

In The News

Indigenous Technologies is the way to make India self-reliant in Aerospace & Defence Production – Dr Jitendra Singh, Hon'ble Minister for Science & Technology and Vice President of CSIR



Union Minister Dr Jitendra Singh inaugurates the Iron Bird Facility for the Saras Mk-2 aircraft on 29 November 2025

CSIR-National Aerospace Laboratories (CSIR-NAL), Bengaluru, under the aegis of the Ministry of Science & Technology, Govt of India, has indigenously designed

and developed the HANSA-3(NG) trainer aircraft for Commercial Pilot Licensing (CPL). Indigenous 19-seater Light Transport Aircraft (LTA) is under development for

Inaugurating the Iron Bird Facility for the Saras Mk-2 aircraft, Dr Jitendra Singh said that this facility will provide a comprehensive, ground-based testing platform for integrating and validating all major aircraft systems.

connecting Tier-1 & Tier-2 cities. The other ongoing initiatives at CSIR-NAL include a high altitude solar-powered drone (High Altitude Platform (HAP)) – to undertake persistent surveillance, NAviMet (DRISHTI and AWOS) for Safe Landing & Take-off Operations at Airports and a collaborative project on 150 kg class Loitering Munition – UAV (LM-UAV) with industry partner M/s Solar Defence & Aerospace Ltd.

Unveiling the production version of Hansa-3(NG) aircraft, Dr Jitendra Singh, Hon'ble Minister for State for Science & Technology (independent charge), and Vice President of CSIR, lauded the efforts of scientists for the successful demonstration and commercialisation of indigenous Hansa-3(NG) with an industry partner, M/s Pioneer Clean Amps Pvt. Ltd (PCA) during April 2025 at New Delhi. He stated that the aircraft will satisfy the requirements of flying clubs for obtaining PPL (Personal Pilot License) & CPL (Commercial Pilot License) by the young generation. As per recent reports, India will need 30,000 pilots over the next 15-20 years, up from the current 6,000-7,000 pilots, given that Indian airlines cumulatively have over 1,700 aircraft on order. CSIR-NAL's industry partner M/s PCA will be setting up the manufacturing facility at Kuppam, Andhra Pradesh. The facility will manufacture 70 to 100 aircraft annually and employ about 250 people. This is the best example of "Atmanirbhar Bharat". The Minister opined that this collaboration



will accelerate the indigenous aircraft manufacturing, making the Hansa-NG competitive on the global platform, as it signals India's growing capabilities in the aerospace manufacturing ecosystem.

The Minister further stated that India has the potential to be among the top three nations in the world in terms of domestic and international passenger traffic. It has an ideal geographical location between the eastern and western hemispheres, a strong middle class of about 300 million Indians and a rapidly growing economy. In view of this, CSIR-NAL is looking to tap this business opportunity as it has already gained good experience in indigenous design and development of pressurised aircraft. CSIR-NAL is currently developing the 19-seat LTA-SARAS MK2 aircraft, which will have digital avionics, glass cockpit, autopilot, command-by-wire flight control system and pressurised cabin, with significant drag and weight reduction complying with IAF requirements. The SARAS MK2 will be derived for both civil/military operations. IAF has

already given a letter of Intent to initially procure 15 aircraft for troop transfer.

Gracing the occasion by inaugurating the Iron Bird Facility for the Saras Mk-2 aircraft on 29 November 2025, Dr Jitendra Singh said that this facility will provide a comprehensive, ground-based testing platform for integrating and validating all major aircraft systems. By identifying and resolving potential problems on the ground, the facility helps to significantly lower the risks and costs associated with the actual flight testing, thereby enhancing safety and reliability. The iron bird facility allows engineers to quickly find and fix design flaws and software bugs early in the development process, and helps to speed up the time to market.

Inaugurating the dedicated manufacturing facility for the High Altitude Unmanned Aerial Vehicles (UAVs) capable of operating at altitudes above 20 km in the stratosphere for military, civil, and scientific applications, the minister said only a few countries like the USA, United Kingdom, Germany, South Korea, New Zealand, and Japan have initiated programmes to develop similar high-altitude aircraft. The Minister further added that India has initiated such a programme to demonstrate a Proof-of-concept through a technology demonstrator vehicle capable of sustained flight for several hours at an altitude of 20 km, thereby joining a select group of the league of developed countries. He expressed his happiness for

the demonstration of CSIR-NAL's subscale version achieving an altitude of 7.5 km above Mean Sea Level (MSL) and an endurance of over 10 hours. He informed that the first flight of the full-scale vehicle to 20 km altitude is planned for March 2027, and this platform will enable the researchers to work on an alternative approach to satellite technology with cost-effectiveness.

Inaugurating the NaviMet (National Aerospace Laboratories Aviation Meteorological) system at HAL Airport, the Minister stated that CSIR-NAL's indigenous, innovative, comprehensive weather monitoring system developed will aid in measuring many crucial weather parameters, such as Visibility, Temperature, Humidity, Present Weather, Pressure, Wind Speed & Direction, etc., at the airports. He further said that the first NaviMet system was installed at HAL's Helicopter Manufacturing Facility at Tumakuru, which was inaugurated in 2022 by the Hon'ble Prime Minister. He expressed his happiness in inaugurating the second system at HAL Airport, Bengaluru.

Lauding the efforts of CSIR-NAL in signing the collaborative agreement with industry participation M/s Solar Defence & Aerospace Ltd, at the stage of design & development itself for LM-UAV, Hon'ble Minister stated that CSIR has initiated a project on indigenous design, development and testing of Loitering Munition (LM) UAV of 150 Kg Class. This LM UAV will be powered by the NAL-developed Wankel engine

Inaugurating the NaviMet system at HAL Airport, the Minister stated that CSIR-NAL's indigenous, innovative, comprehensive weather monitoring system developed will aid in measuring many crucial weather parameters.

already certified by CEMILAC for integration into an unmanned aerial vehicle and qualify the flight. The performance parameters of this UAV will be on par with contemporary UAVs of this class across the globe. It will have a range of 900 kilometres, endurance of 6 to 9 hours, with a service ceiling of 5 kilometres. The UAV will have state-of-the-art features like GPS denied Navigation, Low Radar

the best example of the PPP model. Both CSIR & Solar Group will work together to achieve a common goal of national interest by leveraging their combined skills and knowledge. The Minister wished both the CSIR team and Solar Group a fruitful collaboration to realise the Prime Minister's vision of "Atmanirbhar Bharat" to make India self-reliant in defence production.

Speaking on the occasion, Mr Satyanarayan Nuwal, Chairman, M/s Solar Defence and Aerospace Ltd (SADL), thanked the Hon'ble Minister & CSIR authorities and affirmed that SADL can excel as a successful LM-UAV collaborative & production partner and commercialise at a desired scale to serve the nation's interest. He committed to striving hard to meet the Indian Army's tactical & strategic needs in making India self-reliant in the defence sector.

Speaking on the occasion, Shri AVM Ashish Singh, VSM VM ACAS Ops (Remote), Air HQ (VB), congratulated the Team CSIR & CSIR-NAL for their commitments and R&D efforts towards nation building with their indigenous technologies & products like Hansa-3(NG), Saras Mk2, HAPs, NaviMet, and LM-UAV. He appreciated the Atmanirbhar initiatives in public and private partnership mode.



During the exchange of the collaboration agreement between CSIR-NAL and M/s Defence & Aerospace Ltd, for the development of CSIR's indigenous Loitering Munitions UAV

Cross Section, and AI-enabled DRI (Detection, Recognition & Identification). The overall goal of this project is to offer a make-in-India product to the armed forces with the industry partner M/s. Solar Defence and Aerospace Ltd (SADL), Nagpur, demonstrates

DRISHTI – A Need Born from Safety

A Glorious Journey of 15 Years (2010–2025)

The runway visibility is a critical weather parameter in ensuring safe aircraft landings & take-off

operations, making visual-range assessment systems mandated for every airport. For decades,



India had long relied on imported visibility measurement systems, which were prohibitively expensive and lacked the essential provision for local use. This intrigued CSIR-NAL to commence R&D in 2010 to develop an exact, cost-effective, and fully indigenous solution. The resultant was Drishti, an innovative home-grown transmissometer, and the prototype had the opportunity to be installed at IGI Airport, New Delhi, for rigorous evaluation in the same year. After its successful validation by the nation's sole meteorological authority, the India Meteorological Department (IMD), the first commercial Drishti system was deployed in 2011 at the same IGI Airport, New Delhi, marking the beginning of its R&D mandate.

Breaking Barriers

Developing an indigenous transmissometer from an entirely new concept, meeting the stringent

stipulations of the International Civil Aviation Organisation (ICAO) and the World Meteorological Organisation (WMO) was a highly challenging endeavour. Apart from its fundamental technical challenges, the system must be engineered to endure our nation's diverse weather.

Any transmissometer deployed for airport operations needs mandatory operational requirements for continuous operation with uninterrupted round-the-clock availability.

Drishti, an innovative home-grown transmissometer, which is cost-effective and fully indigenous.



Drishti, maiden system at IGI Airport, New Delhi (2011)

Drishti – the nation's one & only transmissometer, is more than an instrument; it is a statement of the nation's technological self-reliance.

CSIR-NAL's R&D must innovate across optical design, signal processing, environmental sealing, and maintenance-free architecture to satisfy this stringent requirement, ensuring uncompromised reliability in the most challenging operational conditions.

Cutting-edge Design & Technical Excellence

Drishti, which is installed along the runway, has a light transmitter and a light detecting receiver. In contrast, the transmitter emits a collimated beam with spectral characteristics matching runway lights. At the same time, the receiver, embracing a photopically-corrected optical receiver, captures & analyses the attenuated signal to compute visibility. With adaptive baselines (15–150 metres) as per ICAO/WMO, the system guarantees adaptability for diverse runway setups. Built on an industry-standard FPGA platform, Drishti embraces a plethora of innovations in it, to name a few: Miniaturised cum high-precision optics for optimum collimation, electronic modulation & synchronous demodulation for enhanced signal-to-noise ratio, Dual communication connectivity (Landline & Wi-Fi) from runway to ATC for data redundancy, Remote web-based accessibility for real-time data and health monitoring. Designed with virtual Instrumentation, modular hardware & software, and weatherproof IP65 enclosures to exclusively suit Indian tropical weather conditions, Drishti is built to last even in extreme climatic conditions, from scorching

summers to freezing winters. In addition, Drishti embraces the highly ICAO-mandated frangibility with an additional feature of an eco-friendly mechanical pole. Drishti's pivotal measurement capabilities are RVR of 25 to 2000 metres & MOR of 4–10,000 metres, which completely suffice the compatibility for all sorts of airport categories – CAT I, CAT II, CAT III A & III B.

India's Choice for Aviation Safety

Drishti – the nation's one & only transmissometer, is more than an instrument; it is a statement of the nation's technological self-reliance. Conceived, designed, and developed by CSIR-NAL, Drishti has redefined aviation safety in India by offering unparalleled precision at just one-third the cost of its (imported) adversaries. After its stupendous performance delivered during the extreme fog conditions at IGI Airport during the winter 2011–12, CSIR-NAL's Drishti gained the confidence of the meteorologists for its accuracy and reliability.

In 2014, CSIR-NAL & IMD signed a landmark partnership agreement. Under this mutual arrangement, CSIR-NAL will develop Drishti in its laboratory, and IMD will procure & deploy Drishti systems for their usage nationwide. This breakthrough agreement paved the way for Drishti to expand from the nation's capital to most airports nationwide to serve its customers. Today, over 51 Drishti systems operate seamlessly across 21 civilian airports – a living testament to indigenous innovation dedicated

to the highest mandate of all: safeguarding precious human lives in aviation.

From Civil to Defence: Expanding Horizons

Originally, Drishti was developed to address the operational needs of civilian airports. However, Drishti's adaptability to any terrain and its reliability & accuracy attracted the Indian defence to its usage. The proven round-the-clock operation in diverse and often extreme weather conditions made it an ideal solution for mission-critical air operations. These features categorically attributed Drishti to achieving a towering success in defence deployments, surpassing civilian installations. Around 120 Drishti transmissometers are functioning across 36 Indian Air Force airfields, 4 Indian Navy airbases, 1 Indian Army airfield, and 1 HAL airbase.

Where Innovation Meets Recognition

Drishti is considered a true emblem of India's technological self-reliance in aviation meteorology and resonates the nation's currently echoing visions "Atmanirbhar Bharat" & "Viksit Bharat 2047". This indigenous marvel holds one patent, one trademark, and a whopping 14 copyrights, underscoring its originality and innovation. Besides, Drishti Technology is decorated with many coveted awards, to name a few, the CSIR Technology Award, Aeronautical Society of India Award, CSIR-NAL Best Innovation Award, IETE Diamond Jubilee Corporate Award, NRDC

Meritorious Invention Award, IESA Technovation Award, and the Make in India Award. All these recognitions not only endorse Drishti's technical distinction but also underscore its pivotal role in strengthening the nation's aviation safety.

The Road Forward

Drishti technology has been transferred to M/s Central Electronics Limited (CEL) and M/s Tata Advanced Systems Limited (TASL) to meet the nation's burgeoning demand. Drishti's Technology Transfer to industrial partners is to significantly increase its production and seamlessly cater to the growing requirements emanating from different quarters. Following the Technology Transfer, Tata Advanced Systems Limited (TASL) developed & successfully deployed 70 Drishti systems at Defence airbases, HAL & Private airfields. Likewise, CEL, on the other hand, contributed to installing three systems at both Civilian and Defence airstrips. It is very sure that Drishti will capture a sizeable share of the global market for its legacy of field-proven reliability, a decisive cost advantage, and adherence to ICAO and WMO stipulations through the ToT Partners. The next episode for Drishti is shaped by futuristic R&D — pioneering next-generation sensing & AI-based trend forecasting. By delivering unmatched precision at nearly one-third the global cost, Drishti is poised to redefine runway safety worldwide and remain an enduring symbol of India's innovation & self-reliance.

Drishti is considered a true emblem of India's technological self-reliance in aviation meteorology and resonates the nation's currently echoing visions "Atmanirbhar Bharat" & "Viksit Bharat 2047".

Strengthening Science Communication through Publishing

A Scientific Publishing Programme hosted by CSIR-IICT in collaboration with CSIR-NIScPR, showcasing CSIR-NIScPR Premier Journals for Advancing Science Communication.



Effective science communication plays an important role in translating research outcomes and sharing scientific and technological information in a lucid and impactful way. High-quality scientific publishing serves as a spine for ensuring that research findings and advances in science and technology are communicated with credibility, clarity, and global visibility. Keeping this in view, CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad, in collaboration with CSIR-National Institute of Science Communication and Policy Research (CSIR-NIScPR), New Delhi, hosted a significant scientific publishing event aimed at the popularisation and strategic strengthening of CSIR-NIScPR journals. The programme served as an important platform for deliberations on enhancing the visibility, quality, and global

impact of Indian scientific journals published under the aegis of CSIR.

The event brought together a diverse and distinguished gathering of editors, researchers, policymakers, scientists, and publishing professionals from premier CSIR laboratories and institutions. It marked an important step towards reinforcing India's scholarly publishing ecosystem and promoting indigenous journals as credible and influential platforms for disseminating high-quality scientific research. The initiative aligns closely with the broader national vision of *Viksit Bharat*, which emphasises self-reliance, excellence, and global leadership in science and technology.

The programme presented the critical role of CSIR-NIScPR journals that have been communicating India's scientific achievements to the global community. These journals, many of which have a legacy spanning several decades, represent

a rich tradition of scientific rigour, editorial excellence, and innovation. They continue to serve as trusted publications for researchers across disciplines. They foster the exchange of knowledge and support evidence-based policymaking.

Speakers from CSIR-IICT, CSIR-Centre for Cellular and Molecular Biology (CCMB), and CSIR-National Geophysical Research Institute (NGRI) highlighted the importance of strengthening Indian journals to increase their international visibility, citation impact, and relevance. They emphasised that national journals with high quality are essential for showcasing India's research strengths and for nurturing young researchers by providing high-quality, accessible publication avenues. The speakers also appreciated the dedicated efforts of the CSIR-NIScPR team in sustaining and modernising these journals amidst the evolving global publishing landscape.

Dr Geetha Vani Rayasam, Director, CSIR-NIScPR, delivered a comprehensive presentation on the Indian journals published by CSIR-NIScPR. She traced their evolution over the years, elaborated on editorial and peer-review processes, and highlighted their growing global reach. Dr Rayasam emphasised the importance of these journals within the Indian scientific ecosystem, particularly in supporting interdisciplinary research and promoting ethical and transparent publishing practices. In addition, her talk also focused on the relevance of

policy research and Technology Readiness Level (TRL) assessment, stressing their role in translating scientific research into societal and industrial applications.

Dr N Majumdar, Chief Scientist and Scientific Editor, shared valuable insights into the *Indian Journal of Chemistry*, one of CSIR's flagship publications with a strong legacy in chemical sciences research. He discussed the journal's scope, editorial standards, and its continued relevance in advancing fundamental and applied chemical research.

Dr Puspanjali Tripathy, Principal Scientist and Scientific Editor, presented the *Indian Journal of Chemical Technology*, wherein she highlighted the journal's editorial and scientific strengths. She emphasised its unique role in bridging chemical sciences with process engineering and industrial applications. She outlined how the journal supports innovation and technology development by publishing research that connects laboratory findings with real-world industrial needs.

Reflections on Indian journals with rich legacies in biological research were presented by Dr NK Prasanna, Principal Scientist and Scientific Editor. She spoke about the historical significance, contemporary relevance, and future directions of these journals in advancing biological sciences and life science research in India.

Scientists and research scholars from all three laboratories — CSIR-IICT, CSIR-CCMB, and CSIR-NGRI — actively participated in the event, engaging in discussions

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Dr Geetha Vani Rayasam, Director, CSIR-NIScPR, highlighted the importance of communicating science in the Indian context and mentioned the contribution of CSIR-NIScPR in this domain.

and interactions with editors and speakers. The programme concluded on a positive note, reinforcing the collective commitment of CSIR laboratories

and CSIR-NIScPR towards strengthening Indian scientific publishing and enhancing the global impact of Indian research.

Celebration of Science Communication and Outreach at Vigyanika: Science Literature Festival 2025

CSIR-NIScPR, New Delhi, in association with Vijnana Bharati (VIBHA), Indian Institute of Tropical Meteorology (IITM), Pune, and Panjab University, Chandigarh, successfully organised Vigyanika: Science Literature Festival 2025 during 8–9 December 2025 as an integral part of the India International Science Festival (IISF), 2025. The two-day festival celebrated the convergence of science, literature, language, and creative communication, bringing together leading science communicators, scientists, editors, scholars, and science poets from across the country. The event aimed to strengthen the culture of scientific temper through multilingual and culturally rooted forms of science communication.

The festival opened on the 8th of December with an inaugural session titled “*Bhartiya Vigyan Vimarsh me Sahitya aur Sanchar Madhyam ki Bhoomika*”. The session explored the role of literature and communication platforms in shaping India’s scientific discourse. Dr Paramananda Barman, CSIR-NIScPR, offered an overview of Vigyanika. Dr Neel

Sarovar Bhavesh from VIBHA spoke about the significance of communicating science within the Indian context.

Shri Vivekananda Pai, General Secretary of VIBHA, delivered the keynote address. He discussed the importance of an Indian narrative in SciComm. He also highlighted the notable contributions of India in Science and Technology. Prof. Arun Kumar Grover, Former Vice-Chancellor of Panjab University, reflected on the history of India’s scientific institutions and science communication.

Dr Geetha Vani Rayasam, Director, CSIR-NIScPR, highlighted the importance of communicating science in the Indian context and mentioned the contribution of CSIR-NIScPR in this domain. Finally, Dr Rashmi Sharma, Head, NCSTC, DST, talked about the present-day science communication approaches. Their insights highlighted the continuing need for accessible and contextually grounded science communication across the country. Dr Atul Kumar Srivastava, IITM, presented the Vote of Thanks.

Later that day, the “*Vigyan Kavi Sammelan*” showcased a vibrant blend of poetry and science, highlighting how creative expression can illuminate scientific ideas. Esteemed science poets included Prof. Manoj Kumar Patairiya, former Director of CSIR-NISCAIR; Prof. Rajesh Kumar of IIT Indore; Sh. Mohan Sagoria, Associate Editor of *Electroniki Aapke Liye*, along with celebrated science poets Ms Radha Gupta, Prof. Neera Raghav, Mr Yashpal Singh ‘Yash’, TSRS Sandeep, and Dr Anurag Gaur. Their poetry illustrated the power of poetry as a tool for public engagement with science.

The second day of Vigyanika featured a scientific session titled “*Vigyan Se Samruddhi – For Atmanirbhar Bharat*”, which focused on traditional knowledge communication and its role in advancing national self-reliance. The session brought together key figures such as Dr Arvind Ranade, Director, NIF, who highlighted the need for protecting traditional knowledge through Intellectual Property (IP) frameworks, and ensuring proper recognition to knowledge holders. Dr Viswajanani J Sattigeri, Head, CSIR-TKDL, emphasised the importance of documenting, disseminating and implementing policy for traditional knowledge. Dr N Srikanth, DDG, CCRAS, highlighted the importance of value addition and accurate communication of traditional knowledge and its scientific basis.

Lastly, Dr Kanupriya Vashishth, Senior Programme Officer, DBT-BIRAC, talked about life sciences and



biotech innovations in India. The discussion emphasised India’s rich heritage of traditional knowledge, the importance of integrating it into contemporary scientific and innovation ecosystems, and effective communication.

The “*Apni Bhasha Apna Vigyan*”, a panel discussion, highlighted the critical role of Indian languages in science communication and outreach. Speakers included Prof. Arun Kumar Grover; Shri Debobrat Ghose, Editor, *Science India*; Dr Manish Mohan Gore, Editor, *Vigyan Pragati*; Dr HS Sudhira, Director, Research Matters, Gubbi Labs; and Dr Nanaocha Sharma, Director, BRIC-IBSD, Manipur. The panel highlighted that science communicated in one’s own language fosters inclusivity, understanding, and deeper public engagement.

Vigyanika concluded with an interactive session titled “*Engaging and Creative Ways of Communicating Science*,” showcasing innovative outreach strategies from experts across diverse fields. Sh. Kollegala Sharma, former Chief Scientist at CSIR-CFTRI; Mr G Harikrishnan, Director, Capacity Building and Public Outreach at ISRO; Dr Saurabh Sharma, JNU;

As part of IISF 2025, Vigyanika reinforced its commitment to bridging the gap between science and society.

and Ms Pooja Rathod, Wildlife Cinematographer and Filmmaker, shared approaches that spanned storytelling, audio-visual media, field engagement, and public-facing scientific narratives. Their insights highlighted the evolving landscape of science communication in India.

As part of IISF 2025, Vigyanika reinforced its commitment to

bridging the gap between science and society. Through literature, art, Indian languages, and creative media, the event demonstrated the transformative potential of culturally grounded science communication in fostering a scientifically informed and engaged society.

MoUs/Agreements

Another Step towards “Atmanirbhar Bharat”: CSIR-NPL Develops and Transfers High-Volume PM₁ Sampler Technology



In recent years, CSIR-National Physical Laboratory (CSIR-NPL), New Delhi, has been actively engaged in the development, testing, and calibration of several Particulate Matter (PM) technologies. A state-of-the-art facility has been established in the Gas Metrology Section of the Environmental Sciences and Biomedical Metrology Division at

CSIR-NPL. This facility provides comprehensive services to Indian manufacturers and industries in related domains, including filter and mask testing, air purifier testing, Beta ray particle monitor calibration, and manual sampler testing and calibration, among others.

In addition to providing technology support to various industries, several PM measurement technologies, including PM_{2.5}, PM₁₀, and cascade impactor samplers — have already been transferred to Indian manufacturers and successfully commercialised, in line with national initiatives such as “Make in India” and “Atmanirbhar Bharat” (Self-Reliant India).

As a further outcome of this facility, a “High-Volume PM₁ Sampler” technology, indigenously designed and developed at CSIR-

NPL, was transferred to the MSME M/s MJ Environmental Solutions LLP, Noida, during the CSIR Foundation Day celebration, which was held on 29 October 2025, at CSIR-NPL.

This technology features a novel design of a PM₁ impactor sampler, which efficiently segregates particulate matter larger than 1 µm (aerodynamic diameter) and

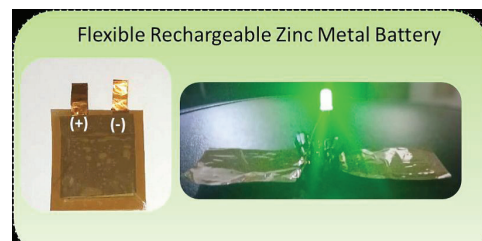
enables the collection of particles ≤ 1 µm in size from ambient air on an 8-inch × 10-inch filter, operating at a high flow rate of 1.13 m³/min (approximately 40 CFM). This marks the first high-volume PM₁ sampling technology developed in India, representing a significant step toward indigenous capability in advanced air quality monitoring systems.

R&D

CSIR-NCL Develops Self-Healing Hydrogel Electrolyte for Safer and Flexible Zinc-Metal Batteries

Researchers at the CSIR-National Chemical Laboratory (CSIR-NCL), Pune, have developed an intrinsic self-healing hydrogel polymer electrolyte for rechargeable Zinc-metal Batteries (RZMBs), addressing major safety and durability challenges associated with dendrite growth and mechanical damage. This research has been published in the prestigious journal *Advanced Energy Materials*.

The work was carried out by a research team led by Dr Sreekumar Kurungot, Chief Scientist, Physical and Materials Chemistry Division, and Ms Priyanka Pandinhare Puthiyaveetil, PhD researcher. The hydrogel polymer electrolyte, named PHBC-4, has been engineered with a combination of hydrogen bonding, dynamic polar covalent B–O interactions, and Zn–O coordination bonding to provide a robust and dynamic polymer network. This innovative



structural design significantly suppresses dendrite formation, a critical factor responsible for short-circuiting and battery failure in traditional zinc-metal batteries.

A key highlight of the material is its autonomous self-healing capability, where the hydrogel can restore up to 93% of its mechanical strength within just five minutes. The researchers demonstrated this feature by powering an LED using a flexible pouch cell constructed with the PHBC-4 electrolyte. Even after cutting the pouch cell with scissors, the internal network reassembled itself, and the LED continued to glow, confirming its potential for flexible and wearable electronic devices.

This breakthrough represents an important advancement toward the development of next-generation sustainable batteries.

The event brought together leading policymakers, academicians, scientists, researchers, public sector organisations, and industry experts to deliberate on next-generation communication and sensing technologies.



Dr Sreekumar Kurungot, Chief Scientist, CSIR-NCL and his student Ms Priyanka Pandinhare Puthiyaveetil

Rechargeable zinc-metal batteries are gaining prominence due to their high safety, abundant raw materials, and environmental compatibility. However, issues such as dendrite growth, hydrogen evolution reactions, and mechanical failure have limited their use in real-world applications. The PHBC-4 electrolyte overcomes these barriers by enabling smooth and uniform zinc deposition and by maintaining structural integrity even under mechanical stress.

The study reported that the PHBC-4 system delivered high ionic conductivity ($4.6 \times 10^{-2} \text{ S cm}^{-1}$), a cation transference number of 0.89, and exceptional cycling stability of over 490 cycles when paired with a Zn-doped MnO_2 cathode. In Zn||Zn symmetric cells, the electrolyte ensured stable plating–stripping behaviour for more than 1032 hours, demonstrating its high durability.

This breakthrough represents an important advancement toward the development of next-generation sustainable batteries suitable for flexible, wearable, and deformable electronic applications.

Reference: *Self-Healing Hydrogel Electrolyte Enabled by Dynamic Polar Covalent and Noncovalent Interactions for High-Performance Rechargeable Zinc-Metal Batteries: A Leap toward Sustainable Energy Storage*, Sreekumar Kurungot et al. *Adv. Energy Mater.* 2025, DOI: 10.1002/aenm.202502883

Workshops/Seminars/Conferences

Three-Day National Symposium on Microwave, Millimetre-Wave and Beyond Technologies for Connected Future ($\mu\text{mTCF-2025}$)

CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI), Pilani, Rajasthan, organised a three-day Symposium on Microwave, Millimetre-wave and Beyond Technologies for Connected Future ($\mu\text{mTCF-2025}$) during 13-15 October 2025. The event brought together leading

policymakers, academicians, scientists, researchers, public sector organisations, and industry experts to deliberate on next-generation communication and sensing technologies.

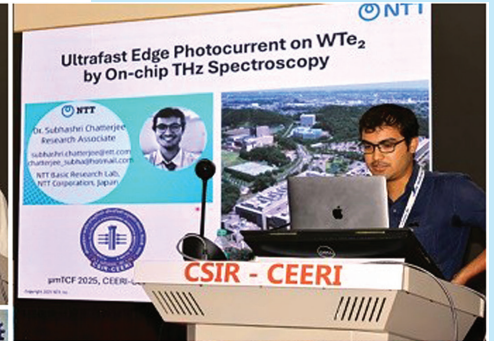
The symposium provided a vibrant platform for discussions on 5G, 6G, microwave, millimetre-

wave and terahertz technologies, with focused sessions on antennas, MMICs, RADARs, microwave components, and electromagnetic systems. The event attracted a full house of participants from academia, research laboratories, industries, startups, and government sectors.

A significant highlight of the symposium was the signing of two MoUs between CSIR-CEERI and M/s Scientific Microwave, Ghaziabad and M/s Digtoid Technologies, Bengaluru. These partnerships aim to strengthen collaborative efforts in 6G, microwave and millimetre-wave technologies, antenna design, and advanced system development.

Delivering the keynote address, Shri Rajesh Kumar Pathak, Director General, Bharat 6G Alliance, on the theme “Beyond 5G to 6G: India Perspective,” emphasised the critical synergy required among government policymakers, R&D institutions, industry, and academia for building a robust techno-commercial ecosystem to support India’s 6G ambitions. He also highlighted the newly released “New Delhi Declaration on 6G” document.

The souvenir of the event was released by the guests during the inauguration function. The technical programme featured 17 invited lectures by eminent experts, covering a spectrum of cutting-edge topics including microwave and millimetre-wave imaging, IoT antenna, aerospace and satellite antenna, stealth microwave sensors and



MoU exchange between CSIR-CEERI and M/s Digtoid Technologies, Bengaluru

components, millimetre-wave ICs for 6G and RADARs, quantum computing, photonics for 6G communication, atomic clocks, low-RCS UAV sensors, OAM-based antenna, communication-sensing convergence, planar TWTs, and THz communication. The event also included three industry talks and a dedicated industry exhibition, showcasing live demonstrations and state-of-the-art products. CSIR-CEERI’s recent technological achievements

The event also included three industry talks and a dedicated industry exhibition, showcasing live demonstrations and state-of-the-art products.

The book's writers, Dr DD Ozha and Dr JR Chunawala, stressed that the book highlights research from many CSIR institutes on turning trash into useful goods.

were also presented through a special video showcase.

A Three-minute Thesis competition provided a platform for full-time PhD scholars to present their research innovations in a concise and engaging format for a general audience.

Twelve members of the industry participated and exhibited advanced products, test equipment, and simulation tools. The symposium received generous support from a wide range of sponsors, including Bharat 6G Alliance, ANRF, Digitode, TMYTEK Technologies, VVDN, R&S Technologies, Keysight, Agmatel Technologies, Bharat Electronics,

Daussault Systems, Jyoti Electronics, Comsol Technologies, Spec Innovations, Applied Concept Group, JV Micronics, Numerigon Technologies, Infinitipoint, as well as IEEE AP-S & RFID Delhi Chapter, IEEE AP-S Jaipur Chapter, Indian Radio Science Society, and the Indian National Academy of Engineering (INAE).

µmTCF-2025 successfully fostered meaningful dialogue, collaboration, and knowledge exchange, paving the way for impactful indigenous advancements in India's future communication and sensing technologies.

Book Release Ceremony – “Waste to Wealth”



CSIR-Central Salt & Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar, had a book release ceremony for its most recent Hindi publication, “Waste to Wealth” (*Kachre Se Kanchan*), on 21 November 2025. Dr Kannan

Srinivasan, Director of CSIR-CSMCRI, oversaw the programme. Dr Geetha Vani Rayasam, Director of the National Institute of Science Communication and Policy Research (CSIR-NIScPR), New Delhi, was the Chief Guest.

Chief Scientist Dr B Ganguly gave the opening remarks. The book's writers, Dr DD Ozha and Dr JR Chunawala, emphasised the book's importance in advancing the Hon'ble Prime Minister's Swachh Bharat Abhiyan goal. They stressed that the book highlights research from many CSIR institutes on turning trash into useful goods and offers insightful information on the management of solid, plastic, electronic, biological, and chemical wastes.

In her address, Dr Geetha Vani Rayasam emphasised the impact of popularising science to foster a scientific mindset and raise public awareness. She promoted the use of a variety of socially relevant strategies for successful science communication. Dr Kannan Srinivasan spoke in detail on CSMCRI's active involvement in creating technologies for adding value to solid wastes, such as the manufacturing of potash fertiliser.

Dr KB Pandey, Principal Scientist, CSIR-CSMCRI, said that the institute has a long history of using a variety of scientific methods to serve society, and one of its significant achievements is the dissemination of R&D discoveries through books and popular science articles. Dr JR Chunawala presented the vote of gratitude to wrap up the programme.

Today's Curious Minds will be Tomorrow's Scientists



The CSIR-NIScPR organised a “Student-Scientist Connect Programme” on 7 November 2025 at Vivekananda Hall, CSIR-NIScPR, Pusa Campus, New Delhi. The event welcomed students from Rajkiya Sarvodaya Bal Vidyalaya, Shakurpur, and Ryan International School, Mayur Vihar, New Delhi.

A total of 57 students participated in the programme

along with 6 teachers, including the Principal of Rajkiya Sarvodaya Bal Vidyalaya, Shakurpur. The programme aimed to cultivate scientific curiosity among young learners and offer them first-hand exposure to scientific and industrial research through interactive sessions and meaningful engagement with scientists.

Mr CB Singh, Head, Jigyasa, Training and HR, emphasised the crucial role of CSIR-NIScPR, and highlighted Jigyasa's mission to inspire curiosity and encouraged the students to be inquisitive and to develop a passion for science that could help them become future scientists and innovators.

The programme began with a warm welcome address by Mr CB Singh, Head of the Jigyasa, Training, and HR Division, and also the Head of the Popular Science Division, CSIR-NIScPR. Interacting with the students, Mr Singh made them familiar with the vision and activities of CSIR, NIScPR, and the Jigyasa initiative. He offered an informative overview of the 37 CSIR laboratories spread across India, elaborating on their diverse areas of specialisation and their significant contributions to advancing scientific research. Emphasising the crucial role of CSIR-NIScPR, he highlighted Jigyasa's mission to inspire curiosity and encouraged the students to be inquisitive and to develop a passion for science that could help them become future scientists and innovators.

Dr Suman Ray, Senior Principal Scientist and Jigyasa Nodal-PI at CSIR-NIScPR, delivered an engaging presentation on the remarkable "Role of CSIR in the Scientific Progress of India" over the past eight decades. She highlighted the wide range of technologies and innovative solutions developed by various CSIR laboratories that have significantly advanced science and technology while contributing to national development and public welfare. Among the notable achievements, Dr Ray showcased the development of indelible ink by CSIR-NPL, an integral component of India's electoral process, and the cost-effective

paracetamol production technology innovated by CSIR-NCL. She also discussed the contributions of CSIR-NAL in creating indigenous kamikaze drones capable of flying up to 1,000 kilometres using home-built engines, thereby strengthening India's defence capabilities. Additionally, she shed light on CSIR-IIIM's "Aroma Mission," which promotes lavender cultivation in Jammu and Kashmir to enhance farmers' livelihoods and support the growth of India's aromatic crops-based economy.

Ms Sonali Nagar, Senior Scientist and Editor, *Science Reporter*, CSIR-NIScPR, delivered an engaging presentation titled "Popular Science Writing with a Focus on Misinformation Overload." She spoke about the growing impact of misinformation on society and emphasised the importance of maintaining scientific integrity while addressing and debunking false information. Ms Nagar illustrated practical methods for verifying facts, validating authentic data sources, and identifying misleading or fraudulent websites. She highlighted the critical role of effective writing skills in science communication, explaining the art of crafting and accessible science narratives. Emphasising clarity, creativity, and accuracy, she encouraged students to present scientific concepts in a manner that both informs and captivates readers from diverse backgrounds, keeping them engaged and inspired by science.

To ensure active participation and reinforce key learning outcomes, a quiz was held after the presentations. The activity encouraged students to reflect on the insights shared during the session while testing their understanding enjoyably and interactively. Winners were awarded science kits as a token of recognition for their enthusiasm and attentiveness.

During the programme, issues of CSIR-NIScPR's popular science magazines were distributed to students and teachers. The event also emphasised the vision and contributions of SVASTIK (Scientifically Validated Societal Traditional Knowledge), an initiative aimed at connecting modern science with India's traditional knowledge systems and indigenous practices. This showcased how scientific principles can harmoniously align with time-tested traditional wisdom. The overarching goal of SVASTIK is to preserve the authenticity of heritage practices, encourage a scientific approach to evaluating them, and instil confidence in the enduring scientific significance of India's traditional knowledge.

The programme's experiential learning component also included a visit to the Raw Materials Herbarium & Museum (RHMD) at CSIR-NIScPR. RHMD serves as a unique repository, housing authentic samples of economically important raw materials of plant, animal, and mineral origin from across India. These engaging experiences allowed students to understand the tangible, real-world applications of science and its vital role in everyday life.

The principal and teachers actively participated in the programme and were felicitated with potted plants as a symbol of appreciation.

The event concluded with the distribution of participation certificates by Mr CB Singh, Head of Jigyasa at CSIR-NIScPR, and Dr Suman Ray, Jigyasa Nodal PI. In his closing remarks, Mr Singh expressed heartfelt appreciation to the participating students, teachers, and staff, and the programme came to an end with a vote of thanks, marking a meaningful conclusion to a day dedicated to inspiring young scientific minds.



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