

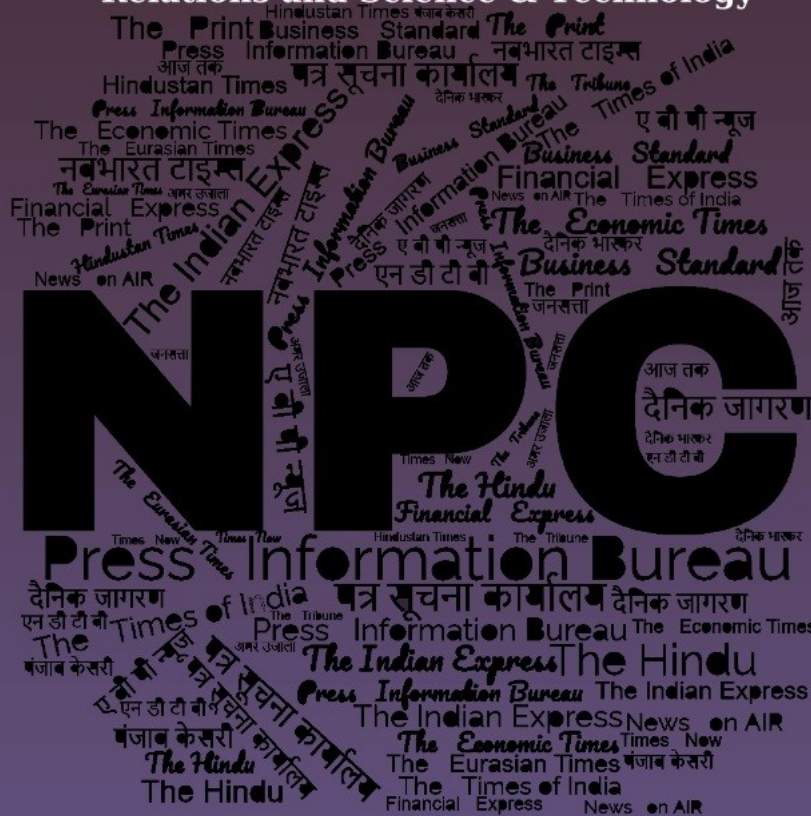
जुलाई  
July  
2024

खंड/Vol. : 49 अंक/Issue : 123  
04/07/2024

# 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  
Metcalf House, Delhi - 110 054

# CONTENTS

S. No.	TITLE	Page No.
<b>DRDO News</b>		<b>1</b>
<b>DRDO Technology News</b>		
1	कब होगी मॉनसून वाली बारिश? अब IMD देगा सटीक जानकारी, DRDO ने तैयार किया मेघसूचक	<i>Hindustan</i> 1
<b>Defence News</b>		<b>2-17</b>
<b>Defence Strategic: National/International</b>		
2	India-Mongolia Joint Military Exercise NOMADIC ELEPHANT Commences In Meghalaya	<i>Press Information Bureau</i> 2
3	TDF scheme playing a crucial role in promoting 'Aatmanirbharta' in defence; Start-ups & MSMEs being encouraged to enhance capabilities in cutting-edge technology	<i>Press Information Bureau</i> 3
4	Indian Navy Chief Admiral Dinesh K Tripathi calls on Bangladesh PM Sheikh Hasina	<i>The Economic Times</i> 5
5	Army chief reviews security situation along LoC in J-K; meets DGP, other police officers	<i>The Economic Times</i> 6
6	Three Theatre Command bases identified, Military Affairs Dept working to integrate forces for future wars	<i>The Economic Times</i> 7
7	Pakistan arming JF-17 jets with Ra'ad nuke missiles	<i>The Times of India</i> 8
8	Russia's Su-57 Back In Reckoning For Indian Air Force; Modi, Putin Likely To Discuss Stealth Fighters For IAF	<i>The EurAsian Times</i> 9
9	Indian Army propels towards zero-emission by introducing 113 electric buses	<i>The Economic Times</i> 11
10	Battle tank comparison: India's T-90 tanks vs China's ZTZ-99A MBTs	<i>Financial Express</i> 11
11	New Cuban radar site near US military base could aid China spying, think tank says	<i>The Economic Times</i> 12
12	After a stop in Cuba, 2 Russian ships dock in Venezuelan port as part of 'show the flag' exercises	<i>The Economic Times</i> 14
13	US allies allege China is developing attack drones for Russia	<i>The Economic Times</i> 14
14	US "Re-Evaluates" 6th-Gen Fighter Program Over Soaring Costs; Air Force Boss Says NGAD Not Dead Yet	<i>The EurAsian Times</i> 16
<b>Science &amp; Technology News</b>		<b>18-24</b>
15	New study connecting rainfall & CO2 increase can aid future conservation of biodiversity hotspots	<i>Press Information Bureau</i> 18
16	Scientists propose a new measure of flexibility for crystals	<i>Press Information Bureau</i> 19

17	ISRO seeks active role in global efforts to shield earth from asteroids	<i>The Economic Times</i>	20
18	ISRO's Aditya-L1 completes first halo orbit around Sun-Earth L1 point	<i>The Indian Express</i>	21
19	ISRO's Chandrayaan 3 rover makes significant discovery at Shiv Shakti point on Moon's South Pole	<i>The Indian Express</i>	22
20	Three crucial Gaganyaan tests planned this year: ISRO chairman	<i>The Hindu</i>	22
21	What Is Geoportal-Bhuvan, ISRO Tool That Gives '10 Times More Info Than Google'?	<i>Times Now</i>	23

# हिन्दुस्तान

Thu, 04 July 2024

## कब होगी मॉनसून वाली बारिश? अब IMD देगा सटीक जानकारी, DRDO ने तैयार किया मेघसूचक

डीआरडीओ ने जो रॉकेट भारतीय नौसेना को सौंपी है, उसका नाम माइक्रोवेव ऑब्स्क्यूरेंट चैफ रॉकेट (Microwave Obscurant Chaff Rocket) है, जिसे शॉर्ट में MOC रॉकेट भी कहा जा सकता है. भारतीय नौसेना को मिला यह एक ऐसा हथियार है, जो पलक झपकते ही दुश्मन का खेल तमाम कर सकता है. इस रॉकेट के प्रहार से दुश्मन का बच पाना बिल्कुल नामुमकिन है. अब आइए इस रॉकेट की खूबियां जानते हैं.

डीआरडीओ ने मौसम विभाग और नौसेना मुख्यालय के समक्ष मेघसूचक का प्रदर्शन किया है। डीआरडीओ का दावा है कि यह तकनीक सभी पैरामीटर पर खरी उतरी है। डीआरडीओ की देहरादून स्थित प्रयोगशाला इंस्ट्रूमेंट रिसर्च एंड डेवलपमेंट इस्टेबलिसमेंट (आईआरडीई) ने इसेविकसित किया है। डीआरडीओ के सूत्रों के अनुसार इस तकनीक को जल्द ही मौसम विभाग को सौंपा जा सकता है।

### इस तरह करेगी काम

लिडार तकनीक में लेजर के जरिये बादलों एवं धूलकणों का आंकलन किया जाता है। इसमें एक लेजर बीम के जरिये किरणें बादलों एवं धूलकणों तक जाती हैं तथा उनसे टकराकर वापस लौटती हैं। यह प्रक्रिया एक सेकेंड के भीतर लाखों बार दोहराई जाती है। इसके बाद एक थ्री डीप मैप तैयार किया जाता है, जिसके जरिये बादलों एवं धूलकणों का सटीक आंकलन किया जाता है जो मौसम के पूर्वानुमान में निर्णायक साबित होता है। इस तकनीक का इस्तेमाल उपग्रह, विमान या ड्रोन के जरिये किया जा सकेगा।

### 100 फीसदी सटीक होगा आंकलन

लिडार तकनीक के जरिये किसी मौसम संबंधी घटना के समय का सौ फीसदी तक निर्धारण संभव हो सकेगा। मसलन, बारिश कितने बजे होगी, यह आंकलन सौ फीसदी संभव होगा। विश्व की चुनिंदा मौसम एजेंसियां इस तकनीक का इस्तेमाल कर रही हैं।

<https://www.livehindustan.com/weather/story-imd-will-give-accurate-information-baout-monsoon-and-weather-drdo-has-prepared-meghsuchak-10373317.html>



**Press Information Bureau**  
**Government of India**

**Ministry of Defence**

*Wed, 03 July 2024*

### **India-Mongolia Joint Military Exercise NOMADIC ELEPHANT Commences In Meghalaya**

The 16th edition of India-Mongolia Joint Military Exercise NOMADIC ELEPHANT commenced today, at Foreign Training Node, Umroi (Meghalaya). The Exercise is scheduled to be conducted from 03rd to 16th July 2024.

Indian contingent comprising of 45 personnel is being represented by a Battalion of SIKKIM SCOUTS along with personnel from other arms and services. The Mongolian contingent is being represented by personnel from 150 Quick Reaction Force Battalion of the Mangolian Army. Exercise NOMADIC ELEPHANT is an annual training event conducted alternatively in India and Mongolia. Last edition was conducted in Mongolia in July 2023.

The Opening Ceremony of the Exercise NOMADIC ELEPHANT was attended by His Excellency Mr. Dambajavyn Ganbold, Ambassador of Mongolia to India and Major General Prasanna Joshi, General Officer Commanding 51 Sub Area of the Indian Army. The aim of the Exercise is to enhance joint military capability of both sides to undertake counter insurgency operations in a Sub Conventional scenario under Chapter VII of the United Nations Mandate. The exercise will focus on operations in the semi-urban and mountainous terrain.

Tactical drills during the Exercise include Response to a Terrorist Action, Establishment of a Joint Command Post, Establishment of an Intelligence & Surveillance Centre, Securing of a Helipad/Landing Site, Small Team Insertion & Extraction, Special Heliborne Operations, Cordon & Search Operations besides Employment of Drones and Counter Drone Systems amongst others. Major General Gyanbyamba Sunrev, Chief of General Staff of the Armed Forces of Mongolia is scheduled to attend the closing ceremony on 16th July 2024 along with Lieutenant General Zubin A Minwalla, General Officer Commanding 33 Corps of the Indian Army.

Exercise NOMADIC ELEPHANT will enable both sides to share their best practices in Tactics, Techniques and Procedures of conducting joint operations. The exercise will also facilitate developing inter-operability, bonhomie and camaraderie between the two armies. This will also enhance the level of defence cooperation, further augmenting bilateral relations between the two friendly nations.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2030373>



## **TDF scheme playing a crucial role in promoting 'Aatmanirbharta' in defence; Start-ups & MSMEs being encouraged to enhance capabilities in cutting-edge technology**

The Technology Development Fund (TDF) scheme is encouraging the participation of public/private industries, especially start-ups and MSMEs, to create an ecosystem aimed at enhancing the capabilities in cutting-edge technology and promoting 'Aatmanirbharta' in defence.

The TDF scheme is a flagship programme of Ministry of Defence executed by Defence Research and Development Organisation (DRDO) under the 'Make in India' initiative.

Till date, a total of 77 projects, with a commitment of over Rs 300 crore, have been sanctioned to various industries, and 27 defence technologies have been successfully realised under the scheme.

Following are the success stories of some start-ups under the TDF scheme:

### **1. Combat Robotics, Pune**

Combat Robotics, the Pune-based start-up, has successfully developed an Innovative Simulator for Unmanned Vehicles. It is a multi-domain simulator that supports Unmanned Ground Vehicles (UGVs), Unmanned Underwater Vehicles (UUVs), Unmanned Surface Vehicles (USVs), and Unmanned Aerial Vehicles (UAVs), serving as an excellent development tool for agencies working on developing autonomous systems.

The simulator provides Comprehensive Environmental Modelling, Scenario & Vehicle Modelling and Intuitive Control Systems with Developer Documentation. It is designed to cater to the demands of testing, and validate the autonomous behaviours of unmanned vehicles across multiple domains. It has been developed under the aegis of Centre for Artificial Intelligence and Robotics (CAIR), a Bengaluru-based laboratory of DRDO.

### **2. ChiStats Labs Private Limited, Pune**

•**Virtual Sensors for Aero Gas Turbine Engine Health Monitoring:** The project involves development of a comprehensive diagnostic system of various parts of Aero Gas Turbine Engine (AGTE), leading to increased operational reliability and longevity of the engine. The system is built on stronger foundations of modern Artificial Intelligence/Machine Learning (AI/ML) technologies. It efficiently handles large-scale data, and conducts operational assessments rapidly with a high degree of accuracy. The virtual sensor framework is being developed indigenously.

The technology has been successfully developed under the technical guidance and mentorship by Gas Turbine Research Establishment, a Bengaluru-based laboratory of DRDO. ChiStats Labs Private Limited is a start-up in the field of data science and artificial intelligence (AI) solutions and the winner of Dare to Dream 2.0 Innovation contest of DRDO.

•**Tools for Data Assessment, Active Learning & Believability for Visual Data:** This groundbreaking project is aimed at enhancing AI model validation and optimisation for



defence applications. It will facilitate collaboration among scientists through shared and reproducible experiments. All the tools are accessible via a user-friendly web interface.

The project focuses on developing a comprehensive framework to address the unique challenges posed by the vast amounts of data generated in defence scenarios. It consists of four key modules: Data/Feature Assessment, Active Learning, AI Believability and Web Application.

It will empower defence organisations to build more accurate, reliable, and efficient AI models, leading to improved decision-making and enhanced capabilities in various critical applications. CAIR, Bengaluru was instrumental in mentoring and monitoring of the project.

### **3. NewSpace Research and Technologies Pvt. Ltd., Bengaluru**

The Bengaluru-based start-up, under the project titled ‘Autonomous Drone as First Responder for Search and Report Operations in Enclosed/Indoor Environments’, has created a cutting-edge UAV capable of exploring indoor environments under various conditions, including in zero light.

The project focuses on development of Indoor UAV integrated with autonomous navigation stack, onboard object detection module and localisation fall back mechanism integrated with flight control firmware. Integration with autonomous navigation stack includes 3D mapping, exploration algorithm and AI/ML engine.

The success of the project opens up avenues for various applications including search and rescue operations, surveillance, industrial inspections, environment monitoring as well as hazardous environment exploration, contributing significantly to technological advancements in unmanned aerial systems. The technology has been developed under the technical guidance and mentorship of CAIR, Bengaluru.

Secretary, Department of Defence R&D and Chairman DRDO Dr Samir V Kamat has congratulated the start-ups and DRDO labs associated with these projects. These achievements mark DRDO’s successful endeavour to promote the industry in realising Prime Minister Shri Narendra Modi’s vision of ‘Aatmanirbhar Bharat’, he said.

The main objectives of the TDF scheme include:

- To provide Grant in Aid to Indian industries, including MSMEs & start-ups, as well as academic and scientific institutions for the development of defence and dual use technologies that are currently not available with the Indian defence Industry.
- To engage with the private industries, especially MSMEs and start-ups, to bring in the culture of Design & Development of Military Technology and support them with Grant in Aid.
- To focus on Research, Design & Development of Niche technologies which are being developed for the first time in the country.
- To create a bridge amongst the Armed Forces, research organisations, academia and qualifying/certifying agencies with private sector entities.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2030445>

## **Indian Navy Chief Admiral Dinesh K Tripathi calls on Bangladesh PM Sheikh Hasina**

Indian Navy Chief Admiral Dinesh K Tripathi called on Bangladesh's Prime Minister Sheikh Hasina, as a part of his ongoing visit to the neighbouring country. During the discussions that took place on July 2, the Prime Minister of Bangladesh appreciated India's contribution to Bangladesh's War of Liberation in 1971.

"Adm Dinesh K Tripathi CNS, on an official visit to Bangladesh, called on HE Sheikh Hasina, Hon'ble Prime Minister of Bangladesh on #02Jul 24. During discussions, the PM of Bangladesh recalled & appreciated India's contribution to Bangladesh's War of Liberation in 1971," the Indian Navy said in a post on X, following the meeting between the Indian Navy Chief, and Sheikh Hasina.

"CNS apprised the PM regarding the progress of ongoing bilateral maritime engagements b/n the Indian navy & the Bangladesh Navy," the post read further.

Adm Dinesh K Tripathi #CNS, on an official visit to #Bangladesh, called on HE Sheikh Hasina, Hon'ble Prime Minister of Bangladesh on #02Jul 24. During discussions, the PM of Bangladesh recalled & appreciated #India's contribution to Bangladesh's War of Liberation in 1971.

#CNS... [pic.twitter.com/sq6SiCsAfX](https://pic.twitter.com/sq6SiCsAfX) - SpokespersonNavy (@indiannavy) July 3, 2024  
Admiral Dinesh K Tripathi is on an official visit to Bangladesh for four days from July 1-4.

The visit is aimed at consolidating bilateral defence relations between India and Bangladesh and exploring new avenues for Naval cooperation, a Navy press release said. The Navy Chief is scheduled to hold bilateral discussions with his counterpart Admiral M Nazmul Hassan, Chief of the Naval Staff, Bangladesh Navy in Dhaka, and also review the Passing Out Parade scheduled at Bangladesh Naval Academy (BNA) at Chittagong on July 4, the release added.

India and Bangladesh share bonds of history, language, culture, and a multitude of other commonalities. The excellent bilateral ties reflect an all-encompassing partnership based on sovereignty, equality, trust, and understanding that goes far beyond a strategic partnership.

The partnership has strengthened, matured and evolved as a model for bilateral relations for the entire region and beyond. In the defence sector, significant bilateral exchanges took place in 2023 with incoming and outgoing visits of the Chiefs of the Indian and Bangladesh Armed Forces.

Bangladesh Chief of Army Staff visited New Delhi from April 27-29, 2023 and on his invitation, the Chief of Staff, Indian Army paid a visit to Bangladesh in June 2023 as presiding officer for the Passing Out Parade at Bangladesh Military Academy.

<https://economictimes.indiatimes.com/news/defence/indian-navy-chief-admiral-dinesh-k-tripathi-calls-on-bangladesh-pm-sheikh-hasina/articleshow/111447242.cms>



## **Army chief reviews security situation along LoC in J-K; meets DGP, other police officers**

Army Chief Gen Upendra Dwivedi reviewed the security situation along the Line of Control (LoC) in Jammu and Kashmir on Wednesday and exhorted the troops to remain steadfast to meet all security challenges, officials said.

This was his first visit to the Jammu region after taking charge as the 30th chief of the Indian Army on June 30 and it assumes significance in view of the ongoing Amarnath Yatra and massive anti-terror operations underway, especially in the hilly districts.

The Army chief reached Jammu in the morning and flew to the border district of Poonch to review the security situation and operational preparedness along the LoC, the officials said, adding he was accompanied by General Officer Commanding-in-chief, Northern Command, Lt Gen Suchindra Kumar and General Officer Commanding (GOC) of the Jammu-based White Knight Corps Lt Gen Navin Sachdeva. Gen Dwivedi also chaired a high-level meeting of Army and police officers on his return from Poonch at the Army headquarters in Nagrota.

Director General of J&K Police R R Swain, Additional Director General of Police, Law and Order, Vijay Kumar and ADGP, Jammu zone, Anand Jain attended the meeting.

In a post on 'X', the additional directorate general of public information of the Army said Chief of Army Staff Dwivedi, along with the Northern Army and the White Knight Corps commanders, visited forward locations of the 'XVI Corps', also known as the White Knight Corps, to review the security situation along the LoC.

"He was briefed on the operational preparedness by the commanders on the ground. The COAS lauded all ranks for maintaining high standards of professionalism and exhorted them to remain steadfast to meet all current and emerging security challenges," the additional directorate general of public information said.

In photos shared by the Army, Gen Dwivedi can be seen interacting with troops. Earlier, the officials said, the Army chief chaired a meeting of field commanders on reaching Poonch before leaving for the forward areas.

He also interacted with some ex-servicemen at the 93 Infantry Brigade and visited the district police headquarters in Poonch, they said. A police spokesperson said Gen Dwivedi was received by Deputy Inspector General of Police, Rajouri-Poonch Range, Tejinder Singh, District Magistrate Yaseen M Choudhary and Senior Superintendent of Police Yougal Manhas.

Gen Dwivedi's visit underscores the commitment to maintaining strong collaboration between the military and civil forces for enhanced security and development in the region, he said. The Army chief, who served as the General Officer Commanding-in-Chief of the Northern Command from 2022 to 2024, returned to Delhi in the evening, the officials added.

<https://economictimes.indiatimes.com/news/defence/army-chief-reviews-security-situation-along-loc-in-j-k-meets-dgp-other-police-officers/articleshow/111466758.cms>

## **Three Theatre Command bases identified, Military Affairs Dept working to integrate forces for future wars**

Even as Prime Minister Narendra Modi assured that the creation of Theatre Commands was on track, the Defence Ministry has identified three locations in Lucknow, Jaipur and Thiruvananthapuram as their headquarters.

The Department of Military Affairs (DMA) under Chief of Defence Staff Gen Anil Chauhan, who is responsible for raising the theatre commands, is now focusing their energy towards implementing over 150 points to enhance integration among the three services and make ready for the multi-domain warfare of the future. On July 2, Prime Minister Modi had stated in Parliament that the creation of theatre commands was on track and modernisation of armed forces was in full swing.

As per the plans of the DMA, the Western Theatre being raised to look after the Pakistan side is planned to be raised at Jaipur while the Northern Theatre to tackle the threat from the eastern and northern sides is planned to be set up at Lucknow, defence sources told ANI.

The Indian Navy-headed Maritime Theatre Command is now planning to come up at Thiruvananthapuram in Kerala and will be looking after the maritime borders of the country and threats emanating from the maritime zone. The Department of Military Affairs is working towards implementing over 150 points aimed at enhancing integration among the forces three to create a joint culture and work ethic there.

This includes integrating the different standard operating procedures of the three services for doing a common task.

The repair and maintenance facilities of the forces for common platforms are also being integrated and the latest example in this would be the Apache attack choppers, ALH Dhruv and AK-203 assault rifles. The 100-day agenda of the Defence Ministry would also see a lot of these points getting implemented by the government.

The Modi government as well as the BJP in its party manifesto have assured about the creation of theatre commands for better preparedness for fighting wars of the future. The creation of Theatre Commands was seen as a tough task but the CDS and the three services have adopted the road of consensus to resolve all the issues for this purpose and have achieved a lot of success in this domain.

It is envisaged that the three Theatre Commands with the CDS on top would be fully empowered to use resources to efficiently conduct operations in the future. The forces would be supported fully and ably by agencies such as Cyber Command, Space Command and Armed Forces Special Operations Division in meeting their challenges

<https://economictimes.indiatimes.com/news/defence/three-theatre-command-bases-identified-military-affairs-dept-working-to-integrate-forces-for-future-wars/articleshow/111466494.cms>

## **Pakistan arming JF-17 jets with Ra'ad nuke missiles**

A recent image captured during rehearsals for the 2023 Pakistan Day Parade has shed light on the potential nuclear capabilities of Pakistan's JF-17 Thunder Block II aircraft. The photograph depicts a JF-17 carrying what appears to be a Ra'ad air-launched cruise missile (ALCM), marking the first public observation of this configuration.

Analyzing images of a JF-17 Thunder Block II from the 2023 Pakistan Day Parade rehearsals, the Federation of American Scientists (FAS) confirmed that the fighter jet was equipped with a Ra'ad-I nuclear missile.

Notably, this was the first time such a configuration had been observed in public," the FAS said in its report. To determine the specific type of Ra'ad missile in the image, comparisons were made with Ra'ad-I and Ra'ad-II missiles displayed in previous Pakistan Day Parades.

While the Ra'ad-II, first unveiled in 2017, was presented as having nearly double the range capability of the Ra'ad-I, external features did not clearly distinguish the two versions until 2022. The latest Ra'ad-II, displayed in 2022 and 2024, features a distinct 'xshaped' tail fin configuration, while the missile photographed on the JF17 more closely resembles the 'twin-tail' configuration of the Ra'ad-I, the FAS report said.

Using Photoshop's Vanishing Point feature and reference measurements from the vehicles carrying the missiles, the lengths of the Ra'ad-I and Ra'ad-II were estimated to be around 4.9 meters each. The missile on the JF-17 was also measured using the aircraft's length as a reference, resulting in a similar 4.9-meter estimate.

These measurements, along with the tail fin configuration, suggest that the missile observed on the JF-17 is likely the Ra'ad-I ALCM rather than the newer Ra'ad-II or the conventional anti-ship variant, Taimoor, the FAS report by Eliana Johns said.

The image provides evidence that Pakistan has made significant progress in equipping its JF-17s with the capability to supplement or replace the nuclear strike role of the ageing Mirage III/Vs.

However, questions remain about the deployment status of the Ra'ad systems and whether Pakistan will continue to retain a nuclear gravity bomb capability or transition to stand-off cruise missiles exclusively.

These developments occur amidst an ongoing nuclear arms competition in the region, with Pakistan, India, and China pursuing advanced technologies such as multiple independently targetable re-entry vehicles (MIRVs).

The heightened tensions and the development of short-range, lower-yield nuclear-capable systems by Pakistan have raised concerns about accelerated arms racing and escalation risks in a potential conflict between India and Pakistan.

<https://timesofindia.indiatimes.com/world/pakistan/pakistan-arming-jf-17-jets-with-raad-nuke-missiles/articleshow/111454243.cms>

## **Russia's Su-57 Back In Reckoning For Indian Air Force; Modi, Putin Likely To Discuss Stealth Fighters For IAF**

The recent announcement that the Indian Prime Minister, Narendra Modi, will visit Russia for a summit meeting with President Putin is a strong signal from New Delhi that it will not let its relationship with Moscow weaken.

Prime Minister Modi last visited Russia in 2019 to attend the Far Eastern Economic Forum in Vladivostok. He last met President Putin in 2022 during the Shanghai Cooperation Organisation (SCO) Summit in Samarkand. Significantly, the two leaders skipped the traditional annual summit meeting between the executive heads of the two countries in 2022 and 2023.

The timing of Modi's visit to Moscow, which is expected to take place on July 8-9, is significant. It will be his first bilateral visit since he won a third term in office. In the past, after being sworn in as Prime Minister, he visited neighboring countries like Bhutan, Maldives, and Sri Lanka. Prime Minister Modi last visited Russia in 2019 to attend the Far Eastern Economic Forum in Vladivostok. He last met President Putin in 2022 during the Shanghai Cooperation Organisation (SCO) Summit in Samarkand.

Significantly, the two leaders skipped the traditional annual summit meeting between the executive heads of the two countries in 2022 and 2023. The timing of Modi's visit to Moscow, which is expected to take place on July 8-9, is significant. It will be his first bilateral visit since he won a third term in office. In the past, after being sworn in as Prime Minister, he visited neighboring countries like Bhutan, Maldives, and Sri Lanka.

### **Joint Development of FGFA**

Now that payment difficulties are over, India's decision to restart joint FGFA development is logical for many reasons. The FGFA was proposed to be developed using the Su-57 as a baseline. During negotiations, the IAF voiced reservations about the aircraft's ability to supercruise and its lack of all-around stealth. Also, the IAF wanted a twin-seat fighter.

Based on IAF reservations, India suspended its participation in the FGFA project, but kept open its option to acquire the aircraft at a later date. In July 2018, India's Defence Minister Nirmala Sitharaman told Business Standard, "In February, it was conveyed to the Russians that they could go ahead with developing the fighter without us. But the option remains, and we could well go back at a later stage and ask to buy the fighter."

Since then, Russia has addressed the shortcomings cited by the IAF during development and operational testing. The latest Su-57 variants feature the AL-51 Stage-2 engines, which facilitate supercruise. The engine thrust is 11 tonnes dry and 17.5 tonnes in afterburner. In comparison, the earlier AL-41F1's engine thrust was 9 tonnes dry and 14.5 tonnes in afterburner.

The significant increase in engine thrust will facilitate supercruise at up to Mach 1.6. Some Russian sources claim that the Su-57 is now the fastest supercruise fighter, capable of cruising at near Mach 2 without an afterburner. The Stage 2 engine additionally improves the fighter's stealth. It features a serrated exhaust nozzle, also known as a chevron nozzle. By altering the exhaust plume's temperature distribution and shape, serrated nozzles can make the fighter harder for IR and radar

sensors to detect and track. Russia is already developing a twin-seat variant of the fighter for training and loyal wingman UCAV operations.

### **Exceeding IAF Expectations**

Russia has also incorporated other improvements in the fighter, which exceed IAF expectations. For example, Russia is developing a variant of the fighter that will be able to act as a mother ship to orchestrate attacks by stealth UCAV drones deep into adversary territory.

Since India put its FGFA participation on hold, Russia has not only improved the Su-57, but it has also operationally tested the stealth fighter, first in Syria and then in Ukraine. In addition, Russia has completed the development of a range of weapon systems designed to fit into the aircraft's internal weapon bays.

### **Adversary Stealth Fighter Build-Up**

Both Indian adversaries, China and Pakistan, have committed to the deployment of stealth fighters in large numbers. The PLAAF is rapidly building up its Chengdu J-20 stealth fighter bomber inventory, and the PAF plans to acquire the Chinese Shenyang J-31 stealth fighter in large numbers.

The stealth buildup is likely to create an operational gap in the IAF's capability to safeguard Indian air space. A gap that may tempt our adversaries into adventurism. According to internet reports, the PLAAF added over 50 J-20 stealth fighters to its inventory from August 2022 to November 2023. Some analysts suggest the production rate may have reached 100 aircraft per year in 2023 and could stabilize at 120 aircraft in 2025.

In comparison, the annual production rate for the Lockheed Martin F-35 is 156 aircraft. However, Lockheed's annual production caters to the global market. Chengdu has just one client – PLAAF. In January 2024, PAF's Air Chief Marshal Zaheer Ahmed Baber Sidhu stated that the “foundation for acquiring the J-31 stealth fighter aircraft has already been laid,” and it's set to become part of the PAF's fleet “in the near future.”

Shenyang Aircraft Corporation has completed the development of the J-31. A customized variant for the PAF is likely under development. Once the customized variant is flight tested, the PAF could sign a firm contract to acquire 25 to 30 J-31s within 2 years. Follow-up contracts are likely. It is possible that by the year 2030, the PLAAF will be able to field 500 J-20 stealth fighter bombers and the PAF around 100 J-31 stealth fighters. As things stand, the IAF would have no stealth fighters in its inventory by then. Indian defense planners likely consider this scenario alarming. Waiting for the AMCA may not be an option anymore.

### **Conclusion**

A serious gap in the IAF's operational capability may emerge from the rapid addition of stealth fighters to the PLAAF inventory and Pakistan's decision to acquire and deploy J-31 fighters “in the near future.”

The revival of the FGFA project is a good option for India to plug the emerging operational gap. Russia is firmly committed to supporting India's desire for localized defense production and sharing defense technology. Russian systems are also known to be cost-effective. Local production of the only operationally proven stealth fighter will give India's military-industrial complex a hefty technological boost and eliminate logistical bottlenecks accruing from a longer pipeline when dealing with a foreign vendor.

<https://www.eurasiantimes.com/russias-su-57-back-in-reckoning-for-indian/>

## Indian Army propels towards zero-emission by introducing 113 electric buses

The Indian Army has procured 113 electric buses for the transportation of troops which will help the country to embark on significant efforts towards the government's green initiatives. The 40-seater buses with an endurance of 250 kilometres are primarily for deployment in the plains and semihilly areas and are currently at the trial stage for procurement.

The procurement is in line with the Government of India's directive on zero carbon emissions and marks a pivotal moment in the Indian Armed Forces' journey towards eco-friendly transportation solutions.

Further, this initiative not only aligns with the global shift towards sustainable practices but also exemplifies India's leadership in leveraging indigenous capabilities to achieve the set environmental goals.

This move will help foster innovation in the defence sector and set a procedure for other government agencies and industries to follow suit. From the battlefield to the forefront of eco-conscious strides, the Indian Armed Forces have embarked on a greener future where national security and environmental stewardship would go hand in hand

<https://economictimes.indiatimes.com/news/defence/indian-army-propels-towards-zero-emission-by-introducing-113-electric-buses/articleshow/111450735.cms>



## Battle tank comparison: India's T-90 tanks vs China's ZTZ-99A MBTs

Securing borders along China is one of the top priorities of India. The country is not leaving any stone unturned to defend its territories from the Dragon's threat! In modern warfare, tanks play an important role in defending the country. Both India and China depend on these heavily.

According to a report of a think tank Observer Research Foundation published on Feb 10, 2023, there has been a large-scale upgrade of equipment in the Western Theater Command (WTC) by China, especially in the forces facing India. China has introduced, in addition to other defence vehicles, Type 15 light tanks and ZTZ-99A Main Battle Tanks (MBTs) to defend its borders along India. The report further says that there are plans to replace these with the newer 40-tonne Type 96B tanks.

### Type 15 light tanks

Nicknamed the Black Panther, the Type 15, is a Chinese third-generation light tank of China. Also, the tank has been shipped to India's neighbour, Bangladesh. The tank's export version is known as



VT-5. In 2013, the Type 62 light tank was retired from the Chinese army, and Type 15 is the practical successor. Reportedly, China has 500 of these.

### **ZTZ-99A Main Battle Tanks**

The ZTZ-99 is a Chinese third-generation main battle tank. It was a replacement for the Type 88 tank which was introduced in the late 1980s. The Type 99 MBT was the first mass-produced third-generation primary battle tank in China. The Type 99 represents a shift towards rapid modernization by the People's Liberation Army (PLA) and has features like high mobility, modular composite armour, tandem-charge defeating ERA, 125 mm smoothbore gun (with ATGM-capability), digital systems, and optics. The unit cost of this tank is 2.5 million dollars.

### **Type 96B tanks**

For the Chinese army, the Type 96 is a second-generation main battle tank and is the final evolution of the Type 88 design. Reportedly, China has 2,500 plus of these. It has a composite armour and operational range of 400 km.

### **Where does India stand?**

In 2020, reportedly, the T-72 and T-90 tanks of the Indian Army were deployed in Demchok, Ladakh. The T-72 tank entered production in 1971. It is from a family of Soviet main battle tanks. In the late 1970s, the Indian Army had decided to acquire T-72 from Russia. After a review of trial results, T-72M and T-72-1982 were chosen as future MBTs of the Indian Army, and a procurement contract for 2,418 T-72s was subsequently inked.

Again, the T-90 is a third-generation Main Battle Tank (MBT). It was developed to replace the T-72. Some of the features include a 125 mm 2A46 smoothbore primary gun, the 1A45T fire-control system, an upgraded engine, thermal sight for the gunner, armour (a blend of steel and composite), smoke grenade dischargers, Kontakt-5 explosive reactive armour (ERA) and the Shtora infrared anti-tank guided missile (ATGM) jamming system.

<https://www.financialexpress.com/business/defence-battle-tank-comparisonnbspindias-t-90-tanks-vs-chinas-ztz-99a-mbts-3542818/>

# THE ECONOMIC TIMES

*Thu, 04 July 2024*

## **New Cuban radar site near US military base could aid China spying, think tank says**

Cuba is building a new radar site likely to be capable of spying on the United States' nearby Guantanamo Bay naval base, a Washington think tank found using satellite images, the latest upgrade to the country's surveillance capabilities long thought to be linked to China.

The base, under construction since 2021 but previously not publicly reported, is east of the city of Santiago de Cuba near the El Salao neighborhood, the Center for Strategic and International Studies (CSIS) said in a report published on Monday and later referenced by the Wall Street Journal. Cuban Vice Foreign Minister Carlos Fernandez de Cossio denied that Cuba was harboring Chinese military interests on the island.

(The) Wall Street Journal persists in launching an intimidation campaign related to #Cuba. Without citing a verifiable source or showing evidence, it seeks to scare the public with tales about Chinese military bases that do not exist and no one has seen, including the US embassy in Cuba," de Cossio said on social media.

Cuba's proximity to the U.S. and its southern military bases makes it a good location for China, Washington's top strategic rival, to seek to collect signals intelligence. CSIS called the new site a "powerful tool" that once operational will be able to monitor air and maritime activity of the U.S. military.

The facility, known as a circularly disposed antenna array with a diameter of approximately 130 to 200 meters could be able to track signals as far as 3,000- 8,000 nautical miles (3,452 - 9,206 miles) away, CSIS said. "Access to such an outpost would provide China with a highly strategic vantage point near Naval Station Guantanamo Bay," it said, referring to the key U.S. military base 45 miles (73 km) east of Santiago, Cuba's second largest city.

Such arrays were used heavily during the Cold War, but Russia and the U.S. have since decommissioned most of their sites in favor of more advanced technology, CSIS said. However, the think tank said China has been actively building new such arrays, including on reef outposts in the South China Sea.

Last year, Biden administration officials said Beijing has been spying from Cuba for years and made a push to upgrade its intelligence collection capabilities there beginning in 2019, allegations that both Beijing and Havana have denied. State Department spokesperson Vedant Patel declined to comment on the report, but told a briefing on Tuesday that the U.S. was "closely monitoring" China's presence in Cuba.

"We know that the PRC (People's Republic of China) is going to keep trying to enhance its presence in Cuba and the United States is going to keep working to disrupt it," Patel said without giving details.

The White House National Security Council and the U.S. Defense Department did not immediately respond to requests for comment. China's embassy in Washington said the U.S. had repeatedly "hyped up" the idea of China's spying and surveillance from Cuba.

"Such claims are nothing but slander," embassy spokesperson Liu Pengyu said. CSIS also said satellite images from March 2024 show Cuba's largest active signals intelligence site at Bejucal, located in the hills near Havana and linked to suspected Chinese intelligence activity for years, has undergone "major updates" in the past decade, calling it a "clear indication of an evolving mission set."

"Collecting data on activities like military exercises, missile tests, rocket launches, and submarine maneuvers would allow China to develop a more sophisticated picture of U.S. military practices," CSIS said.

It said certain radar systems installed in Cuba in recent years are in range to monitor rocket launches from Cape Canaveral and NASA's Kennedy Space Center, a likely interest for China as it seeks to catch up to U.S. space launch technology.

<https://economictimes.indiatimes.com/news/defence/new-cuban-radar-site-near-us-military-base-could-aid-china-spying-think-tank-says/articleshow/111472460.cms>

## **After a stop in Cuba, 2 Russian ships dock in Venezuelan port as part of 'show the flag' exercises**

Two Russian naval ships docked Tuesday in the Venezuelan port of La Guaira after exercises in the Atlantic Ocean that Moscow said were to "show the flag" in remote, important regions, and an initial stopover in Cuba.

The frigate Admiral Gorshkov and the oil tanker Akademik Pashin are part of Russia's Northern Fleet, which since May 17 has been carrying out tasks that include "guaranteeing the Russian naval presence" in "remote areas of the oceans," Russian news agency Tass cited Russia's Ministry of Defence as saying.

The stopover was to last several days and highlight the close ties between Moscow and Venezuelan President Nicolas Maduro's government. Like his predecessor, the late President Hugo Chavez, Maduro has forged a close relationship with Russia. The visit comes before Maduro seeks reelection in July 28 elections.

Venezuelan authorities have not reported the arrival of the Russian vessels, which could barely be seen from afar docked at La Guaira, but Associated Press journalists saw their crewmembers in the city's historic center. In mid-June, the Admiral Gosrhkov and the tanker were among the Russian vessels that docked in Havana, Cuba.

The other vessels present at that stop included a nuclear-powered submarine, and they stayed docked there for five days following drills in the Atlantic Ocean. The exercise was seen by some as a show of strength by Moscow against the backdrop of tensions as US and other Western nations support Kyiv in Russia's war on Ukraine

<https://economictimes.indiatimes.com/news/defence/after-a-stop-in-cuba-2-russian-ships-dock-in-venezuelan-port-as-part-of-show-the-flag-exercises/articleshow/111448440.cms>

## **US allies allege China is developing attack drones for Russia**

Chinese and Russian companies are developing an attack drone similar to an Iranian model deployed in Ukraine, European officials familiar with the matter said, a sign that Beijing may be edging closer to providing the sort of lethal aid that western officials have warned against.

The companies held talks in 2023 about collaborating to replicate Iran's Shahed drone, and started developing and testing a version this year in preparation for shipment to Russia, said the officials, who asked not to be identified to discuss private information. The Chinese drones have yet to be used in Ukraine, they said.

Providing Russia a Shahed-like attack drone would mark a deepening of Beijing's support for Russia despite repeated warnings from the US and its allies.

President Xi Jinping has sought to portray China as neutral in the conflict in Ukraine even as western officials say it's provided components and other support for President Vladimir Putin's forces.

At the same time, US officials have said China is holding off directly providing weapons and artillery, something that would signal an unprecedented escalation and almost certainly trigger more forceful action — such as sanctions — against the world's second-biggest economy. Some nations believe that providing Russia with drones for attack purposes would cross the line into lethal aid, two of the officials said.

One person familiar with the matter said the US assessment is China is weighing whether to send fully built unmanned aerial vehicles, but in the meantime is sending kits that can be converted into attack drones.

The US still doesn't conclude that China is sending lethal aid to Russia, the person said, while acknowledging that other nations may have a different interpretation. China doesn't provide weapons to the parties of the Ukraine conflict and strictly controls exports of dual-use articles, Liu Pengyu, the spokesman for China's embassy in the US, said in a statement.

"On the Ukraine crisis, it is quite clear to the international community who is calling for dialogue and striving for peace, and who is fueling the fight and inciting confrontation," Liu said. "We urge the relevant countries to immediately stop fueling the fight and inciting confrontation." Russia's defense and foreign ministries didn't immediately reply to requests for comment.

Russia has used thousands of Shahed drones against Ukraine since the beginning of the war, even building a factory to mass-produce the Iranian-developed technology, which is relatively cheap to build but costly to defend against.

But Russia still relies on countries like North Korea and Iran for supplies, and on China for critical parts and components. One worry is that China could produce a drone similar to the Shahed at a far greater rate than Iran or Russia, the officials said.

The officials didn't identify the drone under development, but Chinese defense websites and several media outlets have reported the country is developing a kamikaze attack drone called the Sunflower 200, which is described as similar in appearance to the Iranian Shahed 136 drone. Bloomberg News reported in April that China was providing Russia with satellite imagery for military purposes, microelectronics and machine tools for tanks, as well as a swath of technologies used in weapons or needed to produce them.

"China takes every effort, every chance it can get to argue that somehow it's a neutral player in this war in Ukraine, but in reality the PRC is providing a long list of dual-use components, things like machine tools and microelectronics that are enabling Russia to pursue this war of aggression in Ukraine," US Ambassador to NATO Julianne Smith told Bloomberg Television on Tuesday, referring to China by its official name, the People's Republic of China.

"Here inside NATO, we're making sure that we can expose the fact that the PRC is no longer a neutral player and warn China about the risk of getting behind Russia in this unprovoked war of aggression," she said. Back in May, UK Defense Secretary Grant Shapps provoked a tiff with Washington when he suggested that China was working to provide Russia with lethal aid.

US National Security Adviser Jake Sullivan said that to date, the US hadn't seen China providing weapons directly to Russia. Ukrainian President Volodymyr Zelenskiy said at the G-7 summit that President Xi had given him his word he wouldn't provide Russia with weapons.

<https://economictimes.indiatimes.com/news/defence/us-allies-allege-china-is-developing-attack-drones-for-russia/articleshow/111446976.cms>



Wed, 03 July 2024

## **US “Re-Evaluates” 6th-Gen Fighter Program Over Soaring Costs; Air Force Boss Says NGAD Not Dead Yet**

Recent reports have indicated that the USAF is re-examining the specifications for a new crewed sixth-generation stealth combat fighter it is developing as part of the wider Next Generation Air Dominance (NGAD) program.

A major objective is to find ways to reduce the jets' expenses, which might be up to \$250 million per unit. The reports that the US might eventually have to abandon the program generated a lot of frenzy, especially since the US has remained steadfast in its commitment to develop a next-generation aircraft ahead of its adversaries.

Finally, putting all speculations to rest, USAF Secretary Frank Kendall reassured in an interview with Defense News that the service was working on creating an advanced next-generation fighter, but a redesign is needed to control expenses and enhance the integration of loyal wingman drones.

Additionally, Secretary Frank Kendall stated that to keep costs down, the Next Generation Air Dominance fighter aircraft may wind up with a simpler, smaller engine than planned. “The family of systems concept of Next Generation Air Dominance is alive and well,” Kendall said. “I can tell you that we are looking at the NGAD platform design concept to see if it's the right concept or not...We're looking at whether we can do something less expensive and do some trade-offs there.”

Another major goal of the NGAD combat jet program's re-evaluation is to guarantee that these aircraft will be able to cooperate with the service's planned fleets of Collaborative Combat Aircraft (CCA) drones. “It's a very expensive platform,” Kendall said. “It's three times, roughly, the cost of an F-35, and we can only afford it in small numbers.” Kendall had previously told the media that the NGAD jets would cost “multiple hundreds of millions of dollars.”

He said the estimated cost of NGAD is currently three times higher than that of a single F-35 Joint Strike Fighter. Since F-35s typically range in cost from \$80 to \$100 million each, the total cost of NGAD could approach \$300 million per aircraft, potentially limiting the size of its fleet. Kendall said, “The design concept that came out of that [initiative] is a very expensive concept. Scale matters, numbers matter, and so does time. We want to get something there quickly.”

The disclosure has surprised military watchers since it is widely believed that the USAF has been secretly working on a next-generation stealth fighter under the NGAD program for several years now. The USAF had previously suggested that it would begin receiving the latest and most advanced fighter jet by the 2030s. Two hundred NGAD fighters were originally planned to be delivered, but now that plan seems to be falling apart.

Trouble started brewing when USAF Chief of Staff Gen. David Allvin hinted last month that as part of the US government's budget for 2026, military chiefs would advise reorganizing, postponing, or even ending the NGAD program. Recently, the US has discontinued several other high-stakes programs, including the AGM-183A Air-launched Rapid Response Weapon (ARRW).

The USAF is facing challenges in staying within its \$200 billion budget while also needing to invest in other important systems, such as the B-21 Raider bomber, which is a top priority as it prepares for potential combat with countries like China.

### **NGAD Runs Into Uncertainty**

The NGAD has been envisioned as a "system of systems" that will include unmanned drones, manned jets, and a new generation of networking technologies along with new lethal munitions, advanced sensors, more powerful engines, an electronic warfare suite, and battle management capability. The USAF's dithering on the crewed aircraft and the NGAD has also cast doubts about these capabilities in the scaled-down (revamped, less complex, and with a smaller engine) next-generation aircraft.

More importantly, the NGAD is designed to replace the F-22 Raptor as the first operational stealth fighter and maintain the USAF's air power advantage against rapidly advancing air defense and technology. The NGAD fighter jet fleet, totaling around 200 aircraft, is about the same as the current USAF F-22 Raptor fleet, which is planned to be retired, suggesting that the NGAD will take over. This raises questions about the future of the F-22 Raptors, set to be retired by the 2030s.

Writing for The Telegraph, David Axe noted: "It's a startling development for advocates of American air power. For generations, the US military – not to mention the militaries of America's closest allies – have depended on the US Air Force to achieve air superiority against even the most determined and sophisticated foe, affording freedom of action for troops on the ground and ships at sea."

A rethink of the NGAD also makes the CCA look uncertain, considering that they have often been projected together in an ambitious manned-unmanned team. "Having something that's optimized to work with CCAs is another consideration as we look at NGAD," Kendall noted when referring to the Collaborative Combat Aircraft. Kendall announced in March last year that the USAF planned to purchase 1,000 CCA drones specifically to be used in tandem with the upcoming sixth-generation stealth plane and the fifth-generation F-35 Lightning II. "This figure was derived from an assumed two CCAs per 200 NGAD platforms and an additional two for each of 300 F-35s for a total of 1,000," Kendall explained during a keynote address at the 2023 Air and Space Forces Association's Warfare Symposium.

On its part, the USAF has maintained that the crewed fighter component and highly autonomous advanced drones of the NGAD program are the fundamental pillars of its future force structure to deter and address modern threats. "The DAF [Department of the Air Force] is moving forward with a family of systems for the next generation of air dominance," Kendall said in his speech. "That will include both an NGAD platform and the introduction of uncrewed collaborative aircraft to provide affordable mass and dramatically increased cost-effectiveness."

Though there is uncertainty regarding the future of the USAF's air superiority goals and sixth-generation aircraft, Secretary Kendall affirms that the NGAD program remains stable. Even so, experts and observers are sounding alarm bells, warning that the development of a new sixth-generation stealthy combat aircraft could have broader consequences given the ongoing threat from adversaries.

<https://www.eurasiantimes.com/n-us-sixth-generation-combat-aircraft/>





## **New study connecting rainfall & CO<sub>2</sub> increase can aid future conservation of biodiversity hotspots**

The unprecedented global increase in greenhouse gases can decrease rainfall in the equatorial region with associated shift and vegetation, and also replace India's biodiversity hotspots consisting of evergreen forests in the Western Ghats, northeast India and the Andamans into deciduous forests, shows a new study.

Deep time hyperthermal events are considered potential analogs for future climate predictions. However, data of these hyperthermal events are mainly known from the mid- and high latitude regions. However, there is lack of quantitative data from the equatorial or tropical regions.

Researchers from Birbal Sahni institution of Palaeosciences (BSIP), an autonomous institute of Department of Science and Technology, used fossil pollen and carbon isotope data from the Eocene Thermal Maximum 2 (ETM-2), also known as H-1 or Elmo, a period of global warming that occurred around 54 million years ago, to quantify the terrestrial hydrological cycle during that period.

It was during this period that the Indian plate lingered near the equator during its journey from the southern to northern hemisphere. This makes the Indian plate a perfect natural laboratory that offers a peculiar opportunity to understand the vegetation-climate relationship near the equator during the ETM-2.

On the basis of availability of fossils from ETM2, the researchers selected the Panandhro Lignite Mine of Kutch in Gujarat and collected fossil pollen from there.

Analyzing the pollen, they found that when atmospheric carbon dioxide concentration was more than 1000 ppmv near the palaeo-equator, the rainfall decreased significantly, leading to the expansion of deciduous forests.

The study published in the journal *Geoscience Frontiers* raises important questions about the survival of equatorial/ tropical rainforests and biodiversity hotspots under increased carbon emissions. It can help understanding the relationship between CO<sub>2</sub> and hydrological cycle and aid in the future conservation of biodiversity hotspots.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2030413>



## **Scientists propose a new measure of flexibility for crystals**

Researchers have carried out an in-depth analysis of the mechanisms underlying the flexibility of crystals of Metal-organic frameworks (MOFs) and attributed the flexibility to large structural rearrangements associated with soft and hard vibrations within a crystal that strongly couples to strain fields. The analysis opens doors to innovative materials with diverse applications in various industries.

Metal-organic frameworks (MOFs) are a large class of crystalline materials which possess the remarkable ability to absorb gases, such as carbon dioxide, and store them as well as act as filters for crude oil purification. MOFs derive their ability from the presence of nanopores, enhancing their surface areas that, in turn, make them adept at absorbing and storing gases. However, limited stability and mechanical weakness have hindered their broader applications.

Addressing this issue, Professor Umesh V. Waghmare from the Theoretical Sciences Unit at Jawaharlal Nehru Centre for Advanced Scientific Research, (JNCASR) Bengaluru (an autonomous institution under the Department of Science & Technology, Govt. of India) and his team recently introduced a novel quantitative measure of mechanical flexibility for crystals that can be used to screen materials database to identify next-generation flexible materials.

Their paper, “Quantifying the intrinsic mechanical flexibility of crystalline materials”, presents groundbreaking insights on the origin of mechanical flexibility and was published in the journal *Physical Review B*. In particular, the focus of Prof. Waghmare’s research lies with MOFs, which are known for their beautiful crystalline structure and large flexibility.

Historically, flexibility in crystals has been assessed in terms of a parameter called elastic modulus, which is a measure of a material’s resistance to strain-induced deformation. In contrast, this study proposes a unique theoretical measure based on the fractional release of elastic stress or strain energy through internal structural rearrangements under symmetry constraints. This new metric can be readily calculated using standard techniques of simulation and can rate the flexibility of a crystal on a scale of zero to one, zero signifying the least flexibility while one indicates maximum flexibility. Additionally, this development provides a unique and quantitative insight into the flexibility of crystals, a dimension that was previously unexplored.

Using theoretical calculations, the team examined the flexibility of four different systems with varying elastic stiffness and chemistries. They discovered that flexibility arises from large structural rearrangements associated with soft and hard vibrations within a crystal that strongly couples to strain fields.

The team's research thus goes beyond traditional approaches by providing an in-depth understanding of the mechanisms underlying a crystal's flexibility. Unlike previous studies that primarily focused on elastic properties, this work establishes flexibility as an intrinsic property of crystals, independent of their specific shape or form.

The newfound measure of flexibility is poised to revolutionize materials science, especially in the context of MOFs. Prof. Waghmare emphasizes, “This theoretical framework enables the screening of thousands of materials in databases, providing a cost-effective and efficient way to identify

potential candidates for experimental testing. The design of ultraflexible crystals becomes more achievable, offering a practical solution to the challenges posed by traditional experimental methods.”

The collaborative effort underlying this research is particularly noteworthy, with a team of physicists and chemists from Oxford University and the University of California, Santa Barbara involved in the study. This interdisciplinary approach facilitated a more comprehensive understanding of the subject, bridging the gap between theoretical insights and experimental applications.

While the proposed measure of flexibility is theoretical, experimentalists will find it very useful. The potential applications of this research extend beyond the realm of physics, opening doors to innovative materials with diverse applications in various industries.

Paving the way for a new paradigm in materials research, the study exemplifies the significance of interdisciplinary collaboration and theoretical advancements in shaping the future of materials science.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2030412>

# THE ECONOMIC TIMES

*Thu, 04 July 2024*

## **ISRO seeks active role in global efforts to shield earth from asteroids**

ISRO Chairman S. Somanath emphasized the necessity of international collaboration in developing planetary protection systems against asteroids, asserting that no single country can undertake this task alone. Speaking at ISRO's inaugural workshop on planetary defense for students in Bengaluru, he highlighted India's ambition and qualifications to join global missions focused on asteroid research and defense.

He stressed that while asteroids pose potential threats to Earth, they also offer significant opportunities for scientific discovery, potentially revealing insights into the universe's formation and the origins of life on our planet. Somanath expressed India's eagerness to engage in global asteroid research and defense projects, suggesting that ISRO could contribute to forthcoming international missions.

Specifically, he mentioned the planned mission to study the asteroid Apophis in 2029, proposing that India could provide instruments or other support for collaborative missions spearheaded by agencies like NASA, ESA, and JAXA. This willingness to collaborate underscores India's growing capabilities in space exploration and its readiness to participate in more complex and challenging missions.

He also cited India's recent achievements in space exploration to bolster his point, including the successful Chandrayaan-3 mission and the Aditya-L1 solar observatory mission. The latter, India's first solar mission, has recently completed its first halo orbit around the Sun-Earth L1 point. Launched on September 2 last year, Aditya-L1 was inserted into its targeted halo orbit on January 6.

The spacecraft takes 178 days to complete a revolution around the L1 point. Due to various perturbing forces, it underwent station-keeping maneuvers on February 22 and June 7 to maintain

its orbit. The third stationkeeping maneuver has now ensured its continued travel into the second halo orbit path around L1. This mission involves modeling complex dynamics, demonstrating India's proficiency in executing intricate space maneuvers.

Somanath highlighted these accomplishments as evidence of India's readiness to tackle more ambitious missions, including potential asteroid explorations. He expressed confidence in India's expertise in precise spacecraft navigation and capture, which could be invaluable in future asteroid-related endeavors.

Furthermore, he reiterated ISRO's commitment to ongoing projects, announcing that the first unmanned Gaganyaan mission is planned for December 2024 and that work on Chandrayaan-4 and other proposed missions is progressing well.

<https://economictimes.indiatimes.com/news/science/isro-seeks-active-role-in-global-efforts-to-shield-earth-from-asteroids/articleshow/111467351.cms>



Wed, 03 July 2024

## **ISRO's Aditya-L1 completes first halo orbit around Sun-Earth L1 point**

India's first solar mission Aditya-L1 spacecraft completed its first halo orbit around the Sun-Earth L1 point on Tuesday, ISRO said.

The space agency said its station-keeping manoeuvre on Tuesday ensured its seamless transition into the second halo orbit.

The Aditya-L1 mission, which is an Indian solar observatory at Lagrangian point L1, was launched on September 2, 2023 and was inserted in its targeted halo orbit on January 6, 2024.

According to [ISRO](#), Aditya-L1 spacecraft in the halo orbit takes 178 days to complete a revolution around the L1 point.

During its travel in the halo orbit, Aditya-L1 spacecraft will be subjected to various perturbing forces that will cause it to depart from the targeted orbit, the space agency said.

"Aditya-L1 underwent two station-keeping manoeuvres on February 22 and June 7, respectively, to maintain this orbit. Today's third station-keeping manoeuvre has ensured that its travel continued in the second halo orbit path around L1," ISRO said.

The agency explained that Aditya L1's journey around Sun-Earth L1 Lagrangian point involves modeling of complex dynamics.

The understanding of various perturbing forces acting on the spacecraft helped in determining the trajectory accurately and planning precise orbit manoeuvres, it added.

"With today's manoeuvre, the state-of-the-art flight dynamics software developed in-house at URSC-ISRO for the Aditya-L1 missions stands fully validated," ISRO said.

<https://indianexpress.com/article/technology/science/isros-aditya-completes-first-halo-orbit-around-sun-earth-point-9430955/>

Thu, 04 July 2024

## ISRO's Chandrayaan 3 rover makes significant discovery at Shiv Shakti point on Moon's South Pole

In a significant discovery by ISRO's Chandrayaan 3 rover Pragyan on the Moon's South pole, small rock fragments which were scattered around the wall slopes, floor and rim of a small crater have been found in the southern region of the Moon.

According to the data analysis of the Pragyan rover, which landed on the Moon's southern pole on August 23, 2023 being commanded by Vikram lander, the findings will help in resolving the mystery of origin and distribution of rock fragments on the lunar surface.

The Pragyan rover traveled around 103 meters in a single lunar day on the Moon's surface, while it weighed 27 kilograms with several equipment and cameras fitted to it.

At the landing site, which Prime Minister Narendra Modi named as Shiv Shakti point, the rover traversed around 39 meters west and found that the number of rocks and its fragments kept on increasing.

The data analyzed in a report presented at the International Conference on Planets, Exoplanets and Habitability earlier this year points out that these rocks and fragments have been sourced through a crater nearby that region which could have a diameter of around 10 meter.

Due to the exposure to space weathering, two of the rock fragments displayed clear indications of degradation, the report claimed.

According to reports, ISRO officials recently said that the upcoming Chandrayaan-4 mission is targeting to bring back lunar samples from the Shiv Shakti point.

On August 23, 2023, India achieved a historic milestone when its Chandrayaan-3 led Pragyan rover made a soft landing via Vikram lander on the South pole of the Moon, which was the first by any country.

Apart from India, only four other nations have achieved the feat of a soft landing on the lunar surface, namely the US, the former Soviet Union, China and most recently Japan.

<https://indianexpress.com/article/technology/science/chandrayaan-3-rover-makes-significant-discovery-on-moons-south-pole-9431433/>

Wed, 03 July 2024

## Three crucial Gaganyaan tests planned this year: ISRO chairman

Indian Space Research Organisation (ISRO) chairman S. Somanath on Wednesday said that three crucial tests for Gaganyaan mission would be carried out this year.

Speaking on the sidelines of a workshop on planetary defence to commemorate International Asteroid Day, Mr. Somanath said: “This year, there are three experiments pending, which include the first unmanned Gaganyaan (G1) mission, which will be carried out in December.

There is the Test Vehicle (TV) T-2 mission, which is a abort mission demonstration, and the third is pad abort test where we will simulate to abort at the launch pad.”

Speaking on the planetary defence systems and the need for international cooperation in protecting Earth from potential asteroid impacts, he said that ISRO would like to contribute to the upcoming international missions like the Apophis in 2029.

### **Support to mission**

Mr. Somanath said that India could provide instruments or other support to joint missions led by space agencies like NASA, ESA, and JAXA. He said that no one country can develop a planetary protection system against asteroids and international cooperation was needed.

“All space faring nations should unite and work. As a leading space agency, ISRO has also initiated focussed activities towards planetary defence,” he said.

On June 30, 1908, a huge air blast from an asteroid flattened about 2,200 square km of forest destroying nearly 80 million trees in Tunguska, a remote location in Siberia, Russia. In accordance with the UN resolution in 2016, International Asteroid Day is celebrated to “observe each year at the international level the anniversary of the Tunguska impact over Siberia, Russian Federation, on 30 June 1908, and to raise public awareness about the asteroid impact hazard”.

ISRO on Wednesday organised a workshop on planetary defence. The event was attended by student participants and delegates from ISRO centres and academic institutions.

Apart from the basic concept related to asteroids and planetary defence, leading experts from JAXA and ESA also delivered technical talks on Hayabusa-2 asteroid mission, ongoing planetary defence and asteroid monitoring activities undertaken by ESA and the role of organisations like International Asteroid Warning Network and Space Mission Planning Advisory Group in dealing with asteroid impact threats.

<https://www.thehindu.com/news/national/karnataka/three-crucial-gaganyaan-tests-planned-this-year-isro-chairman/article68363428.ece>



*Wed, 03 July 2024*

## **What Is Geoportal-Bhuvan, ISRO Tool That Gives '10 Times More Info Than Google'?**

The India Geoportal-Bhuvan "gives users 10 times the information they get from Google", Indian Space Research Organisation (ISRO) chief S Somanath said. Bhuvan provides valuable insights across various sectors such as agriculture, urban planning, and disaster management. The ISRO chief also emphasised the introduction of two new tools - Bhuvan-Panchayat and NDEM - which mark major strides in enhancing data access and utility. ISRO chief S Somanath said, "...When you talk about India Geoportal-Bhuvan, it gives you 10 times the information you get from Google. Today, we have created two important information dissemination tools -Bhuvan-Panchayat and NDEM. This brings additional data sets."



## **What Is Geoportal-Bhuvan?**

Geoportal-Bhuvan is a tool by ISRO which provides valuable insights across various sectors such as agriculture, urban planning, and disaster management. According to the ISRO chief, Bhuvan's data is not only more comprehensive but also highly localised, catering to specific needs and challenges faced at the ground level. This level of detail is expected to significantly enhance decision-making processes across multiple fields.

### **Two new tools have been launched alongside Bhuvan:**

**Bhuvan-Panchayat:** This tool aims to help empower local governance by supplying enriched datasets and analytical tools. It enables village councils (Panchayats) to make informed decisions based on detailed geospatial data.

**National Database for Emergency Management (NDEM):** It integrates critical datasets to bolster ISRO's disaster response and management capabilities. This tool aids in risk assessment and mitigation during emergencies, reflecting ISRO's commitment to leveraging space technology for societal benefits.

<https://www.timesnownews.com/technology-science/what-is-geoportal-bhuvan-isro-tool-that-gives-10-times-more-info-than-google-article-111458556>

