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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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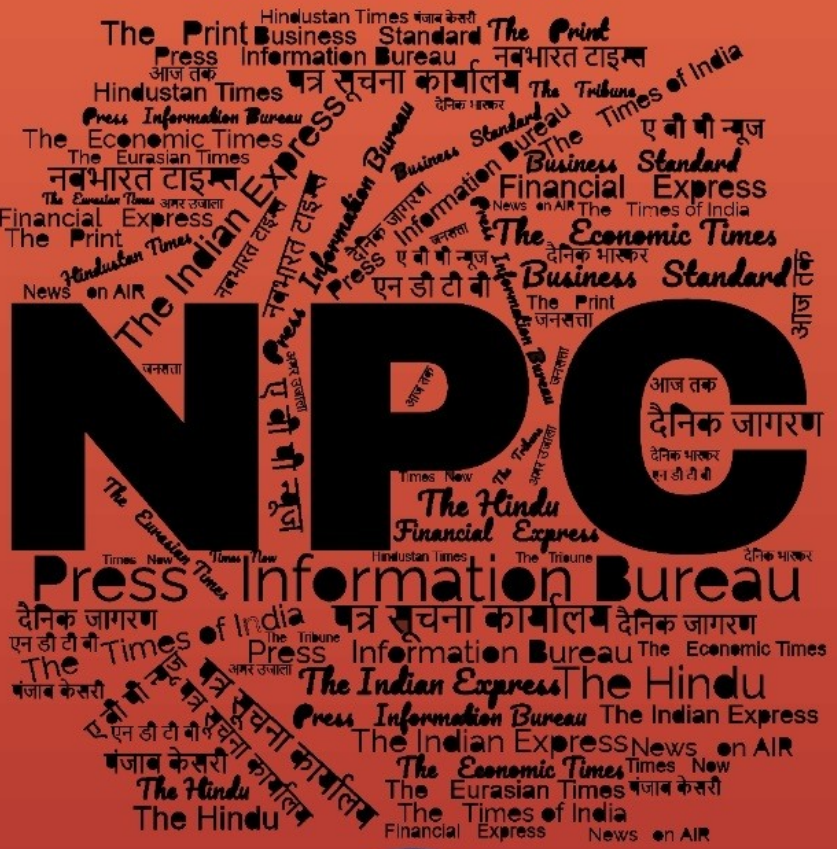

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CONTENTS

Defence News

Defence Strategic: National/International

INS Kochi Arrives at Male, Maldives for Handing Over MNDF CGS Huravee

Source: Press Information Bureau, Dt. 30 Apr 2025,
URL: https://pib.gov.in/PressReleasePage.aspx?PRID=2125571

Indian Navy's frontline Guided Missile Destroyer, INS Kochi, arrived at Male, Maldives, on 28 Apr 25 with Maldives National Defence Forces (MNDF) CGS Huravee, which underwent Normal Refit at Naval Dockyard, Mumbai from Dec 24 till Apr 25.

Shri G. Balasubramanian, High Commissioner of India to the Maldives, handed over MNDF CGS Huravee to Maj Gen Ibrahim Hilmy, Chief of Defence Force, MNDF, at a ceremony held at the MNDF Coast Guard Jetty.

INS Kochi's visit highlights the strong maritime links between India and the Maldives and emphasises the Indian Navy's commitment to security, peace and freedom of navigation in the region. In keeping with the two nations' friendly relations, Maldivian authorities warmly welcomed the ship.

As part of the ship's visit, Capt Mahesh C Moudgil, Commanding Officer, INS Kochi, called on Maj Gen Ibrahim Hilmy, Chief of Defence Force, MNDF and Brig Gen Mohammed Saleem, Commandant, Coast Guard MNDF.

During the ship's stay in harbour, bilateral meetings, cross-deck visits and sports fixtures have been planned between the Indian Navy and the MNDF.

INS Kochi was commissioned on 30 Sept 15 and is part of the Indian Navy's Western Fleet, which is based in Mumbai under the Western Naval Command.

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India, Egypt decide to work on technology abetting terror & terror financing

Source: The Economic Times, Dt. 01 May 2025,
URL: https://economictimes.indiatimes.com/news/defence/india-egypt-decide-to-work-on-technology-abetting-terror-terror-financing/articleshow/120781698.cms

India and Egypt strongly condemned the recent heinous terrorist attack in Pahalgam that targeted domestic and international tourists. Egypt reaffirmed its full support for India in confronting all forms of violence and terrorism aimed at undermining the country's security and stability.

Both sides agreed to strengthen joint efforts in combating terrorism in all its forms and manifestations. The two sides exchanged views on terror threats in their respective countries and regions.

These were decided at the 4th Meeting of the India-Egypt Joint Working Group on Counter Terrorism was held on 30 April in Cairo. The two delegations were led by Ambassador K. D. Dewal, Joint Secretary (Counter Terrorism), Ministry of External Affairs and Ambassador Walid Al-Fiqi, Director of the Department of Counter Terrorism, Ministry of Foreign Affairs of Egypt and included representatives of various agencies from both countries.

Both sides discussed ways to strengthen areas of cooperation to counter new and emerging challenges such as use of technology for terrorist purposes and financing of terrorism, including crypto currencies, unmanned aerial systems and misuse of cyber space by terrorists for spreading terrorist propaganda.

The two sides agreed to further strengthen bilateral cooperation in anti-money laundering efforts, drug trafficking and organized crime. Both sides agreed to deepen cooperation in training and capacity building, cyber security, use of AI for counter terrorism, exchange of best practices and information sharing.

The two sides also discussed strengthening of multilateral cooperation in counter terrorism including in the United Nations, BRICS, the Global Counter Terrorism Forum (GCTF) and FATF. In this context, both sides exchanged views on how to enhance effectiveness of the GCTF and reiterated the commitment to early finalization and adoption of the UN Comprehensive Convention on International Terrorism (CCIT).

Earlier, Egyptian President spoke with PM Narendra Modi and Foreign Minister dialled EAM to express solidarity following Pahalgam attacks.

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Loiter, Strike, Repeat: Inside India's Drone Army For The Next Border Clash

Source: Swarajya, Dt. 30 Apr 2025,
URL: https://swarajyamag.com/defence/loiter-strike-repeat-inside-indias-drone-army-for-the-next-border-clash

The battlefield is changing, and so is India's approach to war.

Along the rugged ridge-lines of the Himalayas and the tense stretches of the western border, the Indian Army is rethinking how it prepares for the next conflict. Tanks, artillery, and infantry still matter—but increasingly, it's the unmanned, hovering machines in the sky that are drawing the most attention. Drones are no longer a futuristic accessory to warfare—they are fast becoming central to it. The world saw it in Ukraine.

Earlier this year, India's Defence Research and Development Organisation (DRDO) and Bharat Electronics Limited (BEL) successfully tested the Integrated Drone Detection and Interdiction System (IDD&IS)—a laser-based setup meant to take down hostile drones along the Line of Actual Control with China. With jamming capabilities at a range of 2–5 km and laser kills up to 800 meters, the system is one response among many to a growing challenge: securing Indian airspace from increasingly frequent drone incursions.

Recent wars—especially the ongoing Russia-Ukraine conflict—have underlined how deeply unmanned systems have changed the nature of combat.

Cheap, agile, and expendable, drones have been used in massive numbers for everything from surveillance and artillery correction to direct strikes and even propaganda. Military planners across the world have taken note—and India is no exception.

Over the past few years, the Indian Army has been steadily expanding its drone fleet, acquiring systems to match evolving threats, especially from across the Line of Control. Pakistan, too, has serious drone capabilities, backed by Chinese-supplied CH-4s and Turkish Bayraktar TB2s, along with cheep, improvised, commercially-available machines built for civilian use, some of which it has provided to its terror outfits.

From loitering munitions to swarm drones, many of these platforms are being developed under the Aatmanirbhar Bharat push, while others are imported or produced through joint ventures. Together, they represent a new phase in the Indian Army's modernisation—not one of dramatic leaps, but of quiet, calculated adjustments.

Here are some such weapons that could come into play if the rising tensions between India and Pakistan post Rawalpindi's Pahalgam gamble turn into active hostilities.

1. Nagastra-1

Maker: Solar Industries India, in collaboration with Z-Motion Autonomous Systems Pvt Ltd.

Inducted/Ordered: Indian Army has 480 units as of December 2024

Role and Capabilities: Weighing just 9 kg, the Nagastra-1 is a man-portable, fixed-wing electric UAV designed for tactical precision and stealth. With a flight endurance of 30 minutes, it offers a 15 km range under man-in-the-loop control, extendable to 30 km in autonomous mode. Its electric propulsion enables a low acoustic signature, making it nearly undetectable at altitudes above 200 metres.

Armed with a 1 kg high-explosive fragmenting warhead designed to neutralise soft-skin targets, the UAV is also equipped with day and night surveillance cameras for round-the-clock intelligence gathering. Unique among its class, the system allows for mission abort, in-flight recovery, and reuse via a parachute recovery mechanism.

Developed with over 75 per cent indigenous components in partnership with Bengaluru-based Z-Motion Autonomous Systems Pvt Ltd, the entire Nagastra-1 system, including the UAV, ground control station, communication control, payload, and pneumatic launcher, is compactly split across two rucksacks with a total weight of 30 kg, ensuring maximum portability for frontline deployments.

2. ALS-50

Maker: Tata Advanced Systems Limited

Inducted/Ordered: In service since 2024; 100 inducted

Role and Capabilities: The ALS-50 is an indigenous loitering munition with a 50 km range, 1 and 1-hour endurance. Featuring anti-jamming capabilities and a 50 kg payload, it is designed for precision strikes in GNSS-denied environments. Its compact design allows for rapid deployment, making it ideal for targeting Pakistani forward posts or supply lines.

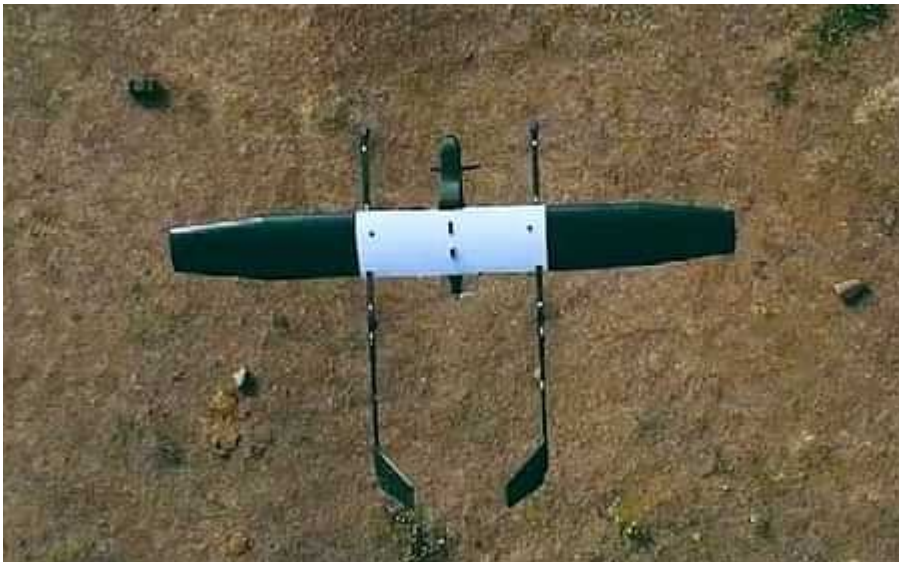
In a conflict, the ALS-50 could disrupt logistics and communications, leveraging its autonomous operation to strike with high accuracy, even under electronic warfare conditions.

3. SWITCH UAV (Advanced Tactical ISR Drone)

Maker: ideaForge (Mumbai-based drone manufacturer)

Inducted/Ordered: Contract worth $20 million (around Rs 140 crore) awarded for an undisclosed number; deliveries to be completed within one year

Role and Capabilities: The SWITCH UAV is a high-altitude capable, man-portable fixed-wing drone with Vertical Take-off and Landing (VTOL) capability. Designed for frontline infantry and Special Forces, particularly in contested regions like Ladakh, the drone is tailored for Intelligence, Surveillance and Reconnaissance (ISR) missions in extreme weather and terrain. Weighing 6.5 kg, the standard SWITCH has a 2-hour endurance and 15 km operational range from heights up to 4,000 metres.



The Army has ordered a more advanced variant with encrypted communications, extended endurance, HD optical payload with long-range target detection, and the ability to cover 700 sq km per launch. SWITCH emerged as the sole drone to pass the Army's rigorous evaluations, beating competition from suppliers like Israel's Elbit.

4. Trinetra

Maker: AeroArc (Indianised version of Skydio drone, USA)

Inducted/Ordered: Nearly 700 ordered by Indian Army

Role and Capabilities: Trinetra is an autonomous surveillance drone developed to meet the unique operational challenges faced by Indian forces in high-altitude and forested regions like Jammu and Kashmir. Adapted for extreme temperatures ranging from -40°C to +55°C and high elevations, Trinetra features six navigation cameras and two thermal cameras that allow obstacle avoidance and target detection without a visual line of sight.

Originally developed by Skydio and used by the US Department of Defense and Ukrainian forces, the platform has been locally tailored by Coimbatore-based AeroArc. While it faced performance issues in Ukraine under Russian electronic warfare, its Indianised variant is optimised for GPS-denied and EW-heavy environments, enhancing Army surveillance and reconnaissance capabilities in hostile terrain.

5. Swarm Drone System (Heterogeneous High-Density Swarm)

Maker: NewSpace Research & Technologies (Bengaluru-based startup)

Inducted/Ordered: 100 swarm drone units inducted

Role and Capabilities: This is India's first operational heterogeneous swarm drone system, capable of autonomous massed attacks up to 50 km into enemy territory. Each swarm comprises 100 drones working cooperatively without a central controller, using advanced AI, autonomy, and edge

computing. Designed to operate in contested airspace, the drones carry small bombs and can self-organise, adapt formations, and continue missions even after partial losses.

Intended for use against armoured columns, artillery positions, and bunkers, the swarm system provides overwhelming saturation attacks, imposing high costs on enemy air defences. Originally conceived through the IAF's 2018 Mehar Baba competition, the programme marks a global first in operational high-density swarming UAS induction. The Army has begun fielding them in mechanised units, with the IAF expected to follow.

6. FPV Kamikaze Drone (Explosive Payload UAV)

Maker: Developed jointly by the Indian Army's Fleur-De-Lis Brigade and Terminal Ballistics Research Laboratory (TBRL), Chandigarh

Inducted/Ordered: First trial batch of 5 inducted; 95 more under procurement as of March 2025

Role and Capabilities: This indigenous First-Person View (FPV) kamikaze drone, a first for the Indian Army, is equipped with a 400-gram shaped charge capable of piercing tank armour. Such a drone would be of much use to the Indian Army if it were to cross the international border into Pakistan. Costing only Rs 1.4 lakh per unit, it is inspired by battlefield successes in Ukraine and offers a low-cost alternative to imported systems like the US Switchblade and Israel's Harop.

Assembled at the Army's Rising Star Drone Battle School, it is tailored for tactical missions with real-time relay systems for precision targeting. Rigorously tested in Pathankot, this system includes dual-safety features and FPV-controlled detonation, making it a reliable, scalable solution for high-impact strikes.

7) Black Hornet

Maker: FLIR Systems (now Teledyne FLIR), USA.

Inducted/Ordered: Inducted 100; 200 more approved

Role and Capabilities: The Black Hornet is a nano-drone weighing just 33 grams, designed for squad-level surveillance and reconnaissance. With a 2 km range and 25-minute endurance, it

provides real-time video feed for urban and rugged terrain operations. In a conflict with Pakistan, Black Hornets could be deployed by infantry units to scout terrorist hideouts or monitor LoC crossings, reducing soldier exposure.

Black Horned nano-droneBlack Horned nano-droneIts stealth and portability make it a critical asset for situational awareness in contested areas. In January 2025, the Army announced plans to procure an additional 200 units of the drone

8. Warmate

Maker: WB Group, Poland.

Inducted/Ordered: Reportedly 100 inducted

Role and Capabilities: The Warmate is a lightweight loitering munition with a 30 km range and a 1.4 kg warhead, designed for precision strikes against personnel and light vehicles. Its portability and 50-minute loiter time make it suitable for rapid-response missions.

In a Pakistan conflict, Warmate drones could target militant groups or small-scale fortifications, offering a low-cost, high-impact solution. Its testing in Ladakh highlights its suitability for high-altitude operations along the LoC.

Its modular design allows for quick deployment by special forces and seamless integration with onboard vehicle systems, including the Ground Control Station and Ground Data Terminal.

The drone is fully autonomous, providing real-time video feeds for battlefield awareness and incorporating advanced control modules that automate most flight phases while assisting the operator with targeting tasks. Despite its autonomous capabilities, the operator retains full control and is solely responsible for activating.

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पाकिस्तानी विमानों और फाइटर जेट के सिग्नल जाम करेगा भारत, उठाया ये बड़ा कदम

Source: Aaj Tak, Dt. 01 May 2025,
URL: https://www.aajtak.in/defence-news/story/india-deploys-jammers-to-block-pakistan-aircraft-navigation-systems-pahalgam-terror-attack-ntc-dskc-2229796-2025-05-01

पहलगाम आतंकी हमले ने भारत और पाकिस्तान के संबंधों को रसातल तक धकेल दिया है. इस बीच भारत की ओर से होने वाली संभावित सैन्य कार्रवाई से पाकिस्तान अलर्ट पर है. ऐसे में भारत ने पाकिस्तान के नैविगेशन सिस्टम पर बड़ी चोट की है. सूत्रों का कहना है कि भारत ने पाकिस्तानी सेना के विमानों द्वारा इस्तेमाल में लाए जा रहे ग्लोबल नैविगेशन सैटेलाइट सिस्टम के सिग्नल को बाधित करने के लिए एडवांस्ड जैमिंग सिस्टम की तैनाती की है. इन्हें पश्चिमी सीमा पर तैनात किया गया है.

भारत के जैमिंग सिस्टम से जीपीएस, GLONASS और बैदू सहित सैटेलाइड आधारित नैविगेशन प्लेटफॉर्म में खलल डालने में सक्षम है. इन सभी का इस्तेमाल पाकिस्तानी सेना के विमानों द्वारा किया जा रहा है. इससे पहले भारत ने पाकिस्तान के विमानों के लिए अपने एयरस्पेस को बंद करने का फैसला किया. पाकिस्तान के लिए भारत का एयरस्पेस 30 अप्रैल से 23 मई तक के लिए बंद रहेगा.

बता दें कि जैमिंग सिस्टम इलेक्ट्रॉनिक वॉरफेयर का हिस्सा है, जिसे रेडियो फ्रीक्वेंसी सिगनलों को बाधित करने के लिए डिजाइन किया जाता है. इससे कई बार गलत सिग्नल भेजकर दुश्मनों के उपकरणों को भ्रमित भी किया जाता है. भारत द्वारा तैनात किए गए ये सिस्टम हाई फ्रीक्वेंसी जैमिंग सिस्टम हैं, जो विशेष रूप से सैन्य अभियानों में उपयोग होने वाले GNSS सिग्नलों को लक्षित करने के लिए डिजाइन किए गए हैं.

पाकिस्तान द्वारा किए गए सीजफायर उल्लंघन के बाद LOC के कई सेक्टरों में गतिविधियां तेज हो गई हैं. भारतीय सेना ने स्थिति पर कड़ी नजर रखी हुई है और सीमावर्ती क्षेत्रों में ऑपरेशनल अलर्ट जारी कर दिया गया है. दरअसल, पहलगाम में आतंकी हमले के बाद भारत सरकार एक्शन मोड में है और पाकिस्तान पर सख्त फैसले ले रही है. इस बीच, नियंत्रण रेखा पर तनाव बढ़ता जा रहा है.

पाकिस्तान पिछले सात दिन से लगातार सीजफायर तोड़ रहा है और हल्के हथियारों से रातभर फायरिंग कर रहा है. लेकिन बुधवार को पाकिस्तान ने स्थिति को और बिगाड़ दिया है. उसने अब जम्मू के परागवाल सेक्टर में अंतरराष्ट्रीय सीमा पर फायरिंग की है. रक्षा सूत्रों का कहना है कि मंगलवार सुबह तक पाकिस्तानी सेना सिर्फ नियंत्रण रेखा पर ही संघर्ष विराम का उल्लंघन कर रही थी, लेकिन अब उसने बुधवार रात जम्मू के परागवाल सेक्टर में अंतरराष्ट्रीय सीमा पर गोलीबारी की है, जिसके बाद पाकिस्तान ने स्थिति को और बिगाड़ दिया है.

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Rajnath Singh to represent India at 80th Victory Day event in Moscow

Source: The Tribune, Dt. 30 Apr 2025,
URL: https://www.tribuneindia.com/news/india/rajnath-singh-to-represent-india-at-80th-victory-day-event-in-moscow/

Defence Minister Rajnath Singh will represent India at the 80th anniversary celebrations of Victory Day to be held in Moscow next month.

As per sources, the Russian side was informed earlier about Rajnath Singh representing India.

Kremlin spokesman Dmitry Peskov today said Indian Prime Minister Narendra Modi would not be attending the celebrations that include a military parade in Moscow on May 9. “India will not be represented at the highest level,” Peskov said.

President Vladimir Putin had invited Modi and Chinese President Xi Jinping to attend the celebration in Moscow to watch the victory parade at the Red Square. Russia has also declared a ceasefire in Ukraine on May 8-10 for WWII Victory Day

Russia's state-run news agency quoted Putin as saying, “On the banks of the Volga, our troops halted and crushed the enemy. A decisive blow was delivered to the Nazi war machine, marking a turning point in the war and opening the road westward — to Berlin and to the Great Victory, whose 80th anniversary we will solemnly celebrate on May 9.”

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Science & Technology News

GenomeIndia

Government of India committed to fostering sustainable development through democratizing and disseminating this national genetic resource knowledge

The Government is committed to ensure fair and equitable access to GenomeIndia data by our researchers

Source: Press Information Bureau, Dt. 30 Apr 2025,
URL: https://pib.gov.in/PressReleasePage.aspx?PRID=2125504

The ‘GENOMEINDIA’, funded by the Department of Biotechnology of the Central Government has completed whole genome sequencing (WGS) database of over 10,000 individuals representing all major population groups, across the country. GenomeIndia data represents Government of India's commitment to scientific inquiry and is poised to reshape health and science in India and beyond, fostering sustainable development through democratizing and disseminating this national genetic resource knowledge.

The result oriented cumulative proactive actions taken by the Department towards setting up of IBDC, release of Biotech PRIDE Guidelines, formulation of FeED Protocols, transfer and storage of GenomeIndia Data in IBDC; followed by the announcements by the highest leaderships in the country indicate strong determination of the Government for sharing of this data with our researchers to analyze critical information, accelerating discoveries and advancements in biological sciences.

For the first time in the country, the department has established the Indian Biological Data Center (IBDC) in March 2020 with 96 TF computing capacity using 2912 CPUs, 39 TB of RAM, 865 TF computing capacity using 64 GPUs, 4 PB of parallel file system with the capability of writing 100GB of data every second and 1.5 PB of disk and tape to store backup copy of data. The Department has released the Biotech-PRIDE Guidelines, 2021 followed by formulation of 'Framework for Exchange of Data (FeED) Protocols' for responsible data sharing.

On 9th January 2025, during the 'Genomics Data Conclave', the 'GenomeIndia Data' was dedicated to the researchers by Shri Narendra Modi, Prime Minister of India. The Prime Minister stated that this national database encapsulates the extraordinary genetic landscape of India and will serve as an invaluable scientific resource to boost genetic and medical research for human health. Further, during the address to the nation on the evening of 25th January, 2025, Her Excellency, Smt. Draupadi Murmu, President of India said that GenomeIndia project marks a significant chapter in the history of Indian Science.

The department also announced the 'Call for Proposals' from researchers to exploit the opportunities of translational research using GenomeIndia data. To address the queries of the researchers, the Department issued the addendum mentioning the types and category of data that will be available for research, also "associated phenotype data" will be shared. It is clarified that access to GenomeIndia data is not limited to the 'Call' but independent requests for data access are being received by IBDC, under the ambit of Biotech PRIDE Guidelines and FeED Protocols.

As on date, this National Resource generated under the GenomeIndia project comprises of Fastq files of 9772 samples (~700 TB), gvcfs: 9772 (~35 TB), phenotypic data from 9330 samples and Joint call files (~3.5 TB) and is archived at IBDC, the National Repository.

To brief about the issue of phenotype data as mentioned in one of the news articles in a leading newspaper, it is stated here that curation and cleaning up of phenotypic data was performed on 9772 samples which underwent WGS and were used in joint calling. Out of these 9772 samples, phenotypic data from 9330 samples could be used because the data available for the rest of the samples (numbering 442) was not usable. Many phenotypic parameters had very high levels of missingness, so the data for the top 27 variables for 9330 samples is available for research. These 27 variables are Albumin, Alkaline_Phosphatase, ALT_SGPT, AST_SGOT, Basophils, Cholesterol, Creatinine, Direct_Bilirubin, Eosinophils, FBS_Fasting_Blood_Glucose, HB_Haemoglobin, HbA1C_Glycosylated_Haemoglobin, HDL, Indirect_Bilirubin, LDL, Lymphocytes, MCH_Mean_Corpuscular_Hb, Monocytes, Neutrophils, Platelet_Count, Protein, RBC_Red_Blood_Cell_Count, RBS, Total_Bilirubin, Triglycerides, Urea, WBC_Total_White_Blood_Cell_Count. The anthropometry data such as: Age, Gender, Height, Weight, Body Fat is also available.

Further, some of the news articles have also raised concern about making 'No Access' for FASTQ files. It is pertinent to mention here that the total size of FASTQ files is approximately 700 TB. The logistical and technical challenges of transferring these files are enormous. It is difficult to ensure the completeness and sanctity of downloads by requesters. Analyzing raw sequencing files often demands two- to three-times more computational capacity, leading to redundant workflows and wasted infrastructure at the national level. By providing equitable access to gVCF files (which

amounts to ~35 TB) instead, data can be shared more quickly and computational resources conserved. The international leading data banks established for more than 2 decades also does not allow the downloading of data; data is provided by their cloud platform. Hence, 'No Access' to FASTQ files in the department's 'Call' means that these files will not be available for download at present. This policy is in line with other global consortia. As IBDC will grow and expand in future, similar provisions may be incorporated.

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World's largest fusion project reaches major milestone with India's help

Source: The Economic Times, Dt. 30 Apr 2025,
URL: https://economictimes.indiatimes.com/news/science/worlds-largest-fusion-project-reaches-major-milestone-with-indias-help/articleshow/120771910.cms

In a major milestone, scientists working on the world's largest nuclear fusion project have completed its main magnet system with India playing a key role in building critical infrastructure. This system will power the core of ITER's Tokamak reactor, which aims to demonstrate that fusion, the energy source of the sun and stars, can be used as a safe and carbon-free power source on Earth.

Unlike nuclear fission, which splits atoms and produces radioactive waste, fusion involves heating hydrogen gas to extremely high temperatures until the atoms fuse, releasing large amounts of energy sans nuclear waste.

India is among the seven main members of the project and has played a key role in building some of its most critical infrastructure, including the massive cryostat cooling systems and heating technologies.

The final part of the magnet system was the sixth module of the Central Solenoid, the main magnet that will drive plasma, the superhot gas in which fusion reactions take place, in the reactor.

Built and tested in the United States, this powerful magnet will soon be assembled at the ITER site in southern France. When complete, it will be strong enough to lift an aircraft carrier and form the electromagnetic heart of the doughnut-shaped fusion machine.

ITER, which stands for International Thermonuclear Experimental Reactor, is a joint scientific effort of more than 30 countries, including India, China, the US, Russia, Japan, South Korea and members of the European Union.

The goal is to prove that fusion energy can be produced at an industrial scale.

The magnet system just completed is critical to creating and controlling the ultra-hot plasma inside the reactor. At full power, ITER is expected to produce 500 megawatts of energy from just 50 megawatts of input.

This would make the plasma self-sustaining, a state known as "burning plasma", which scientists see as key to unlocking fusion energy.

India has designed and manufactured the cryostat, an enormous 30-metre tall and 30-metre wide chamber that houses the entire ITER Tokamak.

India has also built the cryolines that carry liquid helium to cool the magnets to minus 269 degrees Celsius, the temperature needed for superconductivity.

It has also delivered the reactor's in-wall shielding, cooling water systems and key parts of the heating systems that will raise the temperature of the plasma to over 150 million degrees Celsius, 10 times hotter than the Sun's core.

Scientists say that if successful, fusion could offer the world a nearly limitless and clean energy source without the long-lived radioactive waste or carbon emissions of current technologies.

Thousands of scientists and engineers from member countries have contributed components from hundreds of factories on three continents to build a single machine.

ITER Director-General Pietro Barabaschi said, "What makes ITER unique is not only its technical complexity but the framework of international cooperation that has sustained it through changing political landscapes."

"This achievement proves that when humanity is faced with existential challenges like climate change and energy security, we can overcome national differences to advance solutions.

"The ITER Project is the embodiment of hope. With ITER, we show that a sustainable energy future and a peaceful path forward are possible," he said.

With more than 10,000 tonnes of superconducting magnets, made from over 1,00,000 kilometres of special wire, ITER represents a global effort to push the boundaries of science and energy technology.

In 2025, ITER completed the insertion of the first vacuum vessel module into the reactor pit three weeks ahead of schedule. The rest of the components, contributed by different countries, are being assembled piece by piece in what is described as one of the most complex engineering projects ever attempted.

Private companies are also getting involved. In recent years, there has been a growing interest and investments from the private sector in fusion research.

ITER has launched new programmes to share knowledge and research data with private players to speed up innovation and development of future fusion reactors.

Under the current plans, ITER will not produce electricity itself but will serve as a large research facility to test the fusion process at scale. The data generated is expected to help build future commercial fusion power plants.

As the host of the project, Europe is bearing 45 per cent of the construction cost. The other six members -- India, China, Japan, South Korea, Russia and the US -- are each contributing about 9 per cent. But all members will get full access to the research results and patents.

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Potential presence of primitive lunar mantle material at landing site: Study

Source: The Indian Express, Dt. 01 May 2025,
URL: https://indianexpress.com/article/technology/science/potential-presence-of-primitive-lunar-mantle-material-at-landing-site-study-9975799/

The Shiv Shakti point, where the world's first lunar landing was facilitated by India's Chandrayaan 3 in 2023, could hold a promising potential site for scientists to study the most primitive mantle samples on the lunar surface.

The Shiv Shakti point is located at the southern high-latitude highlands of the nearside of the Moon. Scientists from Physical Research Laboratory (PRL) used data gathered by Alpha Particle X-ray Spectrometer onboard the Pragyan rover. They compared metal remnants and elemental concentrations of sulfur, potassium, sodium among others at the Shiv Shakti point where Chandrayaan 3 landed on August 23, 2023. Sulfur, potassium and sodium can give insights into the mantle composition and chemistry.

"There is an anomalous depletion in sodium and potassium at the site, whereas there is an enrichment in sulfur found in the soils at the highland landing site," said the study published in the journal Nature Communications Earth and Environment.

Detailing its significance and the plausible reasons for both depletion and abundance of certain metals, the researchers said,

"There is a potential presence of primitive lunar mantle materials at the landing site, which was excavated during formation of the South Pole-Aitken basin, around 4.3 Ga (billion years) ago and may have got redistributed by subsequent impacts on the SPA basin ejecta. While the primitive mantle contributed to the excess sulfur, it later got mixed up with the materials at the landing site," the paper noted.

The South Pole-Aitken basin is one of the largest known impact craters on the lunar surface.

The low levels of sodium and potassium at the Shiv Shakti point, the researchers said, could suggest that these elements may not have originally existed at the place and time of the very formation of the SPA basin.

The variations in the elemental concentrations revealed by Chandrayaan 3 data has overturned findings made by previous lunar missions — the Apollo 16 and Luna 20 by the US and the Soviets, respectively.

According to the PRL team, Chandrayaan 3 data noted the concentration of sulfur to be 300-500 parts per million higher than in soils gathered by the above missions. The Indian team is studying this anomalous difference in the concentrations and trace the causes at the landing site.

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