

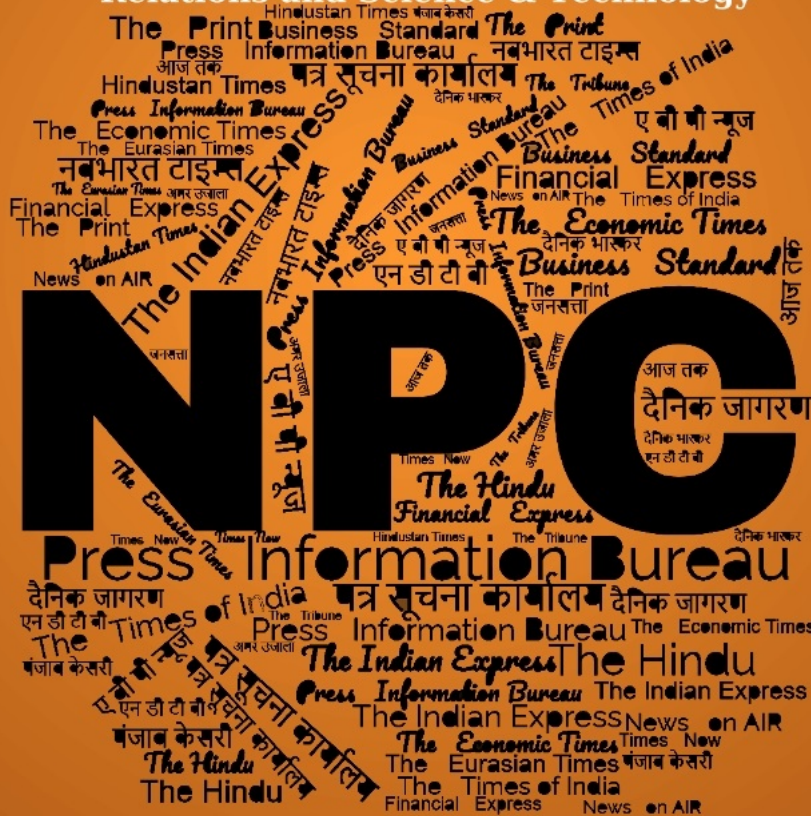
सितम्बर  
Sep  
2024

खंड/Vol. : 49 अंक/Issue : 177  
24 /09/2024

# 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

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# CONTENTS

S. No.	TITLE	Page No.
<b>DRDO News</b>		<b>1-2</b>
1	As LCA Tejas Shines With IAF, DRDO Pushes LCA-N Aircraft To Indian Navy As Delhi Set To Seal Rafale-M Deal	<i>The EurAsian Times</i> 1
<b>Defence News</b>		<b>3-17</b>
<b>Defence Strategic: National/International</b>		
2	Curtain Raiser Navika Sagar Parikrama II	<i>Press Information Bureau</i> 3
3	Quad launches MAITRI maritime initiative in Indo-Pacific; India to host first training workshop in 2025	<i>The Economic Times</i> 4
4	US-China research has given Beijing's military technology boost, House GOP says	<i>The Economic Times</i> 5
5	Army inducts robotic mules; drones, high-altitude tents under evaluation	<i>The Hindu</i> 7
6	MQ-9B drones to Tejas engines: PM Modi's US visit impact on Indian military	<i>Business Standard</i> 9
7	Indian Army in Lebanon watches closely as Israel-Hezbollah hostilities intensify	<i>India Today</i> 11
8	Indian Army to scale up procurement through Government e-Marketplace	<i>The Hindu</i> 12 <i>BusinessLine</i>
9	Invisible War – U.S. Military Awakes To ‘Historically Neglected’ Warfare Domain; Ukraine War Proves EW Rules The Roost! OPED	<i>The EurAsian Times</i> 13
<b>Science &amp; Technology News</b>		<b>18-28</b>
10	Quantum Interferences in Atomic medium can store Light for High Precision Quantum Sensors	<i>Press Information Bureau</i> 18
11	Catalytic Droplets Leading to Faster Chemical Reactions can Bring Quicker Access to Innovative Medications	<i>Press Information Bureau</i> 20
12	Cosmology is at a tipping point–world may be on the verge of discovering new physics	<i>The Print</i> 22
13	Chandrayaan-3’s Pragyan rover discovers big crater older than South Pole-Aitken basin	<i>The Indian Express</i> 25

*Mon, 23 Sep 2024*

## **As LCA Tejas Shines With IAF, DRDO Pushes LCA-N Aircraft To Indian Navy As Delhi Set To Seal Rafale-M Deal**

The Indian Air Force (IAF) is throwing its weight behind the Light Combat Aircraft (LCA), which has been a savior for the indigenous fighter program. The chief of the Defence Research and Development Organisation (DRDO) is pushing for the Indian Navy to buy the naval variant of LCA as the organization works on the Twin Engine Deck Based Fighter (TEDBF).

The Indian Navy expressed interest in LCA-Navy in 2018; however, that changed later as the force decided to go for a foreign fighter jet and await TEDBF's operationalization. On February 6th, 2023, LCA-Navy landed on the deck of the newly commissioned aircraft carrier INS Vikrant.

DRDO Chief Dr. Samir V. Kamat, at the 15th Air Chief Marshal LM Khatre Memorial Lecture in Bengaluru, made a case for the Indian Navy to place an order for 8-10 Naval LCA platforms that can be used in the training role. But the Indian Navy wants the TEDBF project to take off in full flow before taking the final call on LCA-Navy.

The mistake we made was to develop an engine (Kaveri) and platform (LCA) together. We are now in talks with Safran, Rolls-Royce, and GE for joint engine development. Respective governments of Safran & GE have permitted them that the entire IP will be with India if it is in a collaborative role. The Indian Navy's Hawk trainers cannot operate from the aircraft carrier deck. LCA-Navy can step in by training the Indian Navy aviators to operate from the deck using STOBAR.

Dr. Kamat said that the Indian defense research agency's biggest mistake was attempting to develop the platform and the engine together. According to Dr. Kamat, the DRDO managed to develop a fourth-generation Kaveri engine, but it did not deliver the required thrust for LCA-Tejas.

"The mistake we made was designing a platform and engine together. That's never done. You design a platform around the available engine, and engine development is a continuous process; that was a rookie mistake," Dr. Kamat added. To remedy the situation, the DRDO is now looking to collaborate with OEMs to develop the next-generation high-thrust engines. The organization has been in talks with three unions: Safran from France, Rolls-Royce from the UK, and General Electric from the US.

In April 2020, the DRDO and Aeronautical Development Agency (ADA) announced they would develop a new carrier-based fighter aircraft based on the Indian Navy's specifications for the Multirole Carrier Borne Fighters requirements. The government gave a go-ahead to the project in the same year. The preliminary design stage for the TEDBF began in September 2022, and it is expected to be completed by the end of 2024. The prototype is expected to take to the skies by 2026.

### **Indian Navy's Quest For Deck-Based Fighter Jet**

The Indian Navy had misgivings about single-engine deck-based fighter jets. And in 2019, then-Indian Navy Chief Admiral Karambir Singh said: “The Qualitative Requirements [QR] are being made. They said they should be able to push it (TEDBF) out by 2026. If it meets our time and QR requirements, we will take it (fighter aircraft).”

So, instead of focusing on the LCA-Navy’s Mk2 variant, the ADA and DRDO will develop a twin-engine deck-based fighter. The twin-engine fighter jet offers many advantages—increased speed, maneuverability, and enhanced range. The range is expected to be extended to well over 2000 kilometers, and it will be able to carry greater payloads. Also, two engines increase the aircraft’s survivability in case of an emergency.

The project will run concurrently with other fighter jet development programs, such as the Advanced Medium Combat Aircraft-Naval variant. TEDBF will be lighter than the proposed 25 tonnes Naval-AMCA, whose production is expected to commence only after 2030. TEDBF is planned to have a phased array radar. The aircraft will have thirteen external hardpoints, including two for small air-to-air missiles on the wingtips.

It is planned to have a crew of one pilot, a length of 16.3 meters, a wingspan of 11.30 meters, and a maximum take-off weight of 26,000 kilograms. Two General Electric F414 diesel engines power the aircraft with a thrust of 5965 (10000) kgf. The aircraft may have a top speed of 1.6 Mach (2000 km/h), a ceiling of 18000 meters, a combat radius of 800 kilometers without air refueling, and weaponry including a 30-mm gun, guided and unguided rockets, and 8000-kilogram bombs. Presently, the Indian Navy operates the Russian-made Mig-29K on board INS Vikramaditya, formerly known as Admiral Gorshkov.

### **LCA-Navy**

The LCA Navy is designed and developed jointly by ADA and aerospace maker Hindustan Aeronautics Limited (HAL). The first trainer prototype NP1 flew on April 27, 2012, and the fighter prototype NP2 was flown on February 7, 2015. Naval Prototypes (NP1 and NP2) have achieved major landmark milestones like ski jump take-off and arrested landing demonstrations on Shore Based Test Facility (SBTF) at Dabolim Airport, Goa, and operations from indigenous aircraft carriers. The aircraft demonstrated 18 arrested landings and Ski Jump take-offs from INS Vikramaditya in Jan 2020, including hot refueling capability.

The third prototype, called NP5, has also undertaken field and carrier operations from INS Vikramaditya and indigenously built INS Vikrant. LCA Navy NP5 incorporates all improvements identified during the exploitation of NP1 and NP2 and is a production-ready aircraft. In the Annual Report of FY 2022-23, HAL informed that the build of LCA Navy MK I Trainer prototype aircraft NP5 (3rd Naval prototype) had been completed, and the engine ground run was carried out on January 16, 2023. On 18th August 2023, the LCA naval trainer prototype NP5 completed its maiden flight at HAL airport. The aircraft was airborne for 57 minutes, with all parameters normal.

LCA Navy is equipped with state-of-the-art technologies such as a Fly-by-wire flight control system, glass cockpit, and advanced mechanical systems. The aircraft can be operated seamlessly both during the day and night. It features advanced hands-free ski jump take-off and landing flight control modes. LCA Navy Prototypes are carrier-compatible and can operate with Air-to-Air weapons for combat missions.

In addition to being a training platform for the Indian Navy pilots, NP5 aircraft will help to accelerate flight testing activities which will provide designers vital inputs towards design and development of the TEDBF.

<https://www.eurasiantimes.com/as-indian-set-to-seal-rafale-m-deal/>



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

**Ministry of Defence**

*Mon, 23 Sep 2024*

### **Curtain Raiser Navika Sagar Parikrama II**

The Indian Navy is all set to embark on the extraordinary mission of circumnavigating the globe with the second edition of Navika Sagar Parikrama expedition. A curtain raiser event presided by Vice Admiral Krishna Swaminathan, Vice Chief of Naval Staff was held at New Delhi on 23 Sep 24.

Indian Naval Sailing Vessel Tarini would sail on this challenging expedition with two courageous women officers - Lt Cdr Dilna K and Lt Cdr Roopa A on 02 Oct 24. The historic voyage will be flagged off from Naval Ocean Sailing Node, INS Mandovi, Goa. Over a period of eight months, the duo will navigate more than 21,600 nautical miles (approx. 40,000 km) without any external assistance, relying solely on wind power. The circumnavigation highlights the exceptional valour, courage and perseverance of the officers, who will face rigours of high seas, extreme weather conditions, pushing the limits of human endurance. The route will take them through some of the most treacherous waters including the perilous passage around the three great Capes - Cape Leeuwin, Cape Horn and the Cape of Good Hope. The voyage is not just a testament to their personal bravery and skill, but also a celebration of the Indian Navy's commitment to Nari Shakti showcasing their indomitable spirit and determination.

The expedition was conceived by the Indian Navy with the inaugural Navika Sagar Parikrama, the first ever Indian circumnavigation of the globe by an all women crew of six officers in 2017. The second edition of the expedition will be an exceptional one as they will become the first from India to accomplish such a feat in double handed mode. Earlier, Capt Dilip Donde (Retd.) was the first Indian to circumnavigate the globe in 2009 - 10. Subsequently, Cdr Abhilash Tomy (Retd.) was the first Asian skipper to participate in two circumnavigations and accomplished the rare feat of completing the Golden Globe Race in 2022. Significantly, Cdr Abhilash Tomy (Retd.) has been closely associated with the training of both the officers as the official mentor.

The expedition is being conducted under the aegis of Indian Naval Sailing Association based at Naval Headquarters, New Delhi and Ocean Sailing Node, Goa under Southern Naval Command. Both the nodal centers will be coordinating the voyage in liaison with international maritime agencies and authorities.

Speaking on the occasion, VCNS described Navika Sagar Parikrama II as a journey of empowerment, innovation, and commitment to India's maritime heritage while charting new paths

for a brighter and empowered future. He reaffirmed Indian Navy's pledge to uphold the highest standards of professionalism and responsibility, not just on our shores but across the vast expanse of the world's oceans.

A short movie highlighting various aspects of the voyage along with preparatory expeditions and training undertaken by the crew was screened.

During the interaction, both the officers shared their experiences and expressed extreme confidence for the forthcoming expedition embodying the spirit of resilience and indomitable spirit.

Navika Sagar Parikrama II is more than a voyage; it underlines the essence of maritime prowess, self-reliance and commitment to a greater cause.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2057941>

# THE ECONOMIC TIMES

Mon, 23 Sep 2024

## **Quad launches MAITRI maritime initiative in Indo-Pacific; India to host first training workshop in 2025**

India will host the inaugural symposium of the new regional maritime initiative for Training in the Indo-Pacific (MAITRI), to train Quad partners "to monitor and secure their waters, enforce their laws, and deter unlawful behaviour." The first MAITRI workshop will be hosted by India in 2025, said Nancy Izzo Jackson, Deputy Assistant Secretary for South and Central Asian Affairs. "We are also proud to announce a new regional maritime initiative for training in the Indo-Pacific or MAITRI with an inaugural symposium in 2025 that will be hosted by India," she said in a post on X, unveiling a key component of the Quad's maritime strategy.

The MAITRI initiative was among the major outcomes of the sixth summit level meeting of the Quad group of countries, Prime Minister Narendra Modi, US. President Joe Biden, Australian Prime Minister Anthony Albanese and Japanese Prime Minister Fumio Kishida in Delaware. The initiative highlights the Quad's commitment to regional security and capacity building, particularly in the maritime domain.

It also builds on the Indo-Pacific Partnership for Maritime Domain Awareness (IPMDA), a previous initiative designed to deliver maritime domain awareness information to partners. With MAITRI, countries in the Indo-Pacific can better enforce their maritime laws and deter unlawful activities.

The Quad leaders expressed their deep concern over recent "dangerous and aggressive actions in the maritime domain," according to the Wilmington Declaration. They condemned illicit missile launches and affirmed their collective opposition to unilateral actions that threaten peace and stability in the Indo-Pacific. They emphasised the need for international cooperation and adherence to the rule of law, democratic values, and the peaceful settlement of disputes.

Their commitment reflects the Quad's broader strategic alignment in the region, where they have become a force for maintaining global security. Among the key initiatives announced was the Quad-at-Sea Ship Observer Mission, scheduled to launch in 2025.

This initiative aims to improve interoperability and maritime safety, advancing cooperation among member countries. Additionally, the Quad introduced the Indo-Pacific Logistics Network pilot

project to bolster disaster response capabilities through shared airlift capacity and logistics resources.

These initiatives complement previous Quad efforts in the Indo-Pacific, including underwater cable connectivity and disaster resilience projects. The Quad has invested over USD 140 million in underwater cable development to strengthen telecommunication networks in the Pacific. Such initiatives demonstrate the Quad's ongoing commitment to ensuring long-term peace, stability, and development in the Indo-Pacific region while helping partners manage maritime challenges effectively.

The Quad leaders also welcomed the launch of a Quad maritime legal dialogue to support efforts to uphold the rules-based maritime order in the IndoPacific. Former Indian Ambassador to the United States Meera Shankar said that the development is significant from India's point of view as earlier Chinese incursions have been on rise in the Indian Ocean close to the Indian territory.

"They (Quad leaders) have taken the decision to expand the maritime domain awareness programs to the Indian Ocean. Hitherto it was confined to the Pacific and the South China Sea and so on, but now it is being expanded to the Indian Ocean, and India will be making its own contributions in this process," Shankar told ANI.

"So that's very important from India's point of view because we've had concerns that Chinese military presence has not just been limited to the East China Sea or South China Sea. Increasingly, they have been making forays into the Indian Ocean in areas very close to India, including Sri Lanka. And this is obviously something of concern to us. So we are happy that the maritime domain awareness program is being extended to the Indian Ocean," Shankar said.

As per the Wilmington Declaration issued after the Quad Leaders' Summit in the Indo-Pacific Partnership for Maritime Domain Awareness (IPMDA) was announced in 2022 to offer near-real-time, integrated, and cost-effective maritime domain awareness information to partners in the region.

Since then, in consultation with partners, the US have successfully scaled the program across the Indo-Pacific region--through the Pacific Islands Forum Fisheries Agency, with partners in Southeast Asia, to the Information Fusion Center--Indian Ocean Region, Gurugram. In doing so, the Quad has helped over two dozen countries access dark vessel maritime domain awareness data, so they can better monitor the activities in their exclusive economic zones--including unlawful activity.

<https://economictimes.indiatimes.com/news/defence/quad-launches-maitri-maritime-initiative-in-indo-pacific-india-to-host-first-training-workshop-in-2025/articleshow/113585927.cms>

# THE ECONOMIC TIMES

Mon, 23 Sep 2024

## **US-China research has given Beijing's military technology boost, House GOP says**

Partnerships between the US and China at universities over the past decade have allowed hundreds of millions of dollars in federal funding to aid Beijing in developing critical technology that could be used for military purposes, congressional Republicans asserted in a new report.

The report said US tax dollars have contributed to China's technological advancement and military modernization when American researchers worked with their Chinese peers in areas such as hypersonic weapons, artificial intelligence, nuclear technology and semiconductor technology.

The report, released Monday by Republicans on the House Select Committee on the Chinese Communist Party and the House Education and Workforce Committee, raised concerns over the national security risks of collaborations between researchers from the two countries that were once celebrated. It urged stronger safeguards and more robust enforcement. The committees conducted a yearlong investigation as lawmakers and their policy advisers focus on higher education's role in the economic rivalry with China, especially when it comes to technology.

While American universities don't engage in secret research projects, their work - often among the best in the world - has the potential to be turned into military capabilities. The US House of Representatives this month approved about two dozen China-related bills, with a clear goal to compete with Beijing in the tech field. The bills, which still need to be approved by the Senate, seek to ban Chinese-made drones, restrict China-linked biotech companies in the US market, and cut off remote Chinese access to advanced US computer chips.

Other measures include those to curb Beijing's influence on US college campuses and to revive a Trump-era programme meant to root out China's spying and theft of intellectual property at American universities and research institutes. That's despite such efforts raising concerns about racial profiling and the ability to keep up exchange programmes that boost tolerance between the two countries.

Collaboration among US-based scholars and China also declined as a result of the Trump administration's anti-spying programme, which ended in 2022, studies say. Deputy Secretary of State Kurt Campbell said at a forum by the Council on Foreign Relations earlier this year that he would welcome more Chinese students studying humanities and social sciences but "not particle physics" in American schools. Monday's report identified about 8,800 publications that involved US researchers who received funding from the Department of Defence or the US intelligence community working with Chinese researchers - many of whom were affiliated with China's defence research and industrial base.

Such research is "providing back-door access to the very foreign adversary nation whose aggression these capabilities are necessary to protect against," the report said. The House investigation also flagged what it described as problematic joint institutes between US and Chinese universities, which the report said "conceal a sophisticated system for transferring critical US technologies and expertise" to China.

Through those institutes, American researchers and scientists, including those who conduct federally funded research, have travelled to China to work with and advise Chinese scholars and train Chinese students, the report said.

"This creates a direct pipeline for the transfer of the benefit of their research expertise" to China, the report said. The Georgia Institute of Technology, which is named in the report for its joint Georgia Tech Shenzhen Institute, defended its work in China, saying it was focused on educating students, not research, and that the report's claims are "unsubstantiated."

"There was no research conducted at GTSI, no facilitation of technology transfer, and no federal funding provided to China," the university said in a statement. However, Georgia Tech announced September 6 that it would discontinue its participation in the joint institute with Tianjin University and the government of Shenzhen, a city in southern China. Georgia Tech said the partnership was "no longer tenable" after the US Commerce Department accused Tianjin University in 2020 of theft of trade secrets.



The congressional report also identified Tsinghua-Berkeley Shenzhen Institute, which the University of California, Berkeley, and China's Tsinghua University opened in 2015 in the city of Shenzhen to focus on "strategic emerging industries," according to the institute's website. Berkeley's researchers "engage only in research whose results are always openly disseminated around the world" and the school was "not aware of any research by Berkeley faculty at TBSI conducted for any other purpose," Katherine Yelick, the university's vice chancellor for research, said in a statement.

Berkeley also is unwinding its partnership, saying it has no oversight of research activities conducted only by non-Berkeley employees at the joint institute. The US university has decided "to start the process of relinquishing all ownership" in the Shenzhen school "after careful consideration, which began several months ago," Yelick said. She said Berkeley "takes concerns about research security very seriously - including those concerns voiced by Congress."

The University of Pittsburgh, which is named in the report for its cooperation with Sichuan University, said it could not comment because the Pennsylvania university "was not consulted and did not work with the House Select Committee throughout the investigation."

<https://economictimes.indiatimes.com/news/defence/us-china-research-has-given-beijings-military-technology-boost-house-gop-says/articleshow/113614840.cms>



*Mon, 23 Sep 2024*

## **Army inducts robotic mules; drones, high-altitude tents under evaluation**

The Army has procured and inducted 100 robotic mules in forward areas while logistics drones are undergoing trials which will significantly streamline support and movement to forward areas, especially in high altitude. A new tent for high-altitude areas is under evaluation for deployment at temperatures up to -40 degrees Celsius.

All of these were on display last week at the Himtech symposium organised at Leh, specifically showcasing high altitude technologies.

"The Army has procured and has inducted 100 robotic mules under the fourth tranche of emergency procurements (EP)," a defence source confirmed. The fourth round of EPs was undertaken between September 2022 to September 2023.

Contracts up to ₹300 crore can be placed under EP, and deliveries have to be concluded within one year. Since the 2020 standoff with China in Eastern Ladakh, the Army has been looking for a series of technological innovations especially for high altitudes for a range of functions.

The robotic mule is a high-endurance, agile and durable all-weather ground robot for use in a broad range of unstructured urban and natural environments for defence applications. "He is able to walk up to three years. He is able to counter all kinds of obstacles and obstacles... He can go inside water and cross rivers... He has the ability to recognise objects around as there are electro-optics, infrared..." Arjun Aggarwal, managing director and CEO of AeroArc said while speaking at Himtech.

The mule can climb stairs, steep hills and other hurdles and can operate in extreme temperatures, ranging from -40 to +55 degrees Celsius and carry a payload of 15kg. Extreme high-altitude

clothing and habitat is a critical requirement for the Indian Army which is deployed in the world's highest battlefield Siachen and also other super high-altitude locations. At Himtech, DTECH 360 Innovations announced the field launch of its Peak Pods, a high-altitude habitat (tent) designed for sub-zero temperature regions.

“We recognized the need for a solution that could provide safe and sustainable housing in high-altitude regions, where extreme cold can make living conditions unbearable. Peak Pods fill this gap by combining research, modern design and cutting-edge technology to achieve 15° C inside the shelter in sub-zero temperatures, even when the outside temperature is touching minus 40° C, without using fuel or electricity,” said Vinay Mittal, managing director of DTECH 360 Innovations.

“The added feature of an inbuilt bio-toilet makes this a one-of-a-kind holistic solution that is not available anywhere in the world.”

“The Army is already using our solution on a no-cost-no-commitment basis for product evaluation & shortlisting,” Mr. Mittal said adding, “We are quite optimistic about a positive response.”

The product has been under evaluation over the last couple of years at three high altitude locations – Leh (11,500 feet), Daulat Beg Oldie (16,700 feet) and Durbuk (12,500 feet). While the trials at Leh were held from December 2022 to March 2023 and Durbuk from December 2023 to February 2024, the trails at DBO which began in May 2023 are still continuing. Army officials at the exhibition, spoke positively on the trials of the Peak Pod.

The Peak Pod can be rapidly deployed as it can be dismantled into 30kg blocks and are ideal for high-altitude military bases, research stations, adventure tourism destinations, fast-track hospitals, disaster relief camps among others, Mr. Mittal added.

A Drone-A-Thon 2 competition was held at Wari La on September 17-18 which saw over 20 Indian drone manufacturers participating and gave the Army an insight on the capabilities of Indian industry.

In the logistics category the first prize went to Scandron Pvt Ltd. The CargoMax 4000Q drone that was put to test at the competition was also evaluated by the Army and defence sources said a contract is expected soon and will be a significant fillip in logistics deliveries to forward locations.

In the Him-DronaThon challenge, drones on the logistics category were to takeoff from 15400 feet with a minimum of 10kg cargo, attain an altitude of 18,000 feet, cross Wari La Pass and Land at the remote location and then takeoff from the remote location and return back to the base location, Arjun Naik, CEO of Scandron said.

“Scandron used the CargoMax 4000Q drone and carried 20kg weight to successfully complete the parameters of the challenge,” he added. The drone can carry a load of 50kg up to a maximum range of 10km and has an altitude ceiling of 6000 metres. It is scheduled to be flown at Umling La at an altitude of over 19,000 feet in October.

<https://www.thehindu.com/news/national/army-inducts-robotic-mules-drones-high-altitude-tents-under-evaluation/article68675123.ece>

# Business Standard

Mon, 23 Sep 2024

## **MQ-9B drones to Tejas engines: PM Modi's US visit impact on Indian military**

India is poised to finalise a \$3.9 billion deal for the acquisition of 31 long-endurance MQ-9B Predator armed drones from American defence manufacturer General Atomics, further strengthening its ongoing defence partnership with the United States (US). The contract is expected to be signed in mid-October and will include 15 Sea Guardian drones for the Indian Navy and 16 Sky Guardians for the Indian Army and Air Force.

US President Joe Biden hosted Prime Minister Narendra Modi at his personal home in Wilmington, Delaware, on Saturday afternoon. The two leaders held wide-ranging talks covering various critical aspects of India-US relations, including ways to further ramp up bilateral defence and military engagement.

Following the talks between PM Modi and President Biden, a joint fact sheet stated, "President Joe Biden welcomed the progress towards India concluding procurement of 31 General Atomics MQ-9Bs and their associated equipment, which will enhance the intelligence, surveillance, and reconnaissance capabilities of India's armed forces across all domains."

However, there was no specific mention of the ambitious plan to co-produce F-414 fighter jet engines in India.

According to an Economic Times report, the upcoming drone deal will raise the total value of US defence contracts with India to over \$25 billion since 2007.

The joint fact sheet also noted the significant advancements achieved under the US-India defence industrial cooperation framework, highlighting ongoing efforts to enhance co-production agreements for jet engines, munitions, and ground mobility systems.

The announcement of the progress towards acquiring MQ-9B drones came as PM Modi and President Biden reaffirmed their commitment to enhancing bilateral defence cooperation amid shared concerns regarding China's expanding military capabilities, according to news agency PTI.

PM Modi began a crucial three-day visit to the US on September 21, 2024.

### **Why is India acquiring 'hunter-killer' US drones?**

India is acquiring the 'hunter-killer' drones -- 16 Sky Guardian and 15 Sea Guardian drones -- from General Atomics.

The price negotiations have been finalised, with the formal conclusion of the deal anticipated next month, according to a PTI report.

The acquisition of these drones is primarily aimed at strengthening its surveillance capabilities along the frontier with China and in the Indian Ocean region.

The drones have an impressive endurance of approximately 35 hours and can be utilised for various missions.

### **What about the jet engines for Tejas?**

No specific mention was made of the ambitious plans to co-produce F-414 fighter jet engines in India, as noted by agency reports.

However, while no joint projects have been finalised yet, the Economic Times noted that PM Modi and President Biden acknowledged the progress made, referencing to ongoing discussions regarding the production of GE-F414 jet engines for India's Tejas Mark-2 combat aircraft, with an 80 per cent technology transfer estimated at around \$1 billion.

In June 2023, GE Aerospace had signed an agreement with Hindustan Aeronautics Limited (HAL) to co-produce the engines.

### **Any update on India's potential acquisition of Stryker?**

India is reportedly in negotiations to jointly manufacture the US Army's Stryker armoured infantry combat vehicle, addressing a requirement for approximately 530 units.

The US recently showcased its Stryker vehicles, equipped with Javelin anti-tank missiles, during the 'Yudh Abhyas' exercise in Rajasthan.

### **What were the other highlights for India-US defence cooperation?**

PM Modi and President Biden highlighted efforts to co-develop and co-produce unmanned surface vehicle systems and enhance India's maintenance, repair, and overhaul (MRO) capabilities for aircraft and drones.

During the talks, both leaders acknowledged the collaboration between Liquid Robotics and Sagar Defence Engineering to co-develop and co-produce unmanned surface vehicle systems.

In discussions regarding future collaborations, both leaders praised efforts to advance cooperation in advanced sectors, including space and cyber capabilities. They also anticipate enhanced cyber collaboration in the upcoming India-US engagement scheduled for November 2024.

New areas of India-US cooperation will reportedly encompass threat information sharing, cybersecurity training, and joint efforts to mitigate vulnerabilities in energy and telecommunications networks.

PM Modi and President Biden also commended the expanding defence innovation collaboration among the two governments, businesses, and academic institutions, fostered by the India-US Defence Acceleration Ecosystem (INDUS-X) initiative launched in 2023.

"They welcomed the enhanced collaboration between the Indian Ministry of Defence's Innovations for Defence Excellence (iDEX) and the US Department of Defence's Defence Innovation Unit (DIU) through the Memorandum of Understanding signed at the Silicon Valley Summit," the fact sheet added.

Additionally, India plans to post military liaisons to the US Special Operations Command in Florida and the Indo-Pacific Command in Hawaii under a new memorandum of understanding.

PM Modi began a three-day visit to the US on September 21, 2024, including a meeting with President Biden. His agenda also featured participation in the Fourth Quad Leaders' Summit in Wilmington and an address at the 'Summit of the Future' during the UN General Assembly.

[https://www.business-standard.com/external-affairs-defence-security/news/mq-9b-drones-to-tejas-engines-pm-modi-s-us-visit-impact-on-indian-military-124092300797\\_1.html](https://www.business-standard.com/external-affairs-defence-security/news/mq-9b-drones-to-tejas-engines-pm-modi-s-us-visit-impact-on-indian-military-124092300797_1.html)

## **Indian Army in Lebanon watches closely as Israel-Hezbollah hostilities intensify**

As the situation in the Middle East turns grim with the escalating conflict between Israel and Hezbollah, the Indian Army, stationed at the Israel-Lebanon border under the United Nations peacekeeping forces, is closely monitoring the situation.

Nearly 600 Indian soldiers are deployed along the Israel-Lebanon border as part of the United Nations Interim Force in Lebanon (UNIFIL) mission.

Their role in this volatile region is focused on maintaining peace and preventing escalations, not on direct involvement in the conflict. According to defence sources, the Indian Army is closely observing the situation on the ground where Indian troops are stationed.

The conflict between Israel and Hezbollah intensified after a series of explosions in pagers and walkie-talkies used by Hezbollah. The Iran-backed militant group launched missiles at Israel, prompting Tel Aviv to announce extensive strikes across Lebanon.

The Israeli Defence Forces (IDF) targeted several areas in Lebanon, hitting Hezbollah strongholds and ammunition storage sites. The IDF claimed to have struck more than 300 Hezbollah targets, disrupting the group's plans to fire thousands of rockets into Israel.

As these military actions unfolded, the Indian Army remained on alert, operating from their position along the Blue Line—a 120-kilometre demarcation between Israel and Lebanon, established by the United Nations in 2000. Although this line is not a recognised border, it serves as a buffer zone, patrolled by UN peacekeepers. The Indian contingent, deployed there for decades, operates under strict UN protocols, focused on monitoring the area, ensuring peace, and responding to any threats against UN missions.

The Blue Line serves as a peacekeeping zone, and UN forces work to prevent conflicts from escalating between Israel and Lebanon. Though the Indian soldiers are not involved in active combat, they are responsible for maintaining stability in this highly sensitive region. Their primary mission is to protect UN personnel and peacekeeping operations, and to prevent any outbreak of violence along the border.

The region between Tyre and Sidon in Lebanon is a critical area where Hezbollah, supported by Iran, holds significant influence. This area, with its large Shia population and Palestinian refugee camps, is a key Hezbollah stronghold. Although Hezbollah's active presence is limited in some parts, their operatives are active, creating a challenging environment for peacekeepers.

Lebanon's population is a mix of religious communities, with about 67 per cent being Muslim--nearly evenly split between Sunni and Shia--and 32 per cent Christian, along with smaller Druze, Jewish, and other minority communities. The Palestinian refugee camps in the region also play a significant role, with many residents supporting Hezbollah.

The UN peacekeeping force divides its troops into two main sectors--East and West--with brigade-level strength in each, meaning both sectors are covered by 3-4 battalions. The Indian battalion is stationed in the East Sector, near the Golan Heights. Despite ongoing rocket attacks and airstrikes in the region, all Indian soldiers are reported safe.

The headquarters of the UN force is located in Naqoura, and any activity near the Blue Line, such as maintenance or security operations, requires prior approval from UNIFIL to avoid escalating tensions. UNIFIL's work is complicated, as even minor actions in the region can quickly escalate. Whenever Israel plans airstrikes near the troops' positions, they ensure peacekeepers are notified and relocated to safety.

With the mounting conflict and constant tension between Hezbollah and Israel, the Indian Army is carefully assessing the situation on the ground to ensure the safety of Indian soldiers. Currently, around 6,000 Indian soldiers are deployed across various UN missions worldwide, with 159 having lost their lives during these missions over the past decades.

<https://www.indiatoday.in/india/story/israel-hezbollah-lebanon-conflict-indian-army-united-nations-peacekeeping-force-war-2605186-2024-09-23>

## THE HINDU BusinessLine

Mon, 23 Sep 2024

### **Indian Army to scale up procurement through Government e-Marketplace**

The Indian Army has projected to buy spares, medicines, and work modules worth ₹16,000 crore through Government e-Marketplace (GeM) in the coming financial year, scaling up its procurement through this preferred platform from ₹21 crore in 2017 to over ₹15,433 crore in FY 2023-24. This digital transformation of acquisition will enable nearly 50 per cent of Army's revenue budget of ₹25,000 crore to be handled through the GeM, said a senior Army officer.

Of the total procurement of over ₹15,433 crore in FY 2023-24, the Army officials said the force onboarded critical items like rations, medical equipment, and expendable stores (perishable items), which together came to ₹5,000 crore. Meanwhile, the orders placed through the GeM in FY 2022-23 were ₹9,202 crore, said officials.

The GeM, under the General Financial Rules 2017, has emerged as the primary platform for procurement by the Army, providing price discovery tools, enhancing transparency and ease of business.

As part of a round transformation of its financial architecture, the Army is also adopting automation to enhance efficiency and transparency in financial management.

The Financial Planning Directorate, which is the highest body for budgeting in Army that is supervised directly Chief of Army Staff and Vice Chief of Army Staff, is implementing basic automation, including Financial Data Visualization and uploading compiled data through the Financial Planning Management Information System, the officer said.

The Army has conceptualised the Indian Army Financial Information System (IAFIS) to achieve a fully integrated and comprehensive financial automation system.

After extensive collaboration with various organisations like the Public Financial Management System (PFMS), CGDA, and GeM, the project's Request for Proposal (RFP) was uploaded on GeM on August 2, 2024, Army sources said.

The Army officials stated that their increased adoption of competitive bidding, which accounts for 80 per cent of procurement through bids or reverse auctions, and 20 per cent through direct procurement, has resulted in considerable savings for the state exchequer.

These measures, combined with the Army's focus on fostering small and medium-sized enterprises (SMEs) and digitising financial and procurement operations, have significantly improved budget management and ensured real-time monitoring, enhanced transparency, and traceable audit trails, a senior officer observed.

<https://www.thehindubusinessline.com/info-tech/indian-army-to-scale-up-procurement-through-government-e-marketplace/article68674101.ece>



Mon, 23 Sep 2024

## **Invisible War – U.S. Military Awakes To ‘Historically Neglected’ Warfare Domain; Ukraine War Proves EW Rules The Roost! OPED**

Electronic warfare (EW) has been a key factor in the Russia-Ukraine conflict, affecting both sides' military operations. Russia's invasion began with its largest combat deployment of EW capabilities. Russian electronic attack systems and aerial decoys jammed and confused Ukraine's air defense radars, many of which had to be taken offline and relocated.

Ukraine is a 'knowledge ground' for the world to gain valuable insights about the performance of its technologies amid electronic interference. Digital harassment can render information useless and make militaries vulnerable. EW systems vary in size and form, from pocket-sized devices to truck-mounted radar arrays and transceivers to airborne or ship-borne systems. Ukraine and Russia have engaged in a cat-and-mouse game to jam each other's systems.

Space has been a great enabler in all operations, including communications, ISR, navigation, and targeting. Both sides made attempts to jam data links and GPS signals. Ukraine war has, for the first time, democratized warfare through the introduction of drones in large numbers. Electronic jamming and directed energy weapons (DEW) supported anti-drone operations. The combined arms effort of the Israelis against the Syrians in Lebanon's Bekaa Valley in June 1982 was one of the most spectacular operations of modern warfare. The electronic suppression of enemy air defenses woke the world up to the importance of EW.

The more recent Hezbollah communications device explosions, including pagers and walkie-talkies that sounded like fireworks and gunshots, have brought a new dimension to modern warfare. It is time to revisit and draw lessons.

### **Why Electronic Warfare?**

Electronic warfare includes all actions in the entire electromagnetic spectrum to intercept, analyze, manipulate, or suppress the enemy's use of the spectrum and to protect friendly use of the spectrum from similar attacks by an enemy. EW is an element of the technological aspect of strategy and an element of combat power. EW is a military action that involves using electromagnetic energy to control the electromagnetic spectrum (EMS) for military and intelligence purposes.

Depending on their operational range, EW can be divided into tactical (up to 50 kilometers), operational-tactical (up to 500 kilometers), and strategic (over 500 kilometers) categories.

EW aims to control the EMS by exploiting, deceiving, or denying enemy use of the spectrum while ensuring friendly forces can use it. EW uses the EMS to sense, protect, and communicate while also disrupting, denying, and degrading the enemy's ability to use the signals. By exploiting the full EMS and cyber effects, a military force can pre-empt adversarial threats and respond to attacks electronically. EW includes areas such as radar systems, RF engineering, electro-optics, counter-measure development, signature management, signal and image processing, software engineering, sensor systems, and simulation.

### **Electronic Warfare During Russia's Initial Invasion**

Since the 2008 military reforms, the Russian Federation has invested heavily in Cyber and EW as an asymmetric response to NATO military capabilities that depend on sophisticated electronic systems. Russia's invasion force also included its largest combat deployment of EW capabilities to date. During the initial invasion, the VKS (Russia's Aerospace Forces) conducted intensive attacks on Ukraine's Ground-Based Air Defenses (GBAD), using a combination of cruise and ballistic missile strikes and anti-radiation weapons.

Russian electronic attack systems and aerial decoys jammed and confused Ukraine's air defense radars, many of which had to be taken offline or relocated. During the 2014-2022 war in eastern Ukraine, Moscow sent propaganda and fake orders to Ukrainian troops and civilians by spoofing the local cellular network, probably using the RB-341B Layer 3 system.

### **EW By Ukraine**

EW has been a key factor in the Russia-Ukraine conflict, affecting both sides' military operations. Both sides have used EW to jam drones, though unfortunately, because of a lack of coordination, many times friendly drones also got jammed. Both sides have used spoofing capabilities. In a spoofing attack, a person or program successfully identifies as another by falsifying data to gain an advantage and physically take over the entity. Electronic intelligence has been used to capture enemy transmissions.

Ukraine has used US-supplied portable counter-drone jammers. The USA has reprogrammed Ukraine's newly acquired F-16 EW systems to help the jets survive and not give away sensitive NATO electronic information. Ukrainian Startups have developed encrypted signal-hopping walkie-talkies that are easy to use and can be linked to cell phones.

The little-known Ukrainian "Pokrova" system appears capable of suppressing Russian satellite navigation systems like GLONASS and spoofing them by replacing genuine signals with false ones. According to Ukrainians, because of this system, more than 20 of the over 40 missiles launched by Moscow in a January 2024 attack failed to reach their targets.

Ukraine also managed to capture some high-value Russian EW assets during the conflict and is reported to have handed these over to allied nations for technical intelligence purposes. Ukrainian company Kvertus is fielding a back-packable jammer weighing 8 kilograms for individual soldiers. The jammer is intended to block signals in the 850-to-940-megahertz range, the most commonly used bands for first-person view (FPV) small drones. Ukraine's government hosted a hackathon for firms to work on ways to jam Iranian Shahed drones that have been causing havoc.

### **Russia's Initial Underutilised EW Effort**

Russia had not fully capitalized on its EW capabilities initially. Despite the combined kinetic and non-kinetic attacks on Ukraine's GBAD network, the Ukrainian Air Force (UAF) prevented the



VKS (Russian Air Force) from gaining air superiority. This was significant as Ukraine was hugely outnumbered. In some cases, Ukrainian pilots flew below 100 ft to hide below the radar horizon of Russian SAMs (surface-to-air missiles), using ground clutter and terrain masking to avoid detection before popping up to engage VKS fighter aircraft.

Because of the lack of equipment, Russian soldiers often used civilian handheld radios and mobile phones instead of secure, jam-resistant tactical radios. Ukrainian EW forces exploited these weaknesses and managed to eavesdrop on Russia's unencrypted transmissions, jam their communications, and perform targeting for long-range weapons using direction-finding techniques.

Ukrainian EW forces also used electronic attack capabilities to degrade the performance of VKS's airborne early warning platforms. Russia's failure to de-conflict EW activities with the rest of its operations led to unintentional jamming (electronic fratricide) of its own forces, thus enabling Ukrainian GBAD to become more effective. Russia lost many aircraft in the initial months and was forced to depend on costly ballistic and cruise missiles for offensive operations. Effectively, Ukraine managed 'Air Denial,' a state of mutually denied air superiority.

Many Russian aircraft and helicopters, including the US Stinger, the Russian Igla-series, and the more sophisticated laser-guided UK Starstreak, were shot by man-portable air defense systems (MANPADS), which are difficult to defeat by conventional countermeasures. Upgraded digital infrared seekers not only improve targeting but are also resistant to countermeasures, such as flare rejection. It has now become imperative to develop or acquire advanced laser-based Directed Infrared Countermeasures to safeguard air operations against the growing MANPADS threat.

### **Russia's Reviewed EW Effort**

Russia's density of the EW systems it can deploy is thanks to years of investment. Russia had a fresh look and was later able to use EW to counter Ukrainian UAS. It is estimated that Russia has 18,000 to 20,000 dedicated troops in electronic warfare units. Russian EW forces also attempted to jam NATO ISR aircraft operating on the periphery of Ukraine's border. Russia moved long-range SAMs forward to keep NATO surveillance assets at a distance.

When Ukraine received Excalibur artillery shells from the U.S. in March 2022, they were immediately the military's weapon of choice. They used GPS navigation. But by 2023, they started missing the targets. Russian electronic jamming, which overloads a receiver with noise or false information, was blocking the artillery shells' GPS.

Russian Pole-21 and RP-377 jammers were being used to thwart Ukrainian small drone attacks. As the US Air Force's GPS satellites flew overhead, Russian forces attempted to block their signals. The EW was used to disrupt communications and jam GPS signals. The precision-guided munitions were jammed, or their target coordinates were "spoofed," sending them to the wrong location.

Similar issues began to occur in April 2023 almost immediately following the delivery of Joint Direct Attack Munitions (JDAM) guided aerial bombs and Guided Multiple Launch Rocket System (GMLRS) long-range missiles, which can be used with U.S.-made High Mobility Artillery Rocket Systems (HIMARS). Russian soldiers were also jamming communication with Ukrainian drones, causing both reconnaissance and strike drones to crash, land on the spot, or even return to base.

Currently, with the front line largely static amid positional fighting, Russia has positioned one large EW system along every 10 kilometers of the front line. In the "War of Drones," Russia's jamming capabilities have presented a major challenge on the front lines. For months, the aerial drones supplied by Quantum Systems, a German technology firm, had worked smoothly for Ukraine's military, targeting tanks and troops. But by late 2023, the machines abruptly started falling from the

sky as they returned from missions. Russians were jamming the wireless signals that connected the drones to the satellites they relied on for navigation, leading the machines to plummet to Earth.

At least three out of five Russian EW brigades, whose operators gained experience in Syria, are involved in the war in Ukraine. Russia's Shipovnik-Aero EW complex is particularly effective at countering Ukrainian drone operations. The system has a range of 10 kilometers and can control a drone while simultaneously obtaining the coordinates of the operator's location with an accuracy of one meter.

The Krasukha-4 is one of Russia's most advanced EW systems, capable of operating at a distance of up to 300 kilometers. The system is designed mainly for jamming airborne fire control radars or satellites. It can disorient AIM-120 AMRAAM missiles and Patriot air defense radars.

Meanwhile, Ukraine has tried to use EW to help its air defenses confront Russian drones and missiles. Russia has interfered with signals in an attempt to disrupt global positioning system satellites that help Ukraine employ guided aerial and artillery munitions, many of which have been provided by the US. Russia has innovated by making smaller, mobile electronic weapons, like anti-drone guns and tiny jammers that form a radio-wave bubble around trenches.

### **EW Lessons From Ukraine**

It is clear that EW will be a key enabler of the future. The jamming and spoofing that blankets fighting in Eastern Europe offers a trial against Russian tools rarely seen in action. Each country needs to develop a full spectrum of Suppression and Destruction of Enemy Air Defence (SEAD/DEAD) capabilities.

Air and Space-based ISR will remain vital to gaining intelligence on adversary air defenses and the development of countermeasures. Mission planning, mission data, onboard defensive aids, and expendable active and passive countermeasures will be crucial for maximizing survivability. Offensive systems, including electronic attack and anti-radiation weapons, will be required to disrupt, deceive, and destroy hostile air defense networks. If you can stop the enemy's ability to communicate, you really hinder them.

EW will require adequate funding, research, and development. Technology development is an unending process. Low-cost autonomous air systems, designed to operate in swarms and use compact EW payloads to disrupt and confuse air defense systems, are the future. Sophisticated EW equipment and jam-resistant navigation gear would be required. Doctrines and training need to be reviewed. Cyber and Electromagnetic activities cannot be an afterthought. They are a pre-event act. New tactics would need to be evolved.

### **US Needs Fresh Look**

In Iraq, the US military operated a host of electronic warfare systems, including the Navy's EA-18G Growler carrier-based aircraft and the Air Force's EC-130H Compass Call, along with ground forces that have various jammers integrated into their vehicles. The US soon found itself engaged in a battle for spectrum superiority similar to what Ukraine is experiencing today. But instead of small drones, it was dealing with insurgents who were using common devices such as garage door openers to detonate roadside bombs.

Almost 20 years later, in October 2021, former Vice Chairman of the Joint Chiefs of Staff Air Force Gen. John Hyten said that the armed forces were still struggling to master the electromagnetic spectrum. There's a moonshot project highlighted in the recently released US "National Spectrum Strategy" that calls for the development and testing of large-scale dynamic spectrum sharing across multiple types of equipment for contested environments overseas. This will mean applying artificial intelligence to spectrum management. It will help de-conflict military

and civilian spectrum use in benign environments and when the military vies for electromagnetic spectrum dominance during war.

### **To Summarise**

The Ukraine-Russia conflict has seen more EW than we have ever seen before. It's a war that is a battle for spectrum dominance. Emphasis on electronic warfare is a must. US Air Force Secretary Frank Kendall says, "My own experience suggests that this is a historically neglected area that can have an oversized impact."

Since 1991, a separate branch of the Russian military has been dedicated to EW, developing over 60 different EW device models with various purposes and ranges. Using electromagnetic waves to flummox and follow smarter weapons has become a critical part of the cat-and-mouse game between Ukraine and Russia. The anti-drone gun can send a burst of radio signals to overwhelm a drone's communication links. 90 percent of the American and European systems coming to Ukraine were not prepared to meet the EW challenge.

The United States, China, and others have taken note. Chinese experts have also exhaustively chronicled which Russian electronic attacks were most effective against NATO systems and, in turn, where Russia failed. The high level of EW in Ukraine is nothing compared to what the US could face in a conflict with China. In fact, China is trying to understand how the US is reacting to Russian EW assaults in Ukraine.

An EW suite that can effectively disrupt the adversary's C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) will be needed. China's People's Liberation Army EW capability is designed to target space. Experts are now debating whether EW should be elevated to a "war-fighting domain" on par with land, air, sea, space, and cyberspace.

The US Defence Department, in a 2020 "Electromagnetic Spectrum Superiority Strategy," talked of achieving spectrum dominance and integrated EW in all domains but stopped short of declaring it a domain unto itself. "The war in Ukraine has been the performance-enhancing drug for NATO's electromagnetic thinking," Gen. Charles Q. Brown Jr., the chairman of the Joint Chiefs of Staff, said. "It has been the thing that concentrates minds."

If you do not dominate the spectrum, the world will soon be buzzing with freely loitering kamikaze drones. No side can remotely operate even their surface or sub-surface robotic systems without mastering the electromagnetic spectrum. EW is already at the speed of light, and if you embed AI, it will be at the speed of thought.

<https://www.eurasiantimes.com/invisible-war-u-s-military-awakes-to-historically/>



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*Mon, 23 Sep 2024*

### **Quantum Interferences in Atomic medium can store Light for High Precision Quantum Sensors**

Experimentalists have obtained a suitable optical response in an atomic medium that can be used to store light for a significant amount of time, facilitating designing applications for several quantum protocols for high precision quantum sensors, and more.

For several years now, scientists have been working with alkali atoms like Rubidium and Cesium, but there have been little efforts to deploy Potassium, for the sheer difficulty in working with this element.

Gourab Pal and Dr. Saptarishi Chaudhuri of the Quantum Mixtures (QuMix) lab at the Raman Research Institute, an autonomous institute of the Department of Science and Technology (DST), with their theory collaborator Prof. Subhasish Dutta Gupta, TIFR Hyderabad, used thermal Potassium and subjected the atoms to two laser lights in order to create quantum interferences in the atomic medium. The quantum coherence inside this atomic medium was created using the control light, which is also a laser. These probe and control lights were derived from extremely stabilized laser sources to perform the experiments using Potassium atoms.

“The innovative nature of this work lies in the use of Potassium atoms for performing Electromagnetically Induced Transparency (EIT) studies by coherent medium. We looked for the probe light response after it passed through an atomic coherent medium,” said Gourab Pal, PhD student and lead author of the paper titled ‘Velocity selective multiple two-photon dark and bright resonances in Potassium vapor’.

The EIT is a quantum interference phenomenon which dramatically modifies the optical response in atomic medium. In optical nonlinearities, there are multiple unique opportunities for controlling light with the use of light itself. And one classic example of this is EIT. This phenomenon occurs when the transmission of a probe beam is manipulated by the means of a control beam when passing through a dense medium. EIT experiments being scalable into the quantum domain with either one or more particles of light, the associated matter allows the implementation of quantum protocols with atoms and photons, as desired.

Observations following the experiments gave surprising results. Instead of observing just one resonance line shape, as has been the case with other alkali atoms, the QuMix experimentalists this time observed three-line shapes in a single absorption spectrum.

“This novel feature of three transparency windows using potassium vapours was observed for the first time. Usually, only one line shape is generally reported in previous works which deployed either Rubidium or Cesium atoms,” said Dr. Chaudhuri, co-author, and head, QuMix lab.

The latest paper published in Physica Scripta has further enhanced the overall current understanding on various types of quantum resonances in coherent atomic media.

“The additional two-line shapes emerged exclusively due to the closely-spaced, hyperfine ground states in potassium atoms. The two laser lights were found exchanging their excitation pathways using the moving atoms, creating two additional resonance lines. We have studied these experimentally with appropriate theoretical modeling,” explained Pal.

The photons of light beams are stored inside the atomic media. When the coherence is established in the atomic media, the light information is transferred from photons to atoms. After some time, this process reverts.

With India fast advancing its research and development efforts in the field of quantum technologies, RRI researchers said that this ability of storing light for a significant amount of time would come handy in multiple, futuristic quantum protocols, including quantum memory and quantum communication. A direct application of this understanding of coherent atomic media using Potassium would be in the domain of ultra-precise frequency stabilization of lasers.

Since line shapes are tuneable, in terms of position in the frequency domain, it is a perfect tool to stabilize laser frequency, especially where spectroscopic references are unavailable. This would avoid the need for using expensive wave-length meters, the researchers said.

The RRI duo claimed that the findings are unique because it corroborates that the quantum master equation (QME) description is valid even in cases where the ground energy level separation is small. QME is a theoretical tool to simulate quantum mechanical system (here Potassium atomic vapour), where light-matter interactions are studied. This approach is flexible to include various possible decay terms that mimic a real-world quantum system. In our theoretical modeling, we have used QME with relevant decay terms.

Research Paper link : <https://iopscience.iop.org/article/10.1088/1402-4896/ad5b2c>

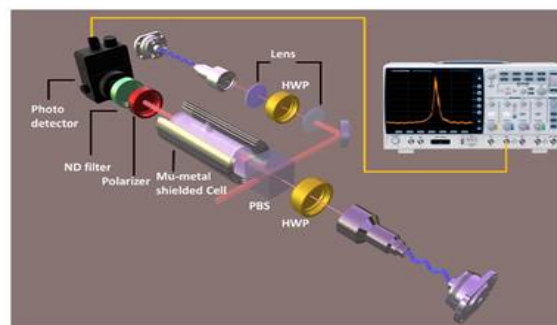


Figure 1: A schematic of the experimental-setup

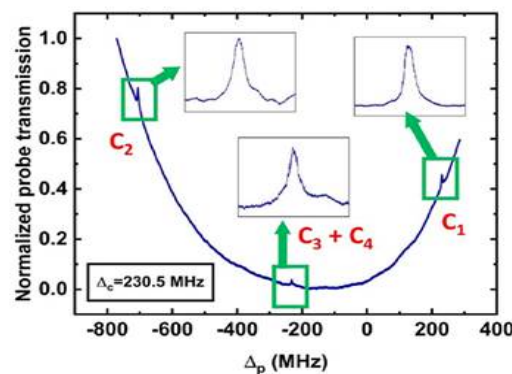


Figure 2: Observation of three bright resonances for a given value of control beam detuning 230.5 MHz

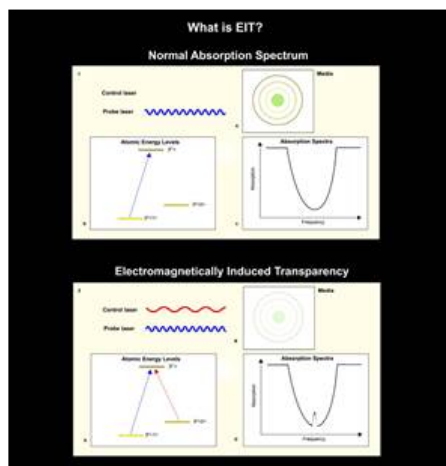


Figure 3: Panel 1 shows the absorption spectrum of an atom under only the Probe light which has an energy similar to  $|F=1\rangle$  to  $|F'\rangle$ .

Panel 2 shows the absorption spectrum of an atom when along with the Probe light, a Control light (energy similar to  $|F=2\rangle$  to  $|F'\rangle$ ) is also passed through it. C shows that at the absorption dip, a peak is seen, which results in EIT.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2057838>



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*Mon, 23 Sep 2024*

## **Catalytic Droplets Leading to Faster Chemical Reactions can Bring Quicker Access to Innovative Medications**

Researchers have developed catalytic droplets that can lead to a 10-fold increase in speed and efficient catalytic reactions and that this is valid below a critical substrate concentration. Such efficient chemical reactions can accelerate drug development, leading to quicker access to innovative medications and potentially lower healthcare costs.

Traditionally, chemists have relied on physical and chemical barriers to confine molecules during catalytic reactions. These methods, while effective, come with inherent limitations. The barriers that keep molecules in place can also restrict the movement of substrates and products, ultimately slowing down the very reactions they are meant to facilitate.

Scientists at Institute of Nano Science and Technology (INST), Mohali, an autonomous institute of Department of Science and Technology explored a way to confine nano-catalyst molecules without impeding their movement. Conducting a bold experiment, Professor Sarmistha Sinha and her team,

sought to confine protein–metal nanocomposites within droplets formed through liquid–liquid phase separation.

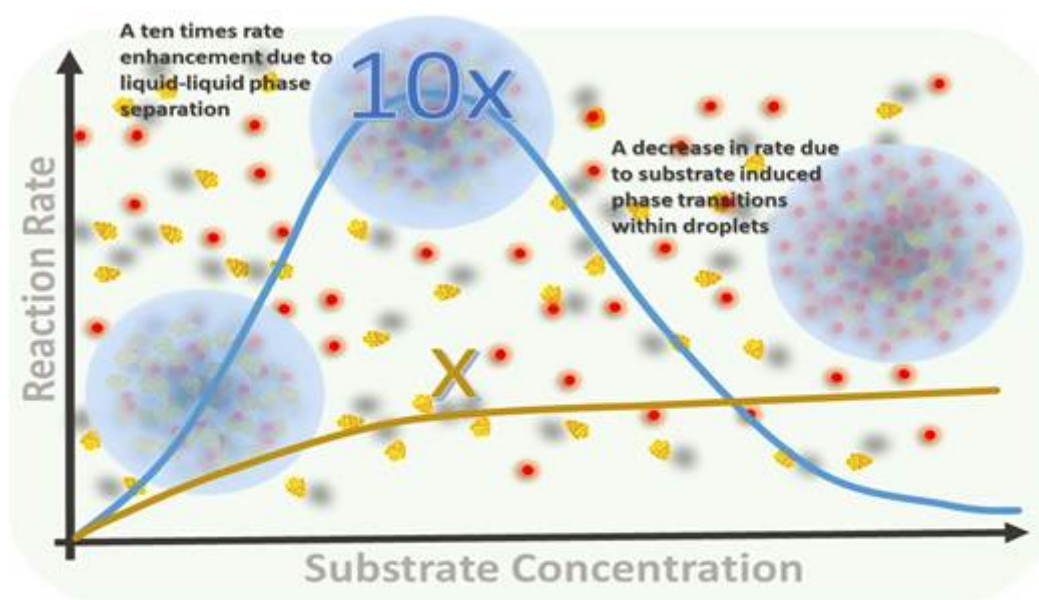
Unlike traditional methods, this approach allowed for barrier-free confinement, so that the molecules within the droplets could move freely. The droplets themselves were indifferent to the native conformation of the proteins they contained, creating an ideal environment for catalysis. The result was a staggering tenfold increase in the catalytic efficiency of the metal nanocatalysts. This discovery opens up new possibilities for accelerating chemical reactions, making them faster and more efficient than ever before.

In a subsequent study, they explored deeper into the behaviour of these droplets under varying conditions. Probing to understand how the interaction between a catalyst and different concentrations of substrate might impact the droplet phase and the kinetics of the catalytic reaction, they found that as the concentration of the substrate increased, the droplets, once fluid and dynamic, began to undergo an internal phase transition.

The excess substrate induced changes within the droplets, restricting the movement of both the substrate and the products. This, in turn, led to a reduction in the overall reaction rate. This discovery suggests that while liquid–liquid phase separation offers incredible potential for enhancing catalysis, the concentration of substrates within these droplets is a critical factor that must be carefully managed.

The finding published in the journal *Nanoscale* represents a paradigm shift in approach to chemical reactions. The ability to confine molecules within barrier-free droplets while maintaining—or even amplifying—reaction rates could lead to more efficient industrial processes, from drug manufacturing to energy production. Moreover, the insights gained from understanding phase transitions within these droplets could pave the way for new technologies that harness the power of liquid–liquid phase separation.

Publication link: <https://doi.org/10.1039/D4NR01402B>



*Fate of Catalytic Droplets*

<https://pib.gov.in/PressReleasePage.aspx?PRID=2057837>

## **Cosmology is at a tipping point—world may be on the verge of discovering new physics**

For the past few years, a series of controversies have rocked the well-established field of cosmology. In a nutshell, the predictions of the standard model of the universe appear to be at odds with some recent observations.

There are heated debates about whether these observations are biased, or whether the cosmological model, which predicts the structure and evolution of the entire universe, may need a rethink. Some even claim that cosmology is in crisis. Right now, we do not know which side will win. But excitingly, we are on the brink of finding that out.

To be fair, controversies are just the normal course of the scientific method. And over many years, the standard cosmological model has had its share of them. This model suggests the universe is made up of 68.3% “dark energy” (an unknown substance that causes the universe’s expansion to accelerate), 26.8% dark matter (an unknown form of matter) and 4.9% ordinary atoms, very precisely measured from the cosmic microwave background – the afterglow of radiation from the Big Bang.

It explains very successfully multitudes of data across both large and small scales of the universe. For example, it can explain things like the distribution of galaxies around us and the amount of helium and deuterium made in the universe’s first few minutes. Perhaps most importantly, it can also perfectly explain the cosmic microwave background.

This has led to it gaining the reputation as the “concordance model”. But a perfect storm of inconsistent measurements – or “tensions” as they’re known as in cosmology – are now questioning the validity of this longstanding model.

### **Uncomfortable tensions**

The standard model makes particular assumptions about the nature of dark energy and dark matter. But despite decades of intense observation, we still seem no closer to working out what dark matter and dark energy are made of.

The litmus test is the so-called Hubble tension. This relates to the Hubble constant, which is the rate of expansion of the universe at the present time. When measured in our nearby, local universe, from the distance to pulsating stars in nearby galaxies, called Cepheids, its value is 73 km/s/Mega parsec (Mpc is a unit of measure for distances in intergalactic space). However, when predicted theoretically, the value is 67.4 km/s/Mpc. The difference may not be large (only 8%), but it is statistically significant.

The Hubble tension became known about a decade ago. Back then, it was thought that the observations may have been biased. For example, the Cepheids, although very bright and easy to see, were crowded together with other stars, which could have made them appear even brighter. This could have made the Hubble constant higher by a few percent compared to the model prediction, thus artificially creating a tension.

With the advent of the James Webb Space Telescope (JWST), which can separate the stars individually, it was hoped that we would have an answer to this tension.



Frustratingly, this hasn't yet happened. Astronomers now use two other types of stars besides the Cepheids (known as the Tip of the Red Giant Branch stars (TRGB) and the J-region Asymptotic Giant Branch (JAGB) stars). But while one group has reported values from the JAGB and TRGB stars that are tantalisingly close to the value expected from the cosmological model, another group has claimed that they are still seeing inconsistencies in their observations. Meanwhile, the Cepheids measurements continue to show a Hubble tension.

It's important to note that although these measurements are very precise, they may still be biased by some effects uniquely associated with each type of measurement. This will affect the accuracy of the observations, in a different way for each type of stars. A precise but inaccurate measurement is like trying to have a conversation with a person who is always missing the point. To solve disagreements between conflicting data, we need measurements that are both precise and accurate.

The good news is that the Hubble tension is now a rapidly developing story. Perhaps we will have the answer to it within the next year or so. Improving the accuracy of data, for example by including stars from more far away galaxies, will help sort this out. Similarly, measurements of ripples in spacetime known as gravitational waves will also be able to help us pin down the constant.

This may all vindicate the standard model. Or it may hint that there's something missing from it. Perhaps the nature of dark matter or the way that gravity behaves on specific scales is different to what we believe now. But before discounting the model, one has to marvel at its unmatched precision. It only misses the mark by at most a few percent, while extrapolating over 13 billion years of evolution.

To put it into perspective, even the clockwork motions of planets in the Solar System can only be computed reliably for less than 1 billion years, after which they become unpredictable. The standard cosmological model is an extraordinary machine.

The Hubble tension is not the only trouble for cosmology. Another one, known as the "S8 tension", is also causing trouble, albeit not on the same scale. Here the model has a smoothness problem, by predicting that matter in the universe should be more clustered together than we actually observe – by about 10%. There are various ways to measure the "clumpiness" of matter, for example by analysing the distortions in the light from galaxies, produced by the assumed dark matter intervening along the line of sight.

Currently, there seems to be a consensus in the community that the uncertainties in the observations have to be teased out before ruling out the cosmological model. One possible way to alleviate this tension is to better understand the role of gaseous winds in galaxies, which can push out some of the matter, making it smoother.

Understanding how clumpiness measurements on small scales relate to those on larger scales would help. Observations might also suggest there is a need to change how we model dark matter. For example, if instead of being made entirely of cold, slow moving particles, as the standard model assumes, dark matter could be mixed up with some hot, fast-moving particles. This could slow down the growth of clumpiness at late cosmic times, which would ease the S8 tension.

JWST has highlighted other challenges to the standard model. One of them is that early galaxies appear to be much more massive than expected. Some galaxies may weigh as much as the Milky Way today, even though they formed less than 1 billion years after the Big Bang, suggesting they should be less massive.

However, the implications against the cosmological model are less clear in this case, as there may be other possible explanations for these surprising results. Key to solving this problem is to

improve the measurement of stellar masses in galaxies. Rather than measuring them directly, which is not possible, we infer these masses from the light emitted by galaxies.

This step involves some simplifying assumptions, which could translate in overestimating the mass. Recently, it has also been argued that some of the light attributed to stars in these galaxies is generated by powerful black holes. This would imply that these galaxies may not be as massive after all.

### **Alternative theories**

So, where do we stand now? While some tensions may soon be explained by more and better observations, it is not yet clear whether there will be a resolution to all of the challenges battering the cosmological model.

There has been no shortage of theoretical ideas of how to fix the model though – perhaps too many, in the range of a few hundred and counting. That’s a perplexing task for any theorist who may wish to explore them all.

The possibilities are many. Perhaps we need to change our assumptions of the nature of dark energy. Perhaps it is a parameter that varies with time, which some recent measurements have suggested. Or maybe we need to add more dark energy to the model to boost the expansion of the universe at early times, or, on the contrary, at late times. Modifying how gravity behaves on large scales of the universe (differently than done in the models called Modified Newtonian Dynamics, or MOND) may also be an option.

So far, however, none of these alternatives can explain the vast array of observations that the standard model can. Even more worrisome, some of them may help with one tension but worsen others.

The door is now open to all sorts of ideas that challenge even the most basic tenets of cosmology. For example, we may need to abandon the assumption that the universe is “homogeneous and isotropic” on very large scales, meaning it looks the same in all directions to all observers and suggesting there are no special points in the universe. Others propose changes to the theory of general relativity.

Some even imagine a trickster universe, which participates with us in the act of observation, or which changes its appearance depending on whether we look at it or not – something we know happens in the quantum world of atoms and particles.

In time, many of these ideas will likely be relegated to the cabinet of curiosities of theorists. But in the meantime, they provide a fertile ground for testing the “new physics”.

This is a good thing. The answer to these tensions will no doubt come from more data. In the next few years, a powerful combination of observations from experiments such as JWST, the Dark Energy Spectroscopic Instrument (DESI), the Vera Rubin Observatory and Euclid, among many others, will help us find the long-sought answers.

### **Tipping point**

On one side, more accurate data and a better understanding of the systematic uncertainties in the measurements could return us to the reassuring comfort of the standard model. Out of its past troubles, the model may emerge not only vindicated, but also strengthened, and cosmology will be a science that is both precise and accurate.

But if the balance tips the other way, we will be ushered into uncharted territory, where new physics will have to be discovered. This could lead to a major paradigm shift in cosmology, akin to

the discovery of the accelerated expansion of the universe in the late 1990s. But on this path we may have to reckon, once and for all, with the nature of dark energy and dark matter, two of the big unsolved mysteries of the universe.

<https://theprint.in/science/cosmology-is-at-a-tipping-point-world-may-be-on-the-verge-of-discovering-new-physics/2279008/>



*Tue, 24 Sep 2024*

## **Chandrayaan-3's Pragyan rover discovers big crater older than South Pole-Aitken basin**

Chandrayaan-3, the milestone moon mission by the Indian Space Research Organisation (ISRO), continues to impress science enthusiasts. This time, analysis of data from the Pragyan rover has led to the discovery of an ancient crater with a diameter of 160 km.

This crater was possibly formed before the South Pole-Aitken (SPA) basin, known as the largest and oldest impact basin on the moon's surface. The discovery was based on the analysis of data transmitted by the Vikram lander and Pragyan rover, both of which successfully completed their mission on September 3, 2023, and were then put into sleep mode.

In a paper published by PRL Ahmedabad scientists, named 'Chandrayaan-3 landing site evolution by South Pole-Aitken basin and other impact craters', it is said that the Chandrayaan-3 mission landed (CH-3 landing site) within a buried impact crater, which is much older than the SPA basin, which is located around 350 km from the South Pole-Aitken basin rim.

Using the Pragyan rover's Navcam and optical high-resolution camera, ISRO has managed to capture a "semi-circular, heavily degraded structure encompassed around the landing site". It is now being called one of the oldest structures on the moon, which was said to have been buried by debris also known as ejecta materials from the SPA basin and 11 other basins surrounding the same.

Findings from the Chandrayaan-3 mission have been helping scientists around the world better understand the moon. This could aid upcoming moon missions, including Chandrayaan-4, planned for 2027.

<https://indianexpress.com/article/technology/science/chandrayaan-3-pragyan-rover-discovers-big-crater-9583520/>

