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समाचार पत्रों से चयनित अंश
Newspapers Clippings

डीआरडीओ समुदाय को डीआरडीओ प्रौद्योगिकियों, रक्षा प्रौद्योगिकियों, रक्षा नीतियों, अंतर्राष्ट्रीय संबंधों और विज्ञान एवं प्रौद्योगिकी की नूतन जानकारी से अवगत कराने हेतु दैनिक सेवा

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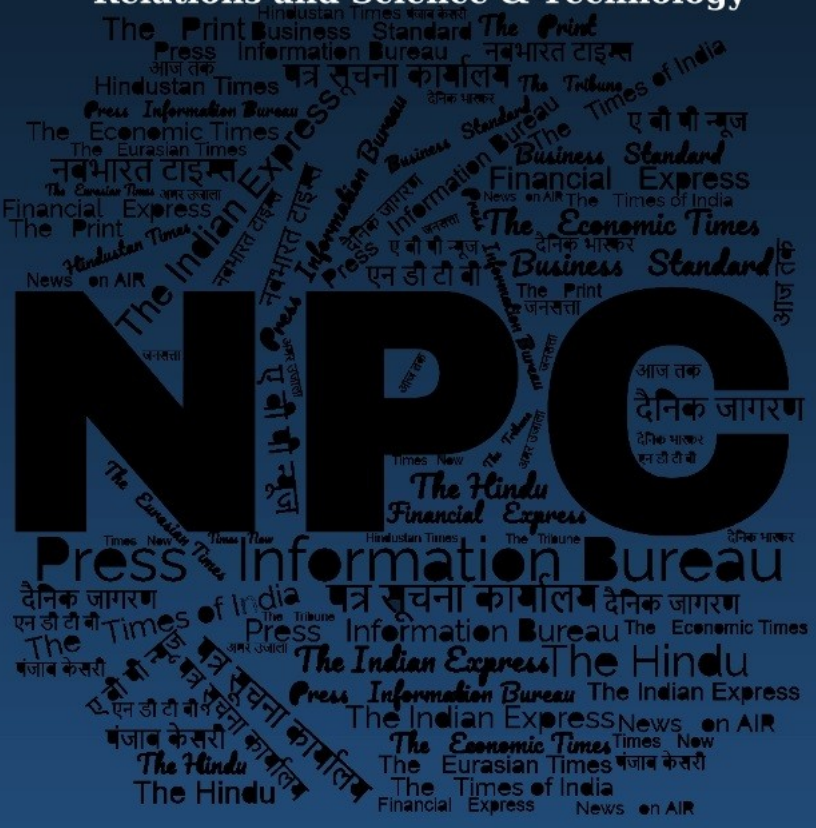

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DRDO News

ARS project gets under way

Source: The Hindu Dt. 17 April 2025,
URL: https://www.thehindu.com/news/national/kerala/ars-project-gets-under-way/article69457965.ece

The steel cutting for the Acoustic Research Ship (ARS) built for the Defence Research and Development Organisation (DRDO) got under way at Garden Reach Shipbuilders and Engineers (GRSE) Limited, Kolkata, on Wednesday.

The contract for the ARS, valued at ₹490.98 crore, was signed between GRSE and DRDO/Naval Physical and Oceanographic Laboratory (NPOL) on October 21, 2024. The ship is expected to be delivered in three years by 2027.

Samir V. Kamat, Secretary, Department of Defence Research and Development, and Chairman, DRDO, was the chief guest. GRSE chairman and managing director P.R. Hari, Chandrika Kaushik DG (PC&SI), DRDO, D. Seshagiri, Director, NPOL, senior scientists from the DRDO and senior officials from GRSE were present.

Once completed, the ARS will be India's first silent class ship. It will be over 90 metres long with a displacement of more than 5,000 tonnes. It is designed to achieve a speed of 12 knots. This state-of-the-art vessel will be equipped with modern facilities including Gondola, Moon pool, and Dropkeel to perform underwater acoustic and oceanographic research activities of the NPOL. The vessel is equipped with a Dynamic Positioning System (DP-II).

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Defence News

Defence Strategic: National/International

India- Uzbekistan Joint Military Exercise DUSTLIK-VI Commences At Foreign Training Node, Aundh

Source: Press Information Bureau, Dt. 16 April 2025,
URL: https://pib.gov.in/PressReleasePage.aspx?PRID=2122061

The 6th edition of India- Uzbekistan Joint Military Exercise DUSTLIK-VI commenced today, at Foreign Training Node, Aundh (Pune). The Exercise is scheduled to be conducted from 16 to 28 Apr 2025.

Indian contingent comprising of 60 personnel is being represented by a Battalion of JAT Regiment and IAF. The Uzbekistan contingent is being represented by personnel from Uzbekistan Army. Joint Exercise DUSTLIK -VI is an annual training event conducted alternatively in India and Uzbekistan. Last edition was conducted in Termez District, Uzbekistan in April 2024.

The theme of the exercise will be based on the theme of Joint Multi Domain Sub Conventional operations in Semi-Urban Scenario. It will focus on responding to a terrorist action involving the capture of a defined territory. It will also include the establishment of a Joint Operations Centre at the battalion level for continuous joint operations, the execution of counterterrorism missions such as population control measures, raids, search-and-destroy operations, and the employment of firepower, including air assets, to neutralise terrorists. Special forces from the Army and Air Force, during the Exercise, will secure a helipad for use as a mounting base for further operations. The Exercise will also cover the deployment of drones, counter-UAS measures, and logistics support by the Air Force to sustain forces in hostile areas. Additionally, helicopters will be utilised for reconnaissance and observation, special heliborne operations (SHBO), small team insertion and extraction (STIE) and other associated missions.

Joint Exercise DUSTLIK -VI will enable both sides to share best practices in Tactics, Techniques and Procedures of conducting Joint Sub Conventional operations. It will facilitate developing inter-operability, bonhomie and camaraderie between the two armies. The Joint Exercise will also enhance defence cooperation, further augmenting bilateral relations between the two friendly nations.

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Five Armed Forces personnel get MacGregor Memorial Medal Award for outstanding contributions in military reconnaissance, exploration & adventure

Source: Press Information Bureau, Dt. 16 April 2025,
URL: https://pib.gov.in/PressReleasePage.aspx?PRID=2122199

Chief of Defence Staff General Anil Chauhan felicitated four individuals from the Armed Forces for their outstanding contributions in the fields of military reconnaissance, exploration and adventure activities during the MacGregor Memorial Medal Award Ceremony held at the United Service Institution of India in New Delhi on April 16, 2025. The awardees for 2023 included Wing Commander D Panda, Indian Air Force and EA (R) Rahul Kumar Pandey, Indian Navy. For 2024, CHEAA(R) Ram Ratan Jat, Indian Navy and Sergeant Jhumar Ram Poonia, Indian Air Force were honoured with the MacGregor Memorial Medal.

Col Ranvir Singh Jamwal, Director NIMAS has been conferred with the Mac Gregor award for 2024. The officer was not physically present to receive the award as he is part of a mountaineering expedition to Mt Kanchenjunga.

Instituted on July 03, 1888, the MacGregor Memorial Medal commemorates Maj Gen Sir Charles Metcalfe MacGregor, KCB, CSI, CIE - founder of the United Service Institution of India established in 1870. Originally intended to recognise the acts of military reconnaissance and exploratory journeys, the medal's scope was expanded in 1986, post-independence, to include military expeditions and adventure activities.

While military reconnaissance and exploration remain the foremost criteria, the medal is open to all ranks (serving and retired) of the Armed Forces, Territorial Army, Reserve Forces, Rashtriya

Rifles and Assam Rifles. To date, 127 medals have been awarded, including 103 prior to independence.

Among the notable recipients are Capt FE Younghusband (1890), Maj Gen Orde Charles Wingate (1943), Maj ZC Bakshi, VrC(1949), Col Narinder Kumar for Siachen Glacier exploration (1978–81) and Cdr Dilip Donde and Lt Cdr Abhilash Tomy for their solo global circumnavigations. The honour continues to inspire and motivate the Armed Forces personnel to undertake courageous feats and uphold the tradition of valour, perseverance and discovery.

The event also featured the launch of the book Bravest of the Brave, a truly inspirational chronicle on the life and heroic journey of Naib Subedar Chunni Lal, AC, VrC, SM, by the Chief of Defence Staff. General Anil Chauhan complimented Lt Gen Satish Dua (Retd), the author and former Chief of Integrated Defence Staff (CISC) for his vivid and heartfelt portrayal of the personal turmoil of a soldier, their unwavering resolve in the face of adversity and their indomitable spirit. The book serves as a poignant tribute to a gallant soldier and a reminder of the selfless service rendered by the men and women in uniform.

The ceremony at USI highlighted the enduring legacy of the Indian Armed Forces in exploration, bravery and service to the nation, while also celebrating stories that continue to inspire future generations.

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Indian Navy Hosts Meghayan-25

Source: Press Information Bureau, Dt. 16 April 2025,
URL: https://pib.gov.in/PressReleasePage.aspx?PRID=2122172

The 3rd edition of the Indian Navy's Meteorological and Oceanological Symposium - Meghayan 25 – was held on 14 Apr 25, to commemorate the formation of the World Meteorological Organisation (WMO) and celebrating WMO Day 2025. Hosted at the Nausena Bhawan at Delhi, the symposium was virtually inaugurated by Adm Dinesh K Tripathi, Chief of the Naval Staff. The event brought together an impressive array of distinguished experts, high-ranking naval officers, outstation guests, and key stakeholders from across the meteorological and oceanographic spectrum. Premier organisations like the India Met Dept (IMD), the Indian Institute for Tropical Meteorology (IITM), the Indian National Center for Ocean Information Services (INCOIS), National Institute of Ocean Technology (NIOT), the Indian Air Force, Space Applications Center (SAC), ISRO, Ahmedabad, National Maritime Foundation (NMF) and the Indian Institute of Technology, Madras (IIT-M) participated in the event. The seminar was organised to align with this year's WMO Day theme - 'Closing the Early Warning Gap Together'.

The technical program was divided into two enriching sessions, each moderated by seasoned Subject Matter Experts. Session I, moderated by RAdm G Rambabu, Principal of the Indian Naval Academy (INA) and the seniormost Met Officer, featured a series of insightful presentations that showcased cutting-edge developments in Marine Meteorology and Oceanology. Session II, moderated by Cmde SMU Athar, Cmde (NE), shifted focus to Statistical Approaches in Weather Forecasting. Both sessions ended with stimulating Q&A, sessions with active participation from

the audience. The event also featured an incisive and thought-provoking Panel Discussion focused on "Closing the Early Warning Gap Together: Enhancing Maritime Security and Coordination" bringing together experts to deliberate on integrated strategies for maritime safety and preparedness. The discussion was moderated astutely by VAdm Pradeep Chauhan (Retd), the Director General NMF.

The final session was presided over by Vice Admiral Krishna Swaminathan, the Vice Chief of Naval Staff. The event was also attended by Vadm Tarun Sobti, the Deputy Chief of Naval Staff, VAdm Lochan Singh Pathania, the Chief Hydrographer to the GoI and veteran Met officers. Dr Nilesh Desai, Director SAC, Ahmedabad graced the occasion as the Guest of Honour, while Dr Mrutyunjay Mohapatra, the Director General IMD and Hony Vice President of the WMO delivered the Keynote Address.

A key highlight of the event was the felicitation of the pioneer of the Navy's Meteorological specialisation, Cmde PI Oommen (Retd). The 94 years young first Principal Director of Naval Oceanology and Meteorology addressed the gathering and shared a few treasured memories and experiences with the audience.

In keeping with the quest for continuous improvement of meteorological services within the Indian Navy, Meteorological and Oceanographic Satellite Data Archival Centre - Indian Navy (MOSDAC-IN) web services, a joint collaboration between the Directorate of Naval Oceanology and Meteorology (DNOM) and SAC was officially launched by Dr Nilesh Desai. MOSDAC-IN, which provides customised satellite derived weather products with separate log-ins for individual Naval Met Offices.

The symposium also saw the revival of its professional Meteorological and Oceanological journal after a gap of almost 10 years. The 10th edition of "Sagarmanthan" was launched during Meghayan 25.

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Why DRDO testing 'Star Wars' laser weapons is a defining moment for India's defence

-by Air Marshal Anil Chopra (former Director General, Centre for Air Power Studies)

Source: FirstPost, Dt. 16 April 2025,
URL: https://www.firstpost.com/opinion/why-drdo-testing-star-wars-laser-weapons-is-a-defining-moment-for-indias-defence-13880511.html

India's Defence Research and Development Organisation (DRDO) on Sunday, April 13, 2025, announced the successful trial of the in-house developed Mk-II(A) Laser-Directed Energy Weapon (DEW) system. It thus demonstrated having mastered the technology for disabling missiles, drones and smaller projectiles. The success has put India in the exclusive and limited club of nations, which possess the high-power Laser-DEW systems.

The trial was carried at the National Open Air Range, Kurnool in Andhra Pradesh. "Indigenously designed and developed Mk-II(A) DEW system was demonstrated in its entire spectrum of

capability by engaging the fixed wing drones at long range, thwarting a multiple drone attack and destroying enemy surveillance sensors and antennae," the DRDO statement said. "The lightning speed of engagement, the precision and the lethality delivered at the target within a few seconds made it the most potent counter drone system."

DEWs are considered a cost-effective defence against low-cost drone attacks. DRDO press release further added, "Cost of firing it for few seconds is equivalent to the cost of couple of litres of petrol. Therefore, it has the potential to be a long-term and low-cost alternative to defeat the target." The system was developed by DRDO's Hyderabad-based Centre for High Energy Systems and Sciences (CHESS), along with other labs, academic institutions and Indian industries.

Once detected by a radar or by its inbuilt Electro Optic (EO) system, laser-DEW can engage targets at the speed of light and use an intense laser beam to cut through the target, burning its electro-optical sensors, causing structural failure or exploding its warhead. This type of cutting-edge weaponry has the potential to revolutionise the battle-space by reducing the reliance on expensive logistics-dependent ammunition. It could also lower the risk of collateral damage.

The proliferation of unmanned aerial systems (UAS) and the emergence of drone swarms as asymmetric threats are driving the demand for DEWs as counter-UAS and counter-swarm capabilities. The DEW would soon be replacing traditional kinetic weapons and missile defence systems due to its ease of operation and cost effectiveness.

What is a DEW and its operational advantages?

A DEW is a ranged weapon that damages its target with highly focused energy. It has no solid projectile. It includes lasers, microwaves, particle beams, and sound beams. Potential applications of this technology include weapons that target personnel, missiles, vehicles, satellites, and optical devices. Many defence labs in the US's have been researching DEWs to counter ballistic missiles, hypersonic cruise missiles, and hypersonic glide vehicles.

DEWs could have several advantages over conventional weaponry. These weapons are fairly discreet as radiation does not generate sound and is invisible. Light, for practical purposes, is unaffected by gravity, wind and Coriolis force (due Earth's rotation), giving it an almost perfectly straight trajectory. This makes aiming much more precise and extends the range to line of sight. Of course, there could some beam diffraction and spread, which may dilute the power and weaken the effect, and absorption or scattering by intervening atmosphere.

Lasers travel at light-speed and have long range, making them suitable for use in space warfare. Laser weapons potentially eliminate many logistical problems in terms of ammunition supply, as long as there is enough energy to power them. Depending on several operational factors, DEWs may be cheaper to operate than conventional weapons. Use of high-powered microwave weapons, which are typically used to degrade and damage electronics such as drones, can be hard to attribute to someone.

Ancient and early DEWs

In Hindu mythology, celestial weapons (Astra) are often described as wielding immense destructive power and are often depicted as being DEWs, capable of delivering devastating effects.

Some notable examples include the Brahmastra, a highly destructive weapon, said to be capable of destroying entire worlds. It is associated with the deity Brahma.

Pashupatastra is considered one of the most devastating weapons, wielded by Shiva's consort Mahakali. Narayanastra, a powerful weapon, said to be capable of even making Shiva fall asleep. Vaishnavastra, a weapon associated with Vishnu, said to be invincible to anyone except its creator. Bhargavastraa powerful weapon associated with the sage Bhargava, known for its immense destructive capabilities. Each is said to have unique capabilities and destructive potential. These weapons are not physical objects but manifestations of divine power, wielded by gods or skilled warriors.

According to a legend, Archimedes created a mirror with an adjustable focal length (or more likely, a series of mirrors) to focus sunlight on ships of the Roman fleet as they invaded Syracuse, setting them on fire. During the early 1940s German engineers developed a sonic cannon that could cause fatal vibrations in its target body. It caused vertigo and nausea at 200-400 metres by vibrating the middle ear bones and shaking the cochlear fluid within the inner ear. At distances of 50-200 metres the sound waves could act on organ tissues and fluids by repeatedly compressing and releasing compressive resistant organs such as the kidneys, spleen, and liver. At such close ranges, the weapon was highly vulnerable to enemy fire. Among the DEW, the Nazis investigated X-ray beam weapons. The intent was to pre-ionize ignition in aircraft engines and hence serve as anti-aircraft DEW and bring planes down into the reach of the flak.

Who all have DEW?

These systems of missile defence are already being deployed by US and Israel. China, France, Germany, the United Kingdom, Russia, India, and Pakistan are also developing military-grade DEWs Meanwhile, Iran and Turkey claim to have them in active service. The first use of directed-energy weapons in combat between military forces was claimed to have occurred in Libya in August 2019 by Turkey, which claimed to use the ALKA directed-energy weapon. Despite all this, most DEWs are still at the experimental stage and it remains to be seen if or when they will be deployed as practical, high-performance military weapons.

Anti-Personnel DEW

The microwave frequency is normally between 300 MHz and 300 GHz (wavelengths of 1 meter to 1 millimetre). "Active Denial System" developed by the U.S. Air Force Research Laboratory and Raytheon is a millimetre wave source that heats the water in a human target's skin and thus causes incapacitating pain. It was developed originally for riot-control duty. Though intended to cause severe pain while leaving no lasting damage, some contend that it could cause irreversible damage to the eyes. It can also destroy unshielded electronics.

Aircraft-Based DEW

Raytheon developed "Vigilant Eagle" is a defence system that directs high-frequency microwaves towards any projectile that is fired at an aircraft. It is supposedly highly effective in defeating MANPADS missiles. The system consists of a missile-detecting and tracking subsystem, and a scanning array. It has a fixed grid of passive infrared (IR) cameras. The missile launch point is

detected, and the scanning array projects microwaves that disrupt the surface-to-air missile's guidance system, deflecting it from the aircraft. Its actual deployment is not known.

The Counter-electronics High Power Microwave Advanced Missile Project (CHAMP) is an American joint concept technology demonstration program to develop an air-launched directed-energy weapon capable of incapacitating or damaging electronic systems by means of an EMP (electromagnetic pulse). Till now airborne platforms were constrained by need of high electric power generation on-board.

Surface-based DEW

Bofors HPM Blackout is a high-powered microwave weapon that is said to be able to destroy at short distance a wide variety of electronic equipment. The effective radiated power (ERP) of Israeli EL/M-2080 Green Pine makes it a hypothetical candidate for conversion into a DEW by focusing pulses of radar energy on target missiles. The energy spikes are tailored to enter missiles through antennas or sensor apertures where they can fool guidance systems, scramble computer memories or even burn out sensitive electronic components.

The Tactical High-power Operational Responder (THOR) is an American high-power microwave DEW. Radio Frequency Directed Energy Weapon (RFDEW) developed in the UK uses radio waves to fry the electronic components of its targets, rendering them inoperable. It is capable of engaging multiple targets, including drone swarms, and reportedly costs less than 13 cents per shot, making it a much cheaper alternative to traditional missile-based air defence systems. It was unveiled in May 2024.

DragonFire is a UK developed laser DEW reportedly in the 50 kW class and is capable of engaging any target within line-of-sight at a currently classified range. It has been tested against drones and mortar rounds and is expected to equip ships, aircraft and ground vehicles from 2027.

During the Iraq War, electromagnetic weapons, including high power microwaves, were used by the US military to disrupt and destroy Iraqi electronic systems and may have been used for crowd control. Types and magnitudes of exposure to electromagnetic fields are unknown.

Anti-drone DEW

A "Pischal-Pro" anti-drone gun, featured at the Dubai Airshow, 2019. It is a battery-powered electromagnetic pulse weapon held to an operator's shoulder, pointed at a flying target in a way similar to a rifle, and operated. The device emits separate electromagnetic pulses to suppress navigation and transmission channels used to operate an aerial drone, terminating the drone's contact with its operator. The out-of-control drone then crashes.

The Russian "Stupor" is reported to have a range of two kilometres, covering a 20-degree sector; it also suppresses the drone's cameras. Stupor is reported to have been used by Russian forces during the Russian military intervention in the Syrian civil war.

Both Russia and Ukraine are reported to use DEW devices during the ongoing conflict. The Ukrainian army are reported to use the Ukrainian KVS G-6, with a 3.5 km range and able to operate continuously for 30 minutes. The manufacturer states that the weapon can disrupt remote

control, the transmission of video at 2.4 and 5 GHz, and GPS and Glonass satellite navigation signals. Ukraine has also used the EDM4S anti drone rifle to shoot down Russian Eleron-3 drones.

Due to the threat posed by drones in regard to terrorism, several police forces have carried anti-drone guns as part of their equipment. These have an effective range of 3 km.

Sonic or acoustic weaponry

Sonic weapons or acoustic weapons, emit very loud sounds, often used for crowd control or to incapacitate individuals. These weapons can cause pain, discomfort, and potential hearing damage due to their high decibel levels. Long-Range Acoustic Devices (LRADs) are specialized loudspeakers covering long distances.

According to the manufacturer's specifications, the systems weigh from 7 to 145 kg and can emit sound in a 30°-60° beam at 2.5 kHz. They range in size from small, portable handheld units which can be strapped to a person's chest, to larger models which require a mount. The power of the sound beam which LRADs produce is sufficient to penetrate vehicles and buildings while retaining a high degree of fidelity, so that verbal messages can be conveyed clearly in some situations.

Some sonic weapons create a focused beam of sound or ultrasound to target a specific area or person. Others produce a broader area field of sound, affecting a larger number of individuals. The loud and painful sounds can cause intense discomfort, potentially leading to panic and disorientation. The unexpected and powerful nature of the sound can also cause psychological stress and fear. They can be used to communicate with or disorient individuals during siege situations. Even wearing earplugs or firmly blocking the ears with hands may not be sufficient to prevent injury. The powerful nature of sonic weapons raises concerns about their potential for misuse and abuse.

LRADs are often fitted on commercial and military ships. They have been used on several occasions to repel pirate attacks by sending warnings and by producing intolerable levels of sound. For example, in 2005 the cruise-liner "Seabourn Spirit" used a sonic weapon to defend itself from Somali pirates in the Indian Ocean. A few years later, the cruise-liner "Spirit of Adventure" also defended itself from Somali pirates by using its LRAD to force them to retreat.

Strategic defence initiative

In the 1980s, US President Ronald Reagan proposed the Strategic Defence Initiative (SDI) programme, which was nicknamed Star Wars. It suggested that lasers, perhaps space-based X-ray lasers, could destroy ICBMs in flight. Out of the SDI program came the Neutral Particle Beam Accelerator developed by Los Alamos National Laboratory, which was among several DEWs examined by the SDI Organization for potential use in missile defence. In July 1989, the accelerator was launched from White Sands Missile Range as part of the Beam Experiment Aboard Rocket (BEAR) project, reaching an altitude of 200 kilometres and operating successfully in space before being recovered intact after re-entry. Despite continued research into NPBs, no known weapon system utilizing this technology has been deployed.

The Soviet Union invested some effort in the development of ruby and carbon dioxide lasers as anti-ballistic missile systems, and later as a tracking and anti-satellite system. There are reports that

the Terra-3 complex at Sary Shagan was used on several occasions to temporarily “blind” US spy satellites in the IR range. It has been claimed that the USSR made use of the lasers at the Terra-3 site to target the Space Shuttle Challenger in 1984. At the time, the Soviet Union was concerned that the shuttle was being used as a reconnaissance platform.

DEWs still evolving

Particle-beam weapons can use charged or neutral particles, and can be either endo-atmospheric or exo-atmospheric. Theoretical research has been on but practical weapons have not been demonstrated yet. Blooming is a problem in particle-beam weapons. Energy that would otherwise be focused on the target spreads out and the beam becomes less effective. Thermal blooming occurs in both charged and neutral particle beams, and occurs when particles bump into one another under the effects of thermal vibration, or bump into air molecules. Electrical blooming occurs only in charged particle beams, as ions of like charge repel one another.

Plasma weapons fire a beam, bolt, or stream of plasma, which is an excited state of matter consisting of atomic electrons and nuclei, and free electrons if ionized, or other particles if pinched. The MARAUDER (Magnetically Accelerated Ring to Achieve Ultra-high Directed-Energy and Radiation) used the Shiva Star project, a high energy capacitor bank which provided the means to test weapons and other devices requiring brief and extremely large amounts of energy, to accelerate a toroid of plasma at a significant percentage of the speed of light. Russia too is developing various plasma weapons.

To summarise

Closer home, there are claims and counter-claims regarding Chinese use of directed energy weapons, specifically “microwave weapons,” in eastern Ladakh in August 2020. While a Chinese academic suggested their deployment during a border standoff, the Indian military refuted these claims, calling them “fake”.

The future of DEW looks promising, suggesting significant growth driven by military investments in advanced technologies. DEWs, including lasers and high-power microwaves, offer advantages like rapid response, precision targeting, and cost-effectiveness, making them attractive for various military applications. However, the technology is still developing, and challenges like high cost and regulations need to be addressed. The DEW market is expected to expand rapidly, with projections indicating a CAGR of over 17.6 per cent between 2025 and 2034.

Increased military spending on advanced defence technologies is a major driver of DEW development. DEWs offer speed-of-light engagement, extreme accuracy, and the potential for non-lethal engagements, making them suitable for various scenarios. DEWs can effectively neutralise unmanned aerial systems. While challenges remain for intercepting advanced missiles, DEWs are being explored as cost-effective solutions against slower-moving cruise missiles. The precision targeting capabilities of DEWs are valuable in urban environments where minimising collateral damage is crucial. The integration of AI and ML is expected to enhance DEW capabilities, including faster target acquisition and energy utilisation.

The initial development of DEWs is expensive, posing a challenge for both military and private sector. Stringent regulations and ethical considerations surrounding DEW deployment need to be

addressed. While progress has been made, many DEW systems are still at the experimental stage. Adversaries may develop countermeasures to neutralise DEW systems, requiring ongoing research and development. Overall, the future of DEWs is characterised by rapid technological advancements, increasing military interest, and a range of potential applications.

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Indian Army showcases strength and self-reliance along the LAC in North Sikkim

Source: The Economic Times, Dt. 16 April 2025,
URL: https://economictimes.indiatimes.com/news/defence/indian-army-showcases-strength-and-self-reliance-along-the-lac-in-north-sikkim/articleshow/120333240.cms

The Indian Army showcases its prowess in the Plateau Sub Sector along the Line of Actual Control in North Sikkim.

Located across the Eastern Himalayas, it is one of the Highest and the Coldest battlefields in the Country. Armed with state-of-the-art equipment and superior technology, most of which is Atmanitbhar, Indian Army soldiers steadfastly guard the LAC.

Besides braving all challenges and protecting the territorial integrity of India, the actions of the Indian Army go beyond defence and security, as it emerges as the largest contributor to improving the livelihood of the locals and preserving wildlife.

Earlier, the Indian Army successfully concluded ARMEX-24, a high-altitude adventure expedition that stands as a testament to endurance, resilience, and operational excellence.

According to a release, the expedition, conducted over 28 days, including acclimatisation, took participants on a formidable journey from the dense jungles of North Bengal to the treacherous, snow-clad heights of Sikkim, covering a total of 146 kilometres.

The expedition was conducted from March 22 to April 14, 2025. Excluding the acclimatisation period, the team undertook 18 days of relentless movement across difficult terrain, navigating steep gradients, unpredictable weather, and rugged trails.

A specially selected team of 20 military personnel--highly trained and mentally robust--volunteered for this mission. Their journey tested their physical endurance, mental resilience, and the power of coordinated teamwork in extreme conditions.

The route spanned dramatic shifts in altitude--from sub-tropical jungles to elevations above 14,000 feet. Soldiers demonstrated adaptive prowess and determination in low-oxygen, high-stress environments.

"ARMEX-24 is more than just an expedition--it reflects the Indian Army's ethos of perseverance, discipline, and operational readiness," said a senior Army official.

"These initiatives sharpen leadership, reinforce camaraderie, and instil the mental toughness essential for success in operations. They ensure our soldiers remain mission-ready--irrespective of the terrain or adversity," the official added.

The successful culmination of ARMEX-24 reinforces the Indian Army's commitment to operational preparedness through rigorous, terrain-realistic training. It also serves to inspire youth across the nation to embrace challenges, develop resilience, and uphold the spirit of adventure and national service.

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Russia may approach Indonesia to set up air base near Pacific

Source: The Economic Times, Dt. 17 April 2025,
URL: https://economictimes.indiatimes.com/news/defence/russia-may-approach-indonesia-to-set-up-air-base-near-pacific/articleshow/120365740.cms

Russia has stepped up military presence in the Indo-Pacific region along China's periphery that would contribute to India's comfort and make the region inclusive.

Moscow is planning to approach Indonesia for an air base in the country's Papua region after stepping up defence ties with Myanmar and Bangladesh, it was learnt. The Russian Air Force may place its long-range bombers in Papua province located closer to the Pacific region.

The move raised alarms in Australia, and it has approached Indonesia for clarification. Setting up the base is easier said than done given the regional dynamics and Jakarta's policy of non-alignment, experts familiar with the Indo-Pacific region pointed out.

India had earlier suggested that Moscow increase its strategic footprint in the Indian Ocean and ASEAN to make the region inclusive. Since the Ukraine war and sanctions, Russia has expanded its economic engagements across Asia, including the ASEAN region. Being the largest economy in ASEAN, Indonesia has been one of Moscow's key partners in SE Asia.

Three Russian Navy warships arrived at Chittagong Port last Sunday for a rare four-day visit to Bangladesh less than a week after army chief Gen Waqar-uz Zaman's trip to Moscow. The visit may have been part of the Bangladesh army chief's efforts to diversify from the Chinese origin defence equipment currently used by the Bangladesh military.

Myanmar has continued to expand its defence ties with Russia to reduce its dependence on China.

Russia has offered to share with Myanmar, India's eastern neighbour, information captured by its reconnaissance satellites to bolster the ruling military junta's fight against insurgents in various provinces.

During junta chief Min Aung Hlaing's recent visit to Moscow, it was announced that Russia had established a joint satellite imagery analysis centre in Myanmar. It was also revealed that Russia had offered to "share information captured by its reconnaissance satellites with the regime for military purposes."

This would boost the junta's ability to plan military operations against rebel groups, said experts on Myanmar affairs.

After the meeting between Min Aung Hlaing and Russian President Vladimir Putin in Moscow—the two sides signed a memorandum of understanding (MoU) for construction of a small nuclear

power plant in Myanmar with Russian support. Rosatom, Russia's state-run nuclear power corporation, said the plant would have a capacity of 100 megawatts with the possibility of trebling it.

Russia, which supplied 90% of Myanmar's energy needs last year, has agreed to step up energy supplies to the Southeast Asian country. During the visit, the junta chief had also sought Moscow's support for other projects in Myanmar.

With Vietnam, a rising star of SE Asia, Russia has decades old strategic partnership. Vietnam sourced most of its defence equipment from the Soviet Union and Russia.

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Iran 'not far' from nuclear bomb: IAEA chief

Source: The Economic Times, Dt. 16 April 2025,
URL: https://economictimes.indiatimes.com/news/defence/iran-not-far-from-nuclear-bomb-iaea-chief/articleshow/120349070.cms

Iran is not far from having an atomic bomb, the head of the UN nuclear watchdog was quoted as saying in a Le Monde interview published Wednesday, just hours before a visit to Tehran.

International Atomic Energy Agency head Rafael Grossi said Iran still had a way to go before getting the bomb, but added: "They're not far from it, you have to acknowledge."

Grossi likened the development of a nuclear weapon to a jigsaw puzzle, adding that Iran "has the pieces and they could eventually put them together one day".

Grossi was due in Iran later Wednesday for talks with senior officials.

The UN watchdog was tasked with overseeing Iran's compliance with the 2015 nuclear deal that fell apart after Donald Trump withdrew from it during his first term as US president.

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India's Defence sector outlook remains strong, with rising indigenisation and record orders: Report

Source: ANI News, Dt. 17 April 2025,
URL: https://www.aninews.in/news/business/indias-defence-sector-outlook-remains-strong-with-rising-indigenisation-and-record-orders-report20250417120152/

India's defence sector is set to grow steadily, supported by strong efforts towards indigenisation, a solid order pipeline, and rising growth opportunities, according to a recent report by Nirmal Bang.The report maintains a positive outlook on the sector, citing the government's focused approach to boost domestic defence production and reduce dependency on imports.

It said, "We maintain a positive outlook on the defence sector, highlighting the ongoing efforts towards indigenisation, a strong order pipeline, and significant growth potential."The report

highlighted that India's annual defence production has already crossed Rs 1.27 trillion and is likely to touch Rs 1.75 trillion by the end of FY25.

Looking ahead, the country aims to reach Rs 3 trillion in defence output by 2029. This ambitious target would further strengthen India's position as a major global hub for defence manufacturing.

In a record-breaking development, the Ministry of Defence signed 193 contracts in 2024-25, with a total value exceeding Rs 2.1 trillion. This is the highest-ever figure and is nearly double the previous record.

Out of these, 177 contracts -- making up 92 per cent of the total -- were awarded to the domestic defence industry. These domestic contracts are valued at around Rs 1.6 trillion, accounting for 81 per cent of the total contract value. This clearly shows the government's strong push towards encouraging home-grown defence manufacturing.

The report also noted that the Defence Acquisition Council (DAC) approved eight capital acquisition proposals worth about Rs 540 billion in FY25. These approvals are part of the broader plan to upgrade and modernise the armed forces.

Among the key projects, the Army will acquire a 1,350-horsepower engine to replace the existing 1,000-horsepower engine used in its T-90 tanks, to improve performance and efficiency. For the Navy, the DAC has approved the purchase of Varunastra Torpedoes -- a major step forward in naval technology.

These anti-submarine torpedoes, developed indigenously by the Naval Science & Technological Laboratory, are designed to be launched from ships and strengthen underwater defence capabilities.

Looking ahead, the report expects that the Ministry of Defence will continue focusing on enhancing the capabilities of the Indian Air Force (IAF) fleet. With consistent efforts in indigenisation, strategic acquisitions, and rising production capacity, India's defence sector is well on track for robust growth in the coming years.

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तेजस-**Mk2** की पहली उड़ान अगले साल फरवरी-मार्च में**,** बढ़ेगी वायुसेना की ताकत

Source: Aaj Tak, Dt. 17 April 2025,
URL: https://www.aajtak.in/defence-news/story/lca-tejas-mkii-fighter-jet-rollout-and-first-flight-timeline-disclosed-dskc-2218047-2025-04-16

हाल ही में कुछ मीडिया आउटलेट्स ने डीआरडीओ प्रमुख डॉ. समीर वी. कामत के हवाले से कहा कि तेजस MkII की पहली उड़ान "6-12 महीनों" के भीतर होगी. जिससे अक्टूबर 2025 की शुरुआत में उड़ान की अटकलें लगाई जा रही हैं. लेकिन ऐसा नहीं है.

कैसे होगा तेजस एमके**2** का प्रोडक्शन टाइमलाइन**?**

1. रोलआउट: अक्टूबर-नवंबर 2025... प्रोटोटाइप असेंबली लाइन से बाहर आएगा, जिससे इंजन ग्राउंड रन और सिस्टम जांच शुरू होगी.

2. टैक्सी ट्रायल: दिसंबर 2025-फरवरी 2026... निम्न और उच्च गति टैक्सी परीक्षण विमान के सिस्टम को मान्य करेंगे.

3. पहली उड़ान: फरवरी-मार्च 2026... पहली उड़ान बुनियादी उड़ान विशेषताओं का परीक्षण करेगी.

4. उत्पादन: 2028-2029 से शुरू, सालाना 18 इकाइयां.

तेजस MkII एक उन्नत 4.5 पीढ़ी का लड़ाकू विमान है, जो तेजस MkI और पांचवीं पीढ़ी के AMCA के बीच की खाई को पाटने के लिए डिज़ाइन किया गया है. इसमें शक्तिशाली F414-INS6 इंजन, उत्तम AESA रडार और उन्नत हथियार सूट है. 2035 तक 120-180 इकाइयों को शामिल करने की योजना है, जो पुराने लड़ाकू विमानों की जगह लेंगे.

जानिए तेजस **Mk2** का खासियत

तेजस मार्क 2 में नाइट विजन चश्मे से जुड़ा हुआ कॉकपिट होगा. यानी रात के समय या अंधेरे में भी इस फाइटर जेट से दुश्मन टारगेट पर हमला किया जा सके. इसमें HOTAS यानी हैंड्स ऑन थ्रॉटल-एंड-स्टिक की व्यवस्था होगी. यानी जिस लीवर से फाइटर जेट कंट्रोल किया जाएगा, उसी से हथियार भी चलेंगे.

2223 km प्रतिघंटा की रफ्तार से चीरेगा आसमान

यह अधिकतम 2223 किलोमीटर प्रतिघंटा की रफ्तार से उड़ेगा. इसकी रेंज करीब 2500 किलोमीटर होगी. अधकितम 56,758 फीट की ऊंचाई तक उड़ान भर पाएगा. इस फाइटर जेट में 30 मिलिमीटर की एक GSh-30-1 गन लगी होगी. यह गन एक मिनट में 1500-1800 गोलियां दाग सकती है. जिसकी रेंज 200 से 1800 मीटर होगी.

एक से एक घातक हथियारों से किया जाएगा लैस

इस गन के अलावा इस फाइटर जेट पर 13 हार्डप्वाइंट्स होंगे. यानी 13 एक जैसे या अलग-अलग तरह के हथियार लगा सकते हैं. इसमें पांच तरह के हवा से हवा में मार करने वाली मिसाइलें लगाई जा सकती हैं. जैसे- MICA, ASRAAM, Meteor, Astra और NG-CCM. इनकी तैनाती लगभग तय मानी जा रही है.

इनके अलावा हवा से सतह पर मार करने वाली चार मिसाइलें लगाई जाएंगी. जिनमें ब्रम्होस-एनजी ALCM, LRLACM, स्टॉर्म शैडो और क्रिस्टल मेज शामिल हैं. यही नहीं इनके अलावा इसमें एंटी-रेडिएशन मिसाइल रुद्रम 1/2/3 लगाने की भी योजना है. इसके अलावा इसमें चार प्रेसिशन गाइडेड बम एक लेजर गाइडेड बम, क्लस्टर म्यूनिशन, लॉयटरिंग म्यूनिशन CATS ALPHA और अनगाइडेड बम लगाए जाएंगे.

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India's armed forces struggle with preparedness amid rising strategic risks

Source: Business Standard, Dt. 17 April 2025,
URL: https://www.business-standard.com/external-affairs-defence-security/news/india-s-armed-forces-struggle-with-preparedness-amid-rising-strategic-risks-125041700116_1.html

India’s purchase of 26 Rafale jets from France’s Dassault Aviation SA cannot conceal the fact that its military is sleepwalking into a crisis. Strategic indecision and an addiction to short-termism have left its armed forces unprepared for the challenges ahead.

The new planes will certainly fill an obvious gap in the military's needs — its two aircraft carriers are dependent on 40 elderly Russian-made MiG-29Ks, of which perhaps half are reportedly serviceable at any given time. But instead of solving India's problems of preparedness, this decision actually reveals their daunting scale.

The real issue isn't the navy but the Indian Air Force, which is known to be understrength and will likely be even less capable a few years from now unless New Delhi starts thinking long term. Scholars such as the Stimson Center's Christopher Clary have warned that India is "underbalancing" China, both before and after deadly clashes along their disputed Himalayan border in 2020.

The problem is, defence planners don't like to spell out what the air force needs. The IAF is supposed to have 45, or at worst 42 squadrons, of 18 aircraft each. Today it would struggle to rustle up 32, and many of those would be one or two planes shy of their full complement. Some of these are ancient MiG-21s, which are due to be phased out this year. India may be left with only 25 or 26 active squadrons by the end of the decade.

The Pakistan Air Force, meanwhile, is supposedly in negotiations with Beijing to buy 40 J-35A fifth-generation fighters. There's general doubt in New Delhi that the Chinese will be willing and able to make Pakistan the first export destination for their prized jet, or that cash-strapped Islamabad will be able to pay for them. But some quietly worry that, if the deal somehow goes through, India's overstretched air force could be outmatched not just by China's but by Pakistan's.

How could it have gone so wrong for an IAF that, a few decades ago, was proud of its preparedness? Part of the problem lies with its timid and tight-lipped defence planners, and part with a government that's simply unwilling to pay the political and economic costs of military modernisation.

New planes are expensive. The Rafales for the navy will cost $7.4 billion. That will already stretch the defence procurement budget, and somehow officials will have to find the money for another 100-plus planes for the air force. But Prime Minister Narendra Modi's fiscal conservatism has left defense spending at historical lows as a proportion of gross domestic product, and his political populism means too much of that is tied to unsustainable pension plans.

Adding to the difficulties, the defence establishment is inefficient even by the standards of the Indian state. Indigenous fighters, developed and manufactured by state-run Hindustan Aeronautics Ltd, were supposed to pick up the slack for the IAF and the navy. The military claims that HAL fails to deliver on time and to spec; the engineers complain that the military changes its mind and has unrealistic expectations.

The last time India tried to buy fighters on the open market, the tendering process took so long that Modi was forced to purchase 34 Rafales in a deal that he struck with the French government. That agreement — sans most of India's usual demands, such as local manufacturing and technology transfer — was urgent because planners determined at least some new jets were needed for India's nuclear deterrent.

It also caused some domestic political controversy. Defence scandals have brought down governments; the fear of corruption tends to paralyse the bureaucracy. Officials dread an open and

structured procurement process, and would much rather the prime minister take the political risk of buying a plane directly.

This unwillingness to go through a proper deliberation and make a transparent choice is a disservice to India — because it leads to strategic indecision. We don't have answers to basic questions: How many planes do we need, and how modern do they have to be? Can we make do with cheaper indigenous fighters for a decade? Can we rule out buying more Russian hardware? Will we have to keep the Americans happy by buying the F-35, as President Donald Trump clearly wants? Are we now locked into the Rafale, which is expensive and produced entirely in France? Or can we go with one of the other European alternatives, such as the Eurofighter Typhoon or Sweden's Gripen, which might suit our circumstances far better?

Emergency, piecemeal purchases simply won't cut it. The IAF needs political direction and cover so it can produce a plan that takes it into the next decades — one that includes technology transfer and localised supply chains of the sort that we know, post-Ukraine, is vital if you get into a war. Whatever option delivers this is the one India must go with — and it can't put off making a clear choice for much longer, or it will find itself outmatched in the sky.

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The Hidden Chinese Shadow in India's Defence: A Wake-Up Call

Source: India.com, Dt. 16 April 2025,
URL: https://www.india.com/news/world/the-hidden-chinese-shadow-in-indias-defence-a-wake-up-call-7760529/

India's armed forces are our nation's shield, protecting us with bravery and strength. Yet, a worrying fact has emerged: many of their high-tech tools, like computers and drones, depend on parts made in China. For the average Indian, this isn't just about gadgets—it's about ensuring our soldiers have equipment that's safe and trustworthy. With tensions between India and China, this reliance raises big concerns about our security. Why are we still using Chinese components, and what's being done to change this?

The issue starts with the critical parts inside our military's computers and drones. Research shows that drones, even those called "Made in India," often use Chinese electronics like cameras, communication modules, and control systems. These can be hacked or carry hidden malware, risking sensitive data. Similarly, computers and servers used by our forces, including those from global brands like HP or IBM, often have Chinese-made components. A 2014 report highlighted that most defence computers rely on foreign hardware, with China as a major supplier. In February 2025, the government cancelled drone contracts worth Rs 230 crore after finding Chinese parts, showing how deep this problem runs.

Why are we stuck with Chinese components? It's a mix of global and local challenges. China produces most of the world's electronic parts, making them cheap and widely available. India's "Make in India" push is trying to close this gap, but we're still catching up in making advanced

components for computers and drones. In the past, we bought systems without strict checks, and now, removing Chinese parts is like solving a complex puzzle. It's tough to build high-tech gear without relying on global supply chains where China dominates.

Thankfully, India is fighting back. The Ministry of Defence is taking strong steps, like halting drone orders and warning companies to avoid Chinese components. They're developing ways to test and remove these parts from sensitive systems, including computers. Events like the 2024 "Him-Drone-A-Thon" in Ladakh are encouraging Indian firms to build drones and tech suited for our needs. The Production-Linked Incentive scheme is boosting local manufacturing, but it's a slow journey. Building our own computers and drone parts requires time, money, and expertise.

For every Indian, this matters because it's about our safety. We want our forces using computers and drones that won't fail them in a crisis. The government's efforts are a good start, but we need faster progress and more investment in Indian technology. As citizens, we can support "Atmanirbhar Bharat" by backing local innovation and demanding secure defence systems. The Chinese puzzle in our computers and drones is a challenge we can't ignore—let's solve it by building a stronger, self-reliant India.

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Army showcases integration of drones, robotic mules in Arunachal

Source: The Tribune, Dt. 17 April 2025,
URL: https://www.tribuneindia.com/news/india/army-showcases-integration-of-drones-robotic-mules-in-arunachal/

The Indian Army has conducted an exercise in Arunachal Pradesh to test the seamless integration of next-generation war-fighting technologies, including robotic mules, various types of drones and small logistics vehicles designed to navigate the last mile.

A Ministry of Defence (MoD) spokesperson said this marked a significant step towards enhancing operational readiness. The Army's 3 Corps successfully carried out the exercise in forward areas of Arunachal Pradesh, showcasing the integration of advanced equipment and weaponry. This effort underscores the Army's rapid transformation drive under the banner of the '++Year of Technology Absorption and Year of Transformation', the spokesperson added.

The 3 Corps is responsible for operations in far-eastern Arunachal Pradesh. The exercise was conducted in rugged, mountainous terrain to ensure effective functioning in challenging conditions, with a focus on enhanced mobility, real-time intelligence, surveillance and reconnaissance (ISR) and advanced communication systems. These components are critical to developing a swift, silent and smart tactical force capable of decisive action on technology-driven battlefields.

By deploying state-of-the-art platforms and modern combat systems, the exercise highlighted improved decision-making, seamless information sharing and synchronised battlefield awareness.

These capabilities significantly boosted the operational agility of the troops, reaffirming the Indian Army's commitment to technological innovation.

The exercise stands as a testament to the Army's preparedness for modern warfare. The Indian Army continues to drive transformation through innovation, with a strong emphasis on jointness, adaptability and enhanced combat effectiveness, the MoD spokesperson said.

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Science & Technology News

As a major breakthrough in shipping transport and inland waterway transport, Vice President CSIR and Minister Dr Jitendra Singh hails India's first indigenously developed hydrogen fuel sea vessel; describes it as a success story emanating from the joint effort of public and private sectors

Source: Press Information Bureau, Dt. 16 April 2025,
URL: https://pib.gov.in/PressReleasePage.aspx?PRID=2122190

As a major breakthrough in shipping transport and inland waterway transport, Union Minister of Science & Technology and Vice President CSIR (Council of Scientific & Industrial Research) Dr Jitendra Singh has hailed India's first indigenously developed hydrogen fuel sea vessel.

Describing it as a success story emanating from the joint effort of public and private sectors, the Minister disclosed that the country's first indigenous green hydrogen fuel cell inland waterway vessel, which may later pave the the way for hydrogen fuel driven larger sea vessels or ships, was developed by Cochin Shipyard Ltd featuring a hydrogen fuel cell-based drivetrain built by KPIT, drawing upon the foundational work enabled by the CSIR.

Dr. Jitendra Singh was convening a high-level meeting today to review the ongoing initiatives and achievements of the Council of Scientific and Industrial Research (CSIR). The meeting was attended by all Heads of CSIR Directorates, the Joint Secretary and Financial Adviser, CSIR.

Director General, CSIR, Dr. N. Kalaiselvi presented a detailed overview of CSIR's current research activities, recent technological advancements, and collaborative engagements with industry. During the discussions, the Minister emphasized the importance of aligning CSIR's scientific pursuits with the vision of Prime Minister Shri Narendra Modi for a Atma Nirbhar, especially in critical technology domains where indigenous development is key.

The Minister lauded the CSIR-New Millennium Indian Technology Leadership Initiative (NMITLI), calling it a unique example of collaborative innovation in the public-private space. As India's largest publicly funded, industry-oriented R&D programme, NMITLI brings together top

institutions, industrial partners, and research labs to pursue high-risk technological ventures with the potential for national impact.

Dr. Jitendra Singh particularly appreciated two recent breakthroughs supported under the NMITLI programme. The first is the development and commercialization of CSIR-TECHNOS Raman Spectrometers (CTR-300 and CTR-150), achieved through a partnership between CSIR–Advanced Materials and Processes Research Institute (CSIR–AMPRI), Bhopal, and M/s TechnoS Instruments, Jaipur.

These high-end Raman spectrometers, approved for marketing in January 2022, represent a significant milestone in India's scientific instrumentation capabilities. Eleven units of indigenous Raman Spectrometers have been supplied across the country to date, demonstrating growing national adoption of this indigenous technology.

The second highlighted success, Dr Jitendra Singh noted, was the development of fuel cell technology under the Industry-Originated NMITLI programme. In this initiative, KPIT collaborated with CSIR-National Chemical Laboratory (CSIR-NCL) Pune and CSIR-Central Electrochemical Research Institute (CSIR-CECRI) to develop and demonstrate low-temperature PEM fuel cell systems. The expertise developed through this collaboration has since been translated into applications for the marine, defence, and automotive sectors. A major outcome of this effort was the launch of the country's first indigenous green hydrogen fuel cell inland waterway vessel by Prime Minister Narendra Modi at Thoothukudi, Tamil Nadu, under the Harit Nauka initiative. The vessel, developed by Cochin Shipyard Ltd., features a hydrogen fuel cell-based drivetrain built by KPIT, drawing upon the foundational work enabled by CSIR.

Dr. Jitendra Singh underscored that these achievements exemplify the role of CSIR in driving technology-led growth and contributing to India's self-reliance in frontier areas.

The Minister called upon the CSIR authorities to continue strengthening the industry linkages, scale up innovations for societal impact and pursue bold R&D initiatives aligned with national priorities.

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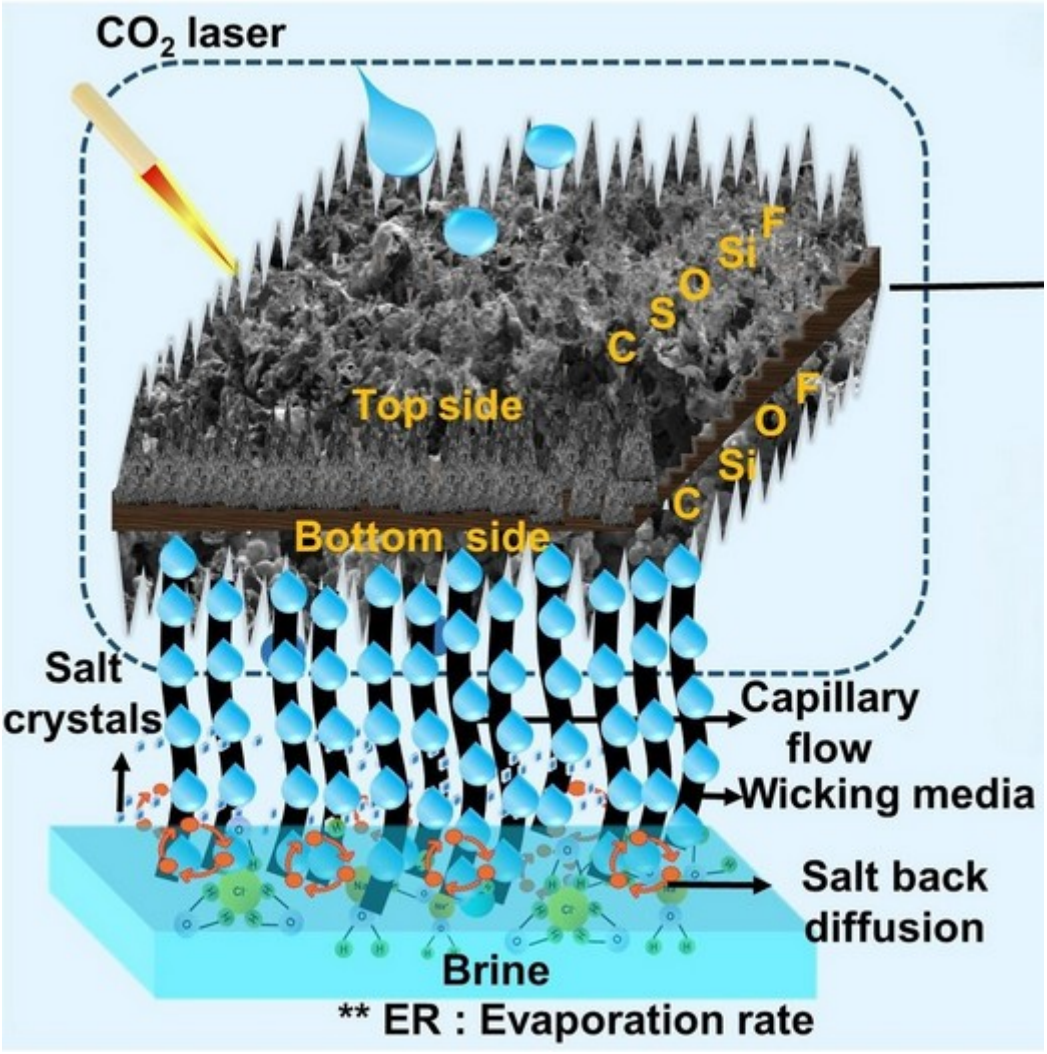
IIT Bombay scientists develop lotus leaf-like solar evaporators for salt water treatment

Source: The Hindu, Dt. 17 April 2025,
URL: https://www.thehindu.com/sci-tech/science/iit-bombay-scientists-develop-lotus-leaf-like-solar-evaporators-for-salt-water-treatment/article69457561.ece

In a significant breakthrough to tackle the freshwater scarcity in various parts of the world, scientists from Indian Institute of Technology Bombay have developed a new material that can facilitate water desalination.

Researchers Professor Swatantra Pratap Singh and Aiswarya C. L. have developed Dual-Sided Superhydrophobic Laser-Induced Graphene (DSLIG) evaporator that addresses multiple shortcomings of earlier evaporators and has the potential for large-scale applications.

While water is abundant on Earth, only about 3% of it is freshwater, and even within that, less than 0.05% is easily accessible. Removing salt (desalination) from seawater and brackish water is seen as one of the solutions to address this problem, with researchers working towards developing more efficient and faster desalination techniques. However, brine (concentrated salt solution) from desalination is a big problem in landlocked places, and industries are looking for zero liquid discharge.



Graphical representation of Dual-Sided Superhydrophobic Laser-Induced Graphene evaporator

The researchers said that solar energy-based desalination methods are considered desirable due to their reduced carbon footprint. However, factors such as fluctuations in intensity and availability of sunlight and reduced rates of absorption of light greatly affect the efficiency and consistency of solar energy-based desalination techniques.

Mr. Singh explained that in recent years, interfacial evaporation systems have emerged as a promising approach. The key component of these systems is an evaporator made from materials that can absorb solar energy and heat up. The evaporator, placed on the surface of the water, focuses solar heat on a thin layer of water at the evaporator's surface rather than heating the entire

volume. This localized heating minimizes heat loss and enhances the efficiency of the desalination process.

However, despite this advantage, the problems with traditional solar desalination techniques do affect interfacial evaporators as well.

“Fluctuations in solar radiation cause temperature variations on the evaporator’s surface. On cloudy days, the performance of the interfacial system is halted due to the lack of solar energy. Additionally, the variation in solar radiation during the day affects the evaporation process, with evaporation rates typically peaking around 2 pm when solar intensity is highest,” Mr. Singh said.

Another major challenge with interfacial evaporation systems is the deposition of salt crystals on the surface of the evaporators. Salt deposition on the surface prevents water from coming in contact with the evaporator, and consequently, its efficiency diminishes over time. This research aims to address both of these issues. In addition to solar heating, DSLIG evaporators can also be heated using electricity (known as Joule heating), Mr. Singh said.

By combining solar and electric heating, the material is protected from fluctuations in the availability of sunlight. When there is less or no sunlight, electricity can be used to heat the evaporator and maintain similar temperatures, ensuring consistent performance. Additionally, DSLIG has a superhydrophobic property, meaning it repels water like lotus leaves.

Owing to the characteristics of their surfaces, superhydrophobic materials reduce the contact area between water droplets and the material surface, making droplets roll over them instead of wetting.

“In desalination applications, the superhydrophobic nature of DSLIG helps prevent salt dissolved in water from sticking to the evaporator surface, thus maintaining efficiency over time. The primary goal of our work was to create a superhydrophobic surface, exhibiting the lotus effect, capable of functioning with both solar and Joule heating,” Mr. Singh explained.

The researchers fabricated DSLIG by coating a layer of a polymer called polyvinylidene fluoride (PVDF) on one side of a thin layer of another polymer LIG, poly (ether sulfone) (PES). Graphene was then engraved on the PVDF polymer side of the material using laser-based engraving technology.

“The material derives its name from the fact that it has two distinct sides formed by the two polymers and the fabrication technique used. PES doesn’t repel water, but it is essential to prevent the evaporator from breaking easily. If only PES were used, the final surface would get wet on both sides. However, using PVDF resulted in hydrophobicity on both surfaces. The use of PES as a substrate ensured mechanical stability, while the PVDF layer contributed to the hydrophobic characteristics necessary for efficient evaporation processes,” the professor said.

Laboratory tests show that DSLIG not only exhibits lotus leaf-like behavior, preventing salt deposition and excellent efficiency for desalination under both electric and solar heating, but is also very effective in treating extremely concentrated salt solutions. This makes it an ideal candidate for treating salt water discharges from other desalination outlets as well as industrial wastewater.

The researchers have also demonstrated that the performance of DSLIG improves when multiple evaporators are stacked on top of each other. While the low carbon footprint, low toxicity, and cost-effectiveness make DSLIG a potential candidate for large-scale sustainable desalination applications and the treatment of industrial wastewater. Mr. Singh said that further field testing is required before such large-scale applications can be made.

“One of the major hurdles the team faces in ensuring and testing the industrial readiness of this technology is a lack of funding. In the meantime, we are looking forward to developing more such superhydrophobic materials that can simultaneously utilise both solar and electric energy with even greater efficiency,” Mr. Singh added.

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IICT and CCMB working to come up with drugs and diagnostics for potential emerging viruses

Source: The Hindu, Dt. 16 April 2025,
URL: https://www.thehindu.com/sci-tech/science/iict-and-ccmb-working-to-come-up-with-drugs-and-diagnostics-for-potential-emerging-viruses/article69456414.ece

CSIR-Indian Institute of Chemical Technology (IICT) and CSIR-Centre for Cellular and Molecular Biology (CCMB) are working on ‘Anti-Viral Mission’ to come up with drugs and diagnostics to deal with potential emerging viruses in the near future.

CCMB Director Vinay Kumar Nandicoori and IICT Director D. Srinivas Reddy at a press conference held in Hyderabad on Wednesday (April 16, 2025) said that the scientific collaboration is not only to repurpose the existing anti-viral drugs but also to come out with new molecules which would lead to better therapeutics.

The top scientists also explained that the joint research between both the premier labs had also helped in repurposing drug treatment for the sickle cell anaemia.

The Atal Incubation Centre (AIC)-CCMB is also involved in finding out mRNA vaccines technology’s - developed indigenously by its researchers for a potential vaccine against SARS-CoV-2 (COVID) - use against other infectious diseases like Tuberculosis (TB), Chikungunya and Japanese Encephalitis.

Science Corridor in Hyderabad

Funding has been received for few other research projects jointly being taken up by researchers from both the labs located adjacent to each other on the Tarnaka-Habsiguda road [in Hyderabad] which is proposed to be taken up as a ‘Science Corridor’ with the help of Hyderabad Metro Rail, they added.

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