block Lawns.

https://www.tribuneindia.com/news/india/india-briefs-sri-lankan-army-chief-on-operation-sindoor/

*

Indian, U.K. navies conduct joint exercise in North Arabian Sea

Source: The Hindu, Dt. 12 Jun 2025

The Indian Navy's stealth frigate INS Tabar, a submarine, and P-8I maritime patrol aircraft participated in a passage exercise with the United Kingdom's Carrier Strike Group in the North Arabian Sea on June 9 and 10, the Ministry of Defence said on Tuesday (June 11, 2025).

The U.K. formation comprised the aircraft carrier HMS Prince of Wales and frigate HMS Richmond.

Indian Navy's INS Tabar during the Passage Exercise (PASSEX) in the North Arabian Sea. UK Carrier Strike Group's HMS Prince of Wales and HMS Richmond also participated in the exercise.

"The multi-faceted naval exercise included unified control of integral helicopters, tactical manoeuvres, coordinated anti-submarine operations, and professional exchange of officers," the Ministry said in a statement.

The joint exercise, it noted, “demonstrates the deepening cooperation between the Indian Navy and the Royal Navy, showcasing a shared commitment to maritime security and robust bilateral ties.”

“This collaboration underscores the strong relationship between the two navies and their dedication to maintaining a secure and stable maritime environment,” it added.

https://www.thehindu.com/news/national/indian-uk-navies-conduct-joint-exercise-in-north-arabian-sea/article69682119.ece

*

Indian Army contingent arrives in Mongolia for Exercise Khaan Quest

Source: The Hindu, Dt. 11 Jun 2025

The Indian Army contingent arrived in Ulaanbaatar, Mongolia, on Wednesday (June 11, 2025) to participate in the multinational military exercise Khaan Quest, scheduled to be conducted from June 14 to 28.

The annual exercise brings together military forces from across the globe to collaborate and enhance their peacekeeping capabilities. The previous edition of Khaan Quest was held in Mongolia from July 27 to August 9, 2024.

The aim of the exercise is to prepare the Indian armed forces for peacekeeping operations in a multinational setting, under Chapter VII of the United Nations Charter.

The exercise, which began as a bilateral initiative between the United States and the Mongolian Armed Forces in 2003, evolved into a multinational peacekeeping endeavour from 2006 onwards. The current edition marks the 22nd iteration of the exercise, the Ministry of Defence said.

“The Indian Army contingent comprising 40 personnel is being represented mainly by troops from a Battalion of the Kumaon Regiment along with personnel from other arms and services. One woman officer and two women soldiers will also form part of the contingent,” the Ministry stated.

The aim of the exercise is to prepare the Indian armed forces for peacekeeping operations in a multinational setting, thereby “increasing interoperability and military readiness in peace support operations under Chapter VII of the United Nations Charter.”

According to the Ministry, the tactical drills to be undertaken will include the establishment of static and mobile checkpoints, cordon and search operations, patrolling, evacuation of civilians from hostile areas, counter-improvised explosive device (IED) drills, combat first aid, and casualty evacuation.

https://www.thehindu.com/news/national/indian-army-contingent-arrives-in-mongolia-for-exercise-khaan-quest/article69682076.ece

*

MoD proposes ‘ancient warfare’ tableaux theme on R-Day

Source: Hindustan Times, Dt. 12 Jun 2025

The defence ministry has suggested “Ancient Warfare/Military Strategy“ as the theme for the tableaux in the 2026 Republic Day parade and formally requested the culture ministry to evaluate the feasibility of incorporating original historical weapons alongside detailed 3D-design sketches of the potential tableau in the display. A letter from the defence ministry to the culture ministry details its choice, and says the idea came from defence minister Rajnath Singh.

”As discussed, Honble RRM (Raksha Rajya Mantri) suggested that during next year RD parade, a tableau containing military history showcasing original equipments, weapons, etc of popular and legendary personalities like Shivaji Maharaj, Ranapratap, Rani Laxmibai, etc may kindly be displayed in the main parade,” says the letter, which has been reviewed by Hindustan Times.

A culture ministry official said that the defence ministry has selected ancient military strategy as its central theme. “The defence ministry sends us a proposal every year regarding their choice of theme . This year, they specified the ancient warfare concept and asked for 2-3 preliminary 3D sketches showing potential tableau designs. We aim to submit the formal proposal complete with these sketches later this month. If approved, detailed development will follow,” the official added, asking not to be named. To be sure, the defence ministry usually publicises its theme in November.

Recent themes include “Swarnim Bharat: Virasat aur Vikas” (Golden India: Heritage and Development) for 2025, ‘Viksit Bharat’ (Developed India) and ‘Bharat-Loktantra ki Matruka’ (India – the mother of democracy) for 2024, and Jan Bhagidari (people’s participation) for 2023. The defence ministry declined comment on a query regarding confirmation of the 2026 theme.

Interestingly, the Indian Army’s “Project Udbhav” (Origin), launched by Singh in 2023 aims to synthesize ancient Indian strategic wisdom with contemporary military practices, studying texts such as Chanakya’s Arthashastra, Kamandaka’s Nitisara, and Thiruvalluvar’s Thirukkural, alongside historical military successes such as the tactics of the Ahom kingdom against the Mughals and the leadership of Chhatrapati Shivaji and Maharaja Ranjit Singh. Singh said during the launch that the objective is to forge a “unique, culturally rooted approach to address modern security challenges by revisiting India’s rich heritage of military thought.”

It is not clear whether the choice of theme has anything to do with India's success in Operation Sindoor, the Indian military's targetting of terrorist hubs and military facilities in Pakistan and Pakistan occupied Kashmir as a response to the April 22 terror strike carried out by Pakistan-sponsored terrorists in Pahalgam in which 26 people were killed. The culture ministry official declined comment on whether there was a link.

A primary task involves sourcing and safely integrating genuine historical weaponry, the official added. Descendants of families who crafted arms for figures such as Maharana Pratap possess preserved prototypes that could be utilized. "We maintain access to a repository of such families who still safeguard these historical artefacts. Following approval of the design, we will engage them to provide appropriate pieces matching the final requirements," the official said.

As the nodal ministry, the defence ministry manages the Republic Day tableau selection. States, union territories, and central ministries submit proposals aligned with the theme. An expert committee evaluates submissions based on criteria including creativity, conceptual clarity, visual impact, and theme adherence through multiple stages. Proposals typically require submission by November, with phased reviews of sketches and 3D models.

https://www.hindustantimes.com/india-news/mod-proposes-ancient-warfare-tableaux-theme-on-rday-101749668156864.html

*

Modern warfare altered distance, vulnerability link: Air Marshal Ashutosh Dixit

Source: Hindustan Times, Dt. 12 Jun 2025

Precision weapons, such as ones used by India against Pakistan during Operation Sindoor, have rendered geographical barriers "almost meaningless" and "altered the relationship between distance and vulnerability," a top Indian Air Force officer said on Wednesday.

Chief of integrated defence staff Air Marshal Ashutosh Dixit at the Air Force Auditorium in New Delhi on Wednesday

“Today, precision-guided munitions like Scalp and BrahMos (missiles) have rendered geographical barriers almost meaningless as strikes with beyond visual range air-to-air missiles and supersonic air-to-ground missiles have become commonplace,” Air Marshal Ashutosh Dixit, chief of integrated defence staff, said at a seminar on surveillance and electro-optics.

“The lessons from Operation Sindoor have reinforced what military strategists have long understood but perhaps not fully appreciated until now. Modern warfare --- thanks to technology --- has fundamentally altered the relationship between distance and vulnerability.” Earlier, the horizon marked the limit of immediate threat, he said.

The launch of Operation Sindoor in the early hours of May 7 --- India’s strikes on terror and military installations in Pakistan and Pakistan-occupied Kashmir (PoK) following the Pahalgam terror strike in which 26 people were shot dead --- triggered a four-day military confrontation with the neighbouring country involving fighter jets, missiles, drones, long-range weapons and heavy artillery. The standoff weapons deployed by India during the operation included the Scalp deep-strike cruise missiles, the Hammer smart weapon and BrahMos supersonic cruise missiles.

“When weapons can strike targets hundreds of kilometres away with pinpoint accuracy, the traditional concepts of front, rear and flanks, combat zones, and depth areas all become irrelevant. What we call the front and the theatre merge into one. This new reality demands that we extend our surveillance envelope far beyond what previous generations could have even imagined,”Dixit said.

The domain of surveillance and electro-optics systems was earlier a force enhancer but has now become the foundation on which modern military operations will take place, he added.

“Today we stand on the cusp of a revolution that will redefine how we perceive, process and project power in the 21st century. When we look at global conflicts commencing from Armenia-Azerbaijan to Russia-Ukraine and Israel-Hamas, and to our own experiences in Operation Sindoor; one truth emerges with crystal clarity --- the side that sees first, sees farthest and sees most accurately, prevails.”

Between the launch of the operation in the early hours of May 7 and the ceasefire on the evening of May 10, Indian forces bombed nine terror camps in Pakistan and PoK and killed at least 100 terrorists, and the IAF struck targets at 13 Pakistani air bases and military installations.

In the early hours of May 7, the IAF struck two terror sites at Markaz Subhanallah in Bahawalpur and Markaz Taiba near Muridke, both in Pakistan’s Punjab province, while the army hit targets at seven places, including Mehmoona Joya in Sialkot, Sawai Nala and Syed Na Bilal in Muzaffarabad, Gulpur and Abbas in Kotli, Barnala in Bhimber, and Sarjal.

The Markaz Subhanallah camp was the farthest target for Indian forces. Located around 100 km from the international border, it is the headquarters of the banned Jaish-e-Mohammed (JeM) and has been used for recruitment, indoctrinating and training terrorists.

Markaz Taiba is the headquarters of the Lashkar-e-Taiba (LeT) founded by Hafiz Saeed. Terrorists trained at this camp were linked to many attacks in India, including the 2008 Mumbai attacks. Ajmal Kasab, the only terrorist captured alive at the time, received training here and so did David Coleman Headley. It is located 25 km inside Pakistan.

During May 9-10, the IAF struck military targets in Rafiqui, Murid, Chaklala, Rahim Yar Khan, Sukkur, Chunian, Pasrur, Sialkot, Skardu, Sargodha, Jacobabad, Bholari and Malir Cantt in Karachi.

Later it emerged that India's targeting of locations within Pakistan during the May 7-10 clash was more extensive than was previously known, with a Pakistani document acknowledging that Indian drones had struck locations ranging from Peshawar in the northwest to Hyderabad in the south.

The graphics in the May 18 Pakistani document detailing India's drone strikes on May 8, 9 and 10 listed seven locations -- Peshawar in Khyber-Pakhtunkhwa province, Attock, Bahawalnagar, Gujrat and Jhang in Punjab province, and Chhor and Hyderabad in Sindh province -- that were not acknowledged as targets by Indian officials at any briefings held during or after the hostilities.

Pakistan's Operation Bunyan-um-Marsoos, which was mounted in response to Operation Sindoor, "folded in eight hours" on May 10 belying Islamabad's ambitious target of bringing India to its knees in 48 hours, chief of defence staff General Anil Chauhan said on June 3.

https://www.hindustantimes.com/india-news/precision-weapons-altered-the-relationship-between-distance-and-vulnerability-air-marshal-ashutosh-dixit-101749669357136.html

*

In precision strike era, war has no front or rear: CISC Air Marshal Ashutosh Dixit

Source: The Economic Times, Dt. 12 Jun 2025

The lesson from India's Operation Sindoor that took down terror targets in Pakistan is that long-range precision-guided munitions like the Brahmos and Scalp have rendered geographical barriers meaningless and the side that sees the farthest and with most accuracy prevails, the Chief of Integrated Defence Staff to the Chairman Chiefs of Staff Committee (CISC) said on Wednesday.

Air Marshal Ashutosh Dixit, who is responsible for coordinating inter-service activities, said that modern technology has fundamentally changed the battlefield as has been evident in recent conflicts, including the Indian cross-border strikes.

"Modern warfare, thanks to technology, has fundamentally altered the relationship between distance and vulnerability. Today, precision-guided munitions like Scalp and Brahmos have rendered geographical barriers almost meaningless," the senior officer said. He added that it can be seen from global conflicts like the Armenia-Azerbaijan war, the Russia-Ukraine war, the Israel-Hamas fight and India's own experience in the recent strike that "the side that sees first, sees farthest and sees most accurately, prevails".

The officer said that with weapons demonstrating the ability to strike hundreds of kilometers away with pinpoint accuracy, the traditional concepts of a battle front, rear, flanks and combat zones have become irrelevant and the war zone has merged into a combined theatre.

"This new reality demands that we extend our surveillance envelope far beyond what the previous generation could have even imagined. We must detect, identify and track potential threats, not when they approach our borders, but when they are still in their staging areas, airfields and bases, deep within their own territory," he said.

This also reflects the Op Sindoor war fighting strategy with Pakistan in which airfields deep within its territory were disabled by long-range air-to-ground missiles, rendering it difficult for Pakistani forces to mount an aerial strike on India. Over the past few years, India has been investing heavily

in stand off weapons like long-range air-to-air missiles, air-to-surface munitions and a range of missiles that are capable of taking down a target anywhere on Pakistani territory.

https://economictimes.indiatimes.com/news/defence/in-precision-strike-era-war-has-no-front-or-rear-cisc-air-marshal-ashutosh-dixit/articleshow/121787400.cms?from=mdr

*

Operation Sindoor highlights need to extend surveillance envelope, says Air Marshal Dixit

Source: The Indian Express, Dt. 12 Jun 2025

Operation Sindoor has thrown up the lesson that modern warfare has fundamentally altered the relationship between distance and vulnerability, thanks to technology, a top military officer said Wednesday, while also highlighting critical importance of deep surveillance in contemporary warfare.

Chief of Integrated Defence Staff, Air Marshal Ashutosh Dixit said the existing principles of war are being challenged and new ones are emerging. “Earlier, the horizon marked the limit of immediate threat. Today, precision-guided munitions like SCALP, BrahMos and HAMMER have rendered geographical barriers almost meaningless, as strikes with BVR AAMs (beyond visual range air to air missiles) and supersonic AGMs have become commonplace,” he said at a seminar hosted by think-tank CAPS (Centre for Air Power Studies) and Indian Military Reviews (IMR).

He said when weapons can strike targets hundreds of kilometres away with pinpoint accuracy, the traditional concepts of front, rear and flanks, combat zones and depth areas all become irrelevant.

“What we call the front and the theatre, merge into one. This new reality demands that we extend our surveillance envelope far beyond what previous generations could have even imagined,” he said, adding that we must detect, identify and track potential threats not when they approach our borders, but when they are still in their staging areas, airfields and bases, deep within adversary territory. “This existed as a concept even earlier but today we have the means to realise it,” he said. “When hypersonic missiles can traverse hundreds of kilometres in minutes and drone swarms can reach their targets before traditional decision-making processes can respond, real-time or near-real-time surveillance becomes… essential for survival.”

https://indianexpress.com/article/india/need-to-extend-surveillance-envelope-says-deputy-air-chief-10061559/

*

Drone warfare came home during Op Sindoor. Where does India stand?

Source: The Indian Express, Dt. 12 Jun 2025

On July 1, 2021, then Army Chief General M M Naravane had warned: “While we pursue our quest for niche technologies, including AI, it would be prudent to remember that future wars will also involve low technology, which is easy to obtain but difficult to defeat.” These words ring truer than ever in the context of two recent events. On June 1, Ukraine bombed five airbases deep inside

Russia using cheap First Person View (FPV) drones, underlining the need to fundamentally reimagine air defences in the age of asymmetric drone warfare.

Weeks earlier in May, during the hostilities in the wake of Operation Sindoor, Pakistan had attacked towns and military facilities across India's western front, from Baramulla to Barmer, with swarm after swarm of relatively low cost, low tech drones for four straight days. Apart from inflicting damage, these attacks were meant to overwhelm India's air defences, clutter radars, exhaust ammunition, gather intelligence, and probe for vulnerabilities.

Drones, a brief history

Unmanned aerial vehicles (UAVs) date back to World War II and the Korean War, where they were used for training anti-aircraft gunners and in specific offensive missions. Their modern military usage took off in the 1990s, after being successfully deployed in the Gulf War of 1991. The Nagorno-Karabakh conflict of 2020 marked a turning point in drone warfare: Azerbaijan's use of Turkish Bayraktar TB2 and Israeli Harop drones devastated Armenian defences, decisively shifting the conflict's dynamics in favour of Baku.

Since then, drones have played a key role in:

- Yemen, where Houthi rebels targeted Saudi oil infrastructure using drone swarms;
- Gaza, where Israel has deployed high-tech drones for surveillance and strikes, and Hamas has used drones for grenades and observation; and
- Ukraine, where both Moscow and Kyiv have deployed commercial quadcopters (DJI drones), military drones (Bayraktar TB2, Orlan-10, Shahed-136), and loitering munitions.

Ukraine has notably used "first-person view" (FPV) racing drones to target tanks, chase individual soldiers and small units, and, most notably, bomb Russian air bases. On June 1, Ukraine carried out Operation Spider's Web, one of the most sophisticated drone operations in history, using 100–150 FPV drones, transported clandestinely in trucks deep into Russia. The target: five key Russian airfields. Ukrainian officials claim to have hit more than 40 Russian aircraft, including strategic bombers like the Tu-22 and Tu-95, and inflicted losses of around $7 billion.

Meanwhile, Russia throughout the war has used Iranian-made Shahed kamikaze drones in swarms to overwhelm Ukrainian air defenses, and target critical infrastructure such as energy grids.

Not one, not two…

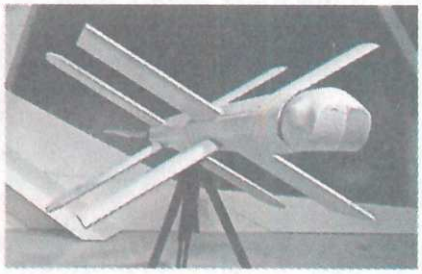
Swarm drones are autonomous or semi-autonomous UAVs that operate in coordinated groups, much like swarms of birds or fish. They communicate via wireless networks and adjust in real time to achieve shared objectives. Swarms are more resilient than traditional drones due to in-built redundancy — even if one drone is intercepted, others can continue on the mission. Drone swarms are thus used to saturate air defences (a few payloads may sneak through even robust defences), gathering intelligence, and attacking high-value targets.

Countries are already developing even more lethal AI-driven swarm drones, capable of making real-time decisions, adapting tactics mid-mission, and coordinating more complex manoeuvres. These are expected to become integral to combined arms warfare, functioning alongside infantry, armour, and cyber units. According to Fortune Business Insights, the global military drone market stood at $14.14 billion in 2023, and is projected to hit $47.16 billion by 2032.

A FEW NOTABLE SWARM DRONE SYSTEMS

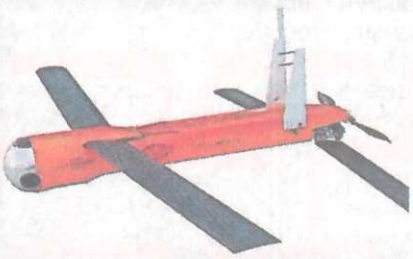
IRAN

System: Shahed-136 (swarms)
Type: Loitering munition
Swarm Size: 10–50
Range: 2,000 km
Features: GPS-guided, low radar signature, low-cost



RUSSIA

System: Lancet & Shahed
Type: Loitering + fixed-wing
Swarm Size: 5–20
Range: 40–300 km
Features: Used in layered attacks with multiple decoys



USA

System: LOCUST
Type: Micro UAV swarm
Swarm Size: 50–100
Range: 30–60 km
Features: AI coordination, launched from tubes

CHINA

System: Drone Swarm (Airborne)
Type: Micro drones
Swarm Size: 100–200+
Range: 10–30 km
Features: Released from drones (*see picture*) or trucks, AI-powered

WHY SWARM DRONES MATTER

Asymmetry: They let low-tech actors hit high-value targets.

Low cost: They are cheap while being expensive to deter.

Saturation: They overwhelm even sophisticated defence systems.

Autonomy: Reduced reliance on GPS or real-time human control.

COUNTERMEASURES AGAINST DRONE SWARMS

KINETIC
System/Technology: Phalanx CIWS, C-RAM
Description: Anti-aircraft guns with radar-guided targeting (used on land/sea).

ELECTRONIC WARFARE
System/Technology: Jammers, GPS spoofers
Description: Disrupt drone communication and navigation systems. Widely used in Ukraine.

DIRECTED ENERGY
System/Technology: High-Energy Lasers (HEL), microwave weapons
Description: Rapid-target engagement, low cost-per-shot. Israel's Iron Beam and American THOR in testing/deployment.

DRONE-ON-DRONE
System/Technology: Interceptor drones
Description: Drones designed to chase and disable other drones. For example, US-made Foretem DroneHunter.

NET SYSTEMS
System/Technology: SkyWall, DroneCatcher
Description: Launch nets to physically capture small drones. Effective only at short ranges.

Data compiled by The Indian Express from multiple sources

Threat of swarms

Chief of Defence Staff General Anil Chauhan, in a lecture in Pune, flagged the rising drone threat: "Now we have drones as small as water bottles — and in swarms," he said, calling these "undetectable" and "untargetable". Air Marshal Anil Chopra (retd), former head of the Centre for Air Power Studies, said that while drone swarms deployed by Pakistan were not particularly effective, the Ukraine example offers some major learnings.

"When you use very cheap drones that carry warheads barely weighing a kilo — like Pakistan did — nothing much happens. They're jammed easily… Only a fool would fire expensive missiles at them," Chopra told The Indian Express. But swarm drone attacks can be carried out anywhere, and at any time. "If someone moves a truck full of drones near an airbase and launches them [like in the case of Op Spider's Web], defending becomes very difficult. In countries like India, with

porous borders and diverse populations, the threat is real," he said. Chopra emphasised upon the need for integration across the security establishment.

"Your intelligence setup, even the local police, matter. Even a traffic constable could make a difference," he said, adding that the success of the Ukraine op was predicated on Kyiv being able to transport its drones thousands of kilometres inside Russia undetected. "Strategic thinking, inventory management — everything must evolve. A $1,000 drone damaging a $200 million aircraft is our new reality," Chopra said.

Countering drone threats

Defence against drones begins with detection. Modern systems employ a mix of AESA radars, electro-optical and infrared sensors, acoustic detectors, and AI-powered fusion systems. Once detected, one option is for drones to be neutralised through kinetic means, that is, with missiles and anti-aircraft guns. But traditional kinetic air defences, especially surface-to-air missiles (SAMs), are costly, and less effective against swarms. Automated gun systems such as C-RAM and Phalanx, which track targets and fire autonomously, are preferred in this role.

Even more cost-effective alternatives include:

- **Directed Energy Weapons (DEWs):** Lasers and microwave pulses that disable drones by damaging sensors or frying electronics;
- **Electronic Warfare (EW):** Jamming GPS signals or communication links;
- **Spoofing:** Misleading drones about their location or issuing false commands;
- **Cyber Attacks:** Taking control of drones and crash them by exploiting software vulnerabilities; and
- **Interceptor drones & nets:** For close-range neutralisation, protecting critical assets.

The asymmetry in cost remains the central challenge in anti-drone warfare. A drone swarm costing roughly $100,000 might take millions of dollars to neutralise with currently available technology. This is why nations, including India, are investing in more cost-effective solutions like EW and DEWs. The ideal defence is a layered system, integrating multiple modes of interception for redundancy and cost-efficiency purposes. Examples include Israel's Iron Dome and the US's Directed Energy M-SHORAD.

India's capabilities

Since 2020, India has ramped up its counter-drone infrastructure, deploying a layered defence that blends indigenous technology, EW, and air defence systems. Key systems include:

- **Akashteer Air Defence Control System:** Developed by Bharat Electronics Ltd, it integrates with the Indian Air Force's integrated command network for real-time tracking;
- **Bhargavastra:** Solar Defence and Aerospace Ltd's weapon system fires 64 micro-rockets in salvos to eliminate drone swarms;
- **DRDO's Anti-Drone System:** It offers 360-degree radar coverage, with both jamming (soft kill) and laser (hard kill) capabilities. Drones can be detected up to 4 km away, and neutralised within a 1 km radius; and

- **Indrajaal:** An AI-powered grid from a Hyderabad startup that combines jammers, spoofers, and intelligence to protect areas up to 4,000 sq km. Already deployed at naval sites in Gujarat and Karnataka.

During the May 2025 swarm attacks, the IAF activated its Integrated Counter-UAS Grid, alongside conventional radars, guns, and missiles, neutralising attempted strikes on 15 military bases and several urban targets.

Looking ahead

There is currently a race to develop both drone and anti-drone capabilities. “Even the Iranians are producing more than 20 Shahed drones per day. And these are powerful. India too has set up an ecosystem with 550 startups in the field. Some tech is acquired, but we’re developing our own tech too,” Chopra said. The future of warfare is here, and it’s unmanned, AI-driven and asymmetric. India’s response to the May 2025 drone swarms signals it is rapidly adapting to this future.

As CDS Chauhan put it: “We are at a cusp where war may be between humans and machines — and tomorrow, between machines themselves. Machines that are autonomous, intelligent, and make decisions. We may need a layered and resilient defence system [to counter] this.”

https://indianexpress.com/article/explained/drone-warfare-came-home-during-op-sindoor-where-does-india-stand-10061470/

*

Scramble for 40 Chinese jets inflates Pakistan's defence budget

Source: The Times of India, Dt. 11 Jun 2025

China’s fifth-generation stealth fighter J-35A, touted as a rival to the American F-35, is at the heart of Pakistan’s military ambitions as it doubles down on defence spending amid telling blows to its economy. Finance minister Muhammad Aurangzeb’s announcement of a 20% hike in the country’s defence budget – the outlay stands at 2.55 trillion rupees ($9 billion) – coincides with reports of advanced arms deals with China.

Pakistan is said to be negotiating with China for 40 stealth fighters, with deliveries potentially starting this August. The J-35A, a twin-engine, multi-role fighter equipped with PL-17 missiles and advanced AESA radar, promises to enhance Pakistan’s air superiority and strike capabilities. Pakistan Air Force has already approved the purchase, and various agencies have reported that pilots are already training in China.

Beijing’s rumoured offer of a 50% discount and lenient payment terms is in line with deepening China-Pakistan ties, with nearly 80% of Pakistan’s arsenal now sourced from there. The acquisition of J-35A stealth fighter jets threatens to escalate tensions with India even as Pakistani diplomats criss-cross foreign shores, preaching restraint and dialogue. The Shehbaz Sharif govt’s decision to prioritise defence over development has also drawn muted criticism within Pakistan’s tightly controlled political space. The budget slashed overall federal expenditure by 7% to 17.57 trillion rupees ($62 billion).

Pakistan was mainly dependent on Chinese-supplied weapons, including J-10C fighters and HQ-9 air defence systems, during last month’s military conflict with India. The country’s economic woes

make this military outlay particularly contentious. It owes $15 billion to China alone, its largest bilateral creditor, and is negotiating a $6-8 billion IMF bailout to avert a total economic collapse. Servicing its $269 billion debt consumes over 1.9% of GDP, leaving little room for social welfare or infrastructure. With national security becoming the rationale to override financial prudence, the budget faced little scrutiny in parliament, reflecting the military's outsized influence on how the country is run.

On the diplomatic front, Pakistan is working overtime to counter India's "terrorism narrative". Foreign minister Ishaq Dar has engaged Gulf states, EU and the UN to portray Pakistan as a stabilising force and India as the aggressor. These efforts include back-channel talks and leveraging the China-Pakistan Economic Corridor to secure economic lifelines from Beijing. During a recent visit to China, Dar thanked Beijing for its support during the India-Pakistan conflict, highlighting it as an "iron-clad" relationship.

https://timesofindia.indiatimes.com/world/pakistan/scramble-for-40-chinese-jets-inflates-pakistans-defence-budget/articleshow/121786080.cms

*

US invites Pak Army Chief to Army Day Event, sparks rage

Source: The Asian Age, Dt. 12 Jun 2025

AGE CORRESPONDENT with agency inputs
NEW DELHI, JUNE 11

Amid growing unease in New Delhi over the international community's engagement with Islamabad, reports have emerged that Pakistan Army chief Gen. Asim Munir has been invited to the United States to participate in the US Army's 250th anniversary celebrations in Washington, DC, on June 14 — an event that coincides with former President Donald Trump's 79th birthday.

The move comes just weeks after Operation Sindoor, launched in response to the April 22 Pahalgam terror attack that killed 26 people. Gen. Munir's presence at the celebration is being seen in some quarters as a sign of deepening US-Pakistan defence ties, despite Islamabad's long-documented role in sponsoring cross-border terrorism in India.

Asim Munir

The development also comes at a time when defence minister Rajnath Singh expressed strong disapproval of the United Nations Security Council naming Pakistan as vice-chair of its counter-terrorism committee — a panel constituted in the aftermath of the 9/11 attacks.

Adding to the diplomatic discomfort, US CENTCOM Commander General Michael Kurilla described Pakistan as a "phenomenal partner in counter-terrorism" during a testimony before the US House Armed Services Committee on Tuesday.

"Pakistan is in an active counter-terrorism fight right now, and they have been a phenomenal partner in the counter-terrorism world," Kurilla said, stressing the need for Washington to maintain strategic ties with both India and Pakistan. "I do not believe it is a binary switch where we can't have one if we have the other. We have to look at the merits of each relationship."

The general's remarks drew sharp criticism from the Indian opposition. Congress leader Jairam Ramesh took to social media platform X (formerly Twitter), calling the development a "diplomatic setback" for the Modi government.

"The US CENTCOM chief has just described Pakistan as a 'phenomenal partner in counter-terrorism'. What do our PM and his cheerleaders have to say about this?" Mr Ramesh asked.

*

रक्षा बाजार में भारत की धमक बढ़ाएंगे ये हथियार

Source: NavBharat Times, Dt. 12 Jun 2025

रक्षा बाजार में भारत की धमक बढ़ाएंगे ये हथियार

आपरेशन सिंदूर के दौरान पाकिस्तान में आतंकी ठिकानों को ध्वस्त करना हो या उसके ड्रोन और मिसाइल हमलों को नाकाम करना हो, भारत के स्वदेशी हथियारों और उपकरणों की शानदार क्षमताओं ने वैश्विक रक्षा उद्योग में खलबली मचा दी है। इनमें से ज्यादातर तकनीकी का विकास और निर्माण रक्षा अनुसंधान एवं विकास संगठन (डीआरडीओ) ने किया है। इस बीच रक्षा बाजार में भारत की हिस्सेदारी बढ़ाने के प्रयास के तहत डीआरडीओ जकार्ता, इंडोनेशिया में आयोजित इंडो डिफेंस एक्जिबिशन-2024 में अपनी कटिंग एज तकनीक का प्रदर्शन कर रहा है। आइये जानते हैं इन तकनीकों और रक्षा उपकरणों के बारे में।

अस्त्र एमके-1

अस्त्र एमके-1 बियांड विजुअल रेंज एयर टू एयर मिसाइल सिस्टम है। इसे लड़ाकू विमानों के लिए बनाया गया है। लड़ाकू विमान से दागी जाने वाली मिसाइल तेजी से पैंतरेबाजी

करने में सक्षम सुपरसोनिक एयरक्राफ्ट को तबाह कर सकती है। मिसाइल दिन और रात में हर मौसम में प्रभावी है। अस्त्र एमके-1 मिसाइल की रेंज करीब 110 किलोमीटर है। यानी इस मिसाइल से लैस लड़ाकू विमान 110 किलोमीटर दूर से दुश्मन के लड़ाकू विमान को निशाना बना सकता है। अस्त्र-1 को सुखोई 30 एमके-आइ लड़ाकू विमान और तेजस में लगाया जा चुका है। डीआरडीओ अस्त्र मिसाइल के कई वैरिएंट जैसे अस्त्र एमके-2 और अस्त्र एमके-3 भी बना रहा है। अस्त्र एमके-3 की अनुमानित रेंज करीब 300 किलोमीटर तक है। इन मिसाइलों को वायुसेना को सौंपे जाने के साथ ही भारत बियांड विजुअल रेंज एयर टू एयर मिसाइल के क्षेत्र में आत्मनिर्भर हो जाएगा।

एयरबोर्न अर्ली वार्निंग एंड कंट्रोल सिस्टम

एयरबोर्न अर्ली वार्निंग एंड कंट्रोल सिस्टम (एईडब्ल्यूएंडसी) हवा में उड़ते हुए दुश्मन के इलाके में

बहुत दूर तक देख सकता है। यह हमलावर लड़ाकू विमान और यूएवी को ट्रैक करके इंटरसेप्टर्स को इन खतरों को नष्ट करने के लिए संदेश देता है और उनको गाइड भी करता है। इसके अलावा यह जमीन पर दुश्मन के मूवमेंट का पता लगा सकता है। इसे वायुसेना के लिए फोर्स मल्टीप्लायर माना जाता है। इसका मतलब है कि यह वायुसेना की ताकत को कई गुना बढ़ा देता है। हाल में आपरेशन सिंदूर के दौरान इस सिस्टम की अहम भूमिका सामने आई है। एस 400 एयर डिफेंस सिस्टम ने करीब 315 किलोमीटर दूर से इसी तरह के सिस्टम पाकिस्तान के अवाक्स को नष्ट कर नया रिकॉर्ड बनाया है।

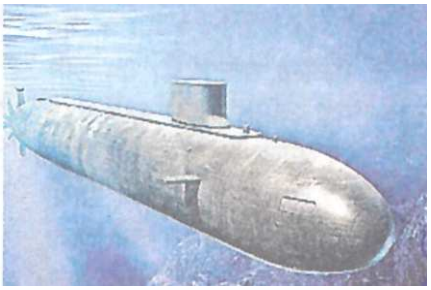
वरुणास्त्र

वरुणास्त्र युद्धपोत से लॉन्च किया जाने वाला हैवी वेट एंटी सबमरीन टारपीडो है। यह समुद्र की गहराई में सबमरीन को निशाना बना सकता है। वरुणास्त्र एंटी सबमरीन वारफेयर क्षमता से लैस सभी युद्धपोतों से दागा जा सकता है। इसे 2016 में भारतीय नौसेना में शामिल किया गया था।

मैन पोर्टेबल एंटी टैंक गाइडेड मिसाइल

यह मिसाइल सेना की इन्फैंट्री और पैराशूट (विशेष बलों) के लिए है। मैन पोर्टेबल मिसाइल को ट्राइपॉड के जरिये लॉन्च किया जाता है। इसकी अधिकतम रेंज 2.5 किलोमीटर है। इसका वजन 15 किलोग्राम से कम है।

लो फ्रीक्वेंसी डंकिंग सोनार : लो फ्रीक्वेंसी डंकिंग सोनार (एलएफडीएस) एक ऐसी सोनार प्रणाली है, जिसका इस्तेमाल कम आवृत्ति वाली ध्वनियों का उपयोग करके पानी के नीचे के लक्ष्यों को ढूंढने और उनका पता लगाने के लिए किया जाता है। यह मुख्य रूप से एंटी-सबमरीन वारफेयर के लिए है। एलएफडीएस को आमतौर पर हेलीकाप्टर या विमान से पानी में उतारा जाता है और समुद्र में लक्ष्यों का पता लगाने के लिए उपयोग किया जाता है। इसे एडवांस्ड लाइट हेलीकाप्टर (एएलएच) पर लगाया गया है और यह सक्रिय और निष्क्रिय दोनों तरह के सोनार ऑपरेशन में सक्षम है।



रिमोटली आपरेटेड व्हीकल (आरओवी) दक्ष : आरओवी इम्प्रोवाइज्ड एक्सप्लोसिव डिवाइस की पहचान और हैंडलिंग के लिए एक उपयोगी उपकरण है। इसका उपयोग वातावरण में परमाणु और रासायनिक तत्वों के स्तर का सर्वेक्षण और निगरानी करने के लिए भी किया जा सकता है। आरओवी सीढ़ियां चढ़ सकता है और यह लगातार 3 घंटे तक काम कर सकता है। आरओवी को 100 मीटर की दूरी पर फाइबर आप्टिक संचार द्वारा या वायरलेस संचार के जरिये 500 मीटर की दूरी से नियंत्रित किया जा सकता है।

*

भारत–US का साथ अभ्यास

Source: NavBharat Times, Dt. 12 Jun 2025

भारत और अमेरिका की वायुसेना के बीच पहली इंडिपेंडेंट स्पेशल फोर्सेस एक्सरसाइज पूरी हुई। एक्सरसाइज टाइगर क्लॉ-2025 पिछले महीने 26 तारीख को शुरू हुई थी और 10 जून को पूरी हुई। इसे उत्तर भारत में कई जगहों पर किया गया। इस का मकसद रणनीतिक साझेदारी को और मजबूत बनाना था।

*

Science & Technology News

फिर टला AXIOM-4 मिशन

Source: Dainik Jagran, Dt. 12 Jun 2025

नई दिल्ली, प्रेट्र: अंतरिक्ष में दोबारा भारत का परचम लहराने के लिए अभी और इंतजार करना पड़ेगा। गगनयात्री शुभांशु शुक्ला तीन अन्य अंतरिक्षयात्रियों के साथ बुधवार शाम स्पेसएक्स के फाल्कन-9 राकेट से अंतरराष्ट्रीय अंतरिक्ष स्टेशन (आइएसएस) के सफर पर रवाना होने वाले थे, लेकिन एक्सिओम-4 मिशन को फिर टाल दिया गया। फाल्कन-9 राकेट में रिसाव का पता लगने पर इस बार मिशन को टाला गया। लांचिंग की नई तारीख बाद में घोषित होगी।

शुभांशु अंतरिक्ष में जाने वाले दूसरे भारतीय होंगे। राकेश शर्मा 1984 में सोवियत संघ के सोयूज अंतरिक्षयान से अंतरिक्ष स्टेशन सैल्यूट 7 पर गए थे। राकेश शर्मा भारत के पहले अंतरिक्षयात्री हैं। एक्सिओम स्पेस के एक्सिओम मिशन को पहले तीन बार टालना पड़ा था। अंतरिक्षयात्रियों को 29 मई को फ्लोरिडा के कैनेडी स्पेस सेंटर से आइएसएस के सफर पर रवाना होना था, लेकिन इसे आठ जून तक टाला गया। फिर 10 जून तक टाला गया।

*

After bad weather, liquid oxygen leak stalls Shubhansh Shukla-piloted Axiom-4 lift-off

Source: The Times of India, Dt. 12 Jun 2025

Group Captain Shubhanshu Shukla's lift-off to Indian space history will have to wait. As D-Day dawned in India, Elon Musk-owned SpaceX announced that the Axiom-4 launch had been indefinitely deferred, citing a LOX (liquid oxygen) leak in the Falcon-9 rocket that engineers were unable to troubleshoot immediately.

Axiom-4 was to start its journey to the International Space Station from Kennedy Space Center's Launch Complex-39A at 5.30pm IST on Wednesday. The originally scheduled Tuesday launch was postponed by a day due to adverse weather.

"Standing down from tomorrow's Falcon-9 launch of Ax-4 to the International Space Station to allow additional time for SpaceX teams to repair the LOX leak identified during post-static fire booster inspections. Once complete - and pending range availability - we will share a new launch (date)," Space X said in a statement released at 8.45pm Eastern Time Tuesday (6.15am IST, Wednesday). Hours earlier, it had shared a video of Falcon-9 and Dragon at sunrise and said the

weather was 85% favourable for lift-off, with teams continuing to monitor highwinds in the ascent corridor.

Installing purge to plug leak: SpaceX

Hours earlier, it had shared a video of Falcon-9 and Dragon at sunrise and said the weather was 85% favourable for lift-off, with teams continuing to monitor highwinds in the ascent corridor. Isro chairman V Narayanan said, "... Based on the discussion on this topic by the Isro team with the experts of Axiom and SpaceX it has been decided to correct the leak and carry out necessary validation tests before clearing for the launch."

TOI had reported on June 10 that SpaceX had unresolved technical snags that were detected during a 10-second pre-static test fire. On Saturday, Dragon and Falcon "went vertical" on the launch pad ahead of a dry rehearsal. On Sunday (June 8), SpaceX performed the static fire and began analysing data. "We discovered a few things during the static fire that we had to go take a look at. We found a LOX leak that we previously had seen on this booster during its entry on its last mission and discovered that we had not fully repaired the booster during refurbishment, or we actually didn't find a leak and didn't get it corrected," William Gerstenmaier, SpaceX vice-president of build and flight reliability, said late Monday.

Stating that teams were trying to fix the issue, he added, "We should get that completed today, and we will have that back in configuration, and we are installing a purge that will essentially mitigate the leak." SpaceX also identified a thrust vector control issue with engine 5. The affected components have since been replaced. Gerstenmaier stressed the company's continued focus on safety and precision, noting that "space flight is really hard, and we are learning every day".

https://timesofindia.indiatimes.com/science/after-bad-weather-liquid-oxygen-leak-stalls-shubhanshu-shukla-piloted-axiom-4-lift-off/articleshow/121788812.cms

*

Axiom-4 launch: Crew safety paramount, ISRO insisted in review meets

Source: The Times of India, Dt. 12 Jun 2025

Hours after SpaceX revealed late Monday that it had detected multiple snags in the Falcon-9 rocket that was to launch the Axiom-4 (Ax-4) crew aboard the Dragon spacecraft, a series of meetings unfolded Tuesday and in all of them, Isro asserted that crew safety was paramount.

Group Captain Shubhanshu Shukla is part of the Ax-4 crew and is set to become only the second Indian to go to space.

As part of the launch preparation, all nine engines of the first stage were to be tested together. During one of those tests, it was found that a control actuator had a glitch, and during static test fire, a liquid oxygen (LOX) leak was detected. Once this information came out on Monday, Isro was part of a meeting with all the stakeholders, where it strongly articulated its concerns about astronaut safety and wanted detailed discussions before greenlighting the launch.

"That ISRO team was led by chairman V Narayanan helped, given his experience, especially with cryogenic propulsion systems. After all, he helped build it for India. Isro had requested that all issues with the rocket needed to be 'resolved' before they went ahead with the launch," a source said. When contacted, Narayanan told TOI: "All I can say at this juncture is that for India and Isro,

the safety of our astronaut and crew is paramount. Mission partners have decided to correct the leak and carry out necessary validation tests before clearing for the launch."

When SpaceX vice-president of build and flight reliability, William Gerstenmaier, first revealed the information about the leak during a mission readiness review late on Monday, the issue was not categorised as something concerning. He said it would be resolved and the rocket would be ready for launch.

However, after subsequent meetings between all partners involved in the mission, SpaceX and the other partners decided to scrub the launch, seeking "additional time for teams to repair the LOX leak.

https://timesofindia.indiatimes.com/science/axiom-4-launch-crew-safety-paramount-isro-insisted-in-review-meets/articleshow/121787241.cms

*

In a first, a 'quick peek' image of the Sun's turbulent south pole surfaces

Source: The Indian Express, Dt. 12 Jun 2025

WILL DUNHAM
JUNE 11

THE ROBOTIC Solar Orbiter spacecraft has obtained the first images ever taken of our sun's two poles as scientists seek a deeper understanding of Earth's host star, including its magnetic field, its 11-year cycle of activity and the solar wind.

The European Space Agency Wednesday released images taken in March using three of Solar Orbiter's onboard instruments. They show the sun's south pole from a distance of roughly 40 million miles (65 million km), obtained at a period of maximum solar activity. Images of the north pole are still being transmitted by the spacecraft back to Earth.

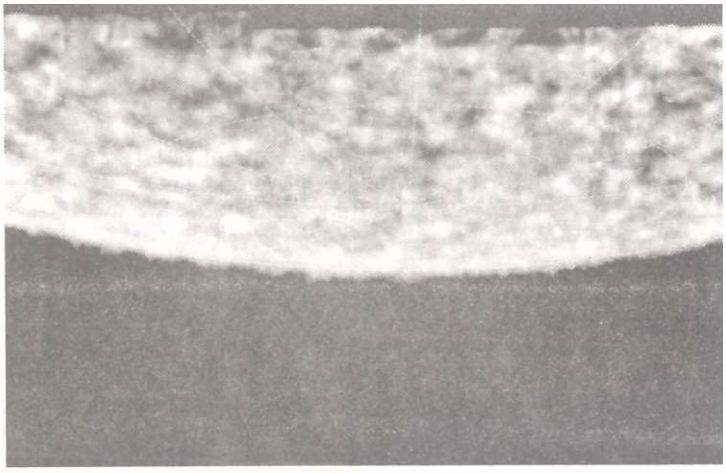
Solar Orbiter, developed by ESA in collaboration with the NASA, was launched in 2020 from Florida. Until now, all the views of the sun have come from the same vantage point – looking face-on toward its equator from the plane on which Earth and most of the solar system's other planets orbit, called the ecliptic plane.

Solar Orbiter used a slingshot flyby around Venus in February to get out of this plane to view the sun from up to 17 degrees below the solar equator. Future slingshot flybys will provide an even better view, at beyond 30 degrees.

"The best is still to come. What we have seen is just a first quick peek," said solar physicist Sami Solanki of the Max Planck Institute for Solar System Research in Germany, who heads the scientific team for the spacecraft's Polarimetric and Helioseismic Imager instrument.

"The spacecraft observed both poles, first the south pole, then the north pole," Solanki said. "The north pole data will arrive in the coming weeks or months."

Solar Orbiter is gathering data on phenomena including the sun's magnetic field, its activity cycle, and the solar wind, a relentless high-speed flow of charged particles emanating from the



A radiance map of the Sun's south pole. AP

sun's outermost atmospheric layer that fills interplanetary space. "We are not sure what we will find, and it is likely we will see things that we didn't know about before," said solar physicist Hamish Reid of University College London's Mullard Space Science Laboratory.

The sun is a ball of hot electrically charged gas that generates a powerful magnetic field, which flips from south to north and back again every 11 years in what is called the solar cycle.

"What we have been missing to really understand this (solar cycle) is what is actually happening at the top and bottom of the sun," Reid said.

"Whilst the Earth has a clear north and south pole, the Solar Orbiter measurements show both north and south polarity magnetic fields are currently present at the south pole of the sun. This happens during the maximum in activity of the solar cycle, when the sun's magnetic field is about to flip. In the coming years, the sun will reach solar minimum, and we expect to see a more orderly magnetic field around the poles of the sun," Reid said.

"We see in the images and movies of the polar regions that the sun's magnetic field is chaotic at the poles at the (current) phase of the solar cycle - high solar activity, cycle maximum," Solanki said. The sun is located about 149 million km from our planet.

"The data that Solar Orbiter obtains during the coming years will help modelers in predicting the solar cycle. This is important for us on Earth because the sun's activity causes solar flares and coronal mass ejections which can result in radio communication blackouts, destabilize our power grids, but also drive the sensational auroras," Reid said.

"Solar Orbiter's new vantage point out of the ecliptic will also allow us to get a better picture of how the solar wind expands to form the heliosphere, a vast bubble around the sun and its planets," Reid added. REUTERS

*

The Tribune
The Statesman
पंजाब केसरी जनसत्ता
The Hindu
The Economic Times
Press Information Bureau
The Indian Express
The Times of India
Hindustan Times
नवभारत टाइम्स
दैनिक जागरण
The Asian Age
The Pioneer