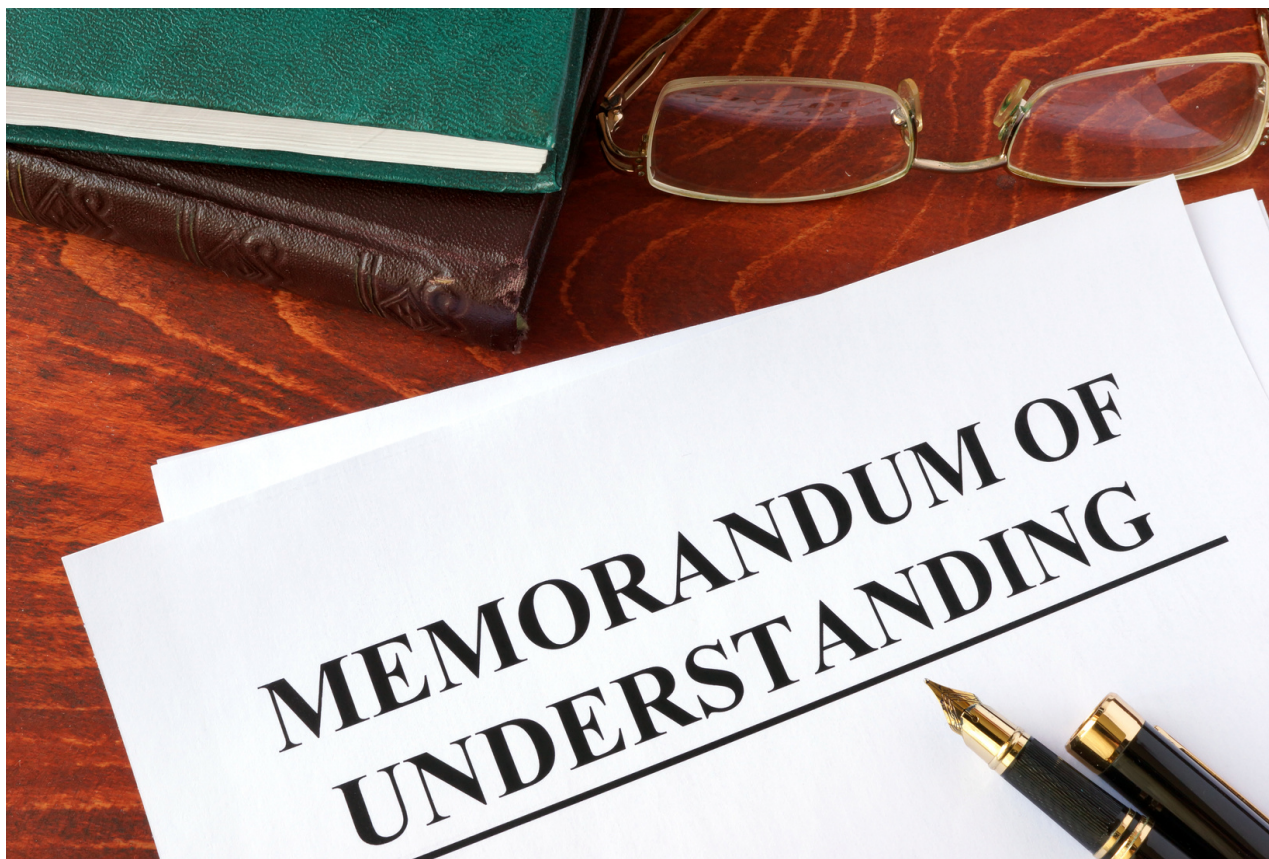




SCIENCE AND TECHNOLOGY PULSE

VOL. 2 ISSUE 5
MAY 2025





DST and DRDO Partner to Boost Space Surveillance Capabilities through ARIES-IRDE Collaboration

The defence and aerospace industries can leverage this collaboration for improved satellite tracking, threat detection, and the development of electro-optical payloads. AI-tech firms and optics manufacturers will also benefit from opportunities in space-grade imaging systems and intelligent data processing tools.

The Aryabhata Research Institute of Observational Sciences (ARIES), Nainital (under DST), and DRDO's Instruments Research & Development Establishment (IRDE), Dehradun, signed an MoU on 13th May 2025 to enhance India's ground-based Space Situational Awareness (SSA). The partnership aims to utilise ARIES's advanced telescopic and radar infrastructure, including the 3.6 m Devasthal Optical Telescope, alongside IRDE's expertise in Electro-Optical surveillance systems. Together, they will focus on real-time monitoring of space objects, AI/ML-based image analysis, and joint R&D on optical systems for astronomy and SSA. The collaboration also supports training, knowledge exchange, and the development of high-end data acquisition systems. The institutes' close geographical location will help streamline joint activities and foster seamless coordination.

In this newsletter
you can expect
updates from:

Government Initiatives

Health and Medicine

Emerging Technologies

Environmental Science

Space Exploration

Food and Agriculture



Ecofriendly Optical Sensor Offers Precision Cholesterol Detection for Health Diagnostics

The biosensor, published in Nanoscale by the Royal Society of Chemistry, can benefit the diagnostics, biomedical devices, and preventive healthcare industries by enabling scalable, sustainable cholesterol testing tools.

Researchers at the Institute of Advanced Study in Science and Technology (IASST), Guwahati, have developed a highly sensitive, eco-friendly, and cost-effective optical sensing platform using silk fibre functionalised with phosphorene quantum dots to detect cholesterol. This lab-scale point-of-care device can trace cholesterol levels even below the standard range, aiding early diagnosis of diseases like atherosclerosis, heart attacks, hypertension, and cancer. Integrated into a cellulose nitrate membrane, the sensor eliminates electronic waste and demonstrates strong accuracy in real-world biological samples. The device's precision and sustainability make it promising for regular health monitoring and disease risk assessment.



DST Researchers Explore Stable Peptidomimetic Drugs for Treating Neurodegenerative Diseases

This research benefits the biopharmaceutical and neuroscience industries by enabling the development of stable, brain-penetrant therapies for neurodegenerative diseases. It also supports cost-effective innovation through the repurposing of existing peptidomimetic drugs.

Researchers at the Institute of Advanced Study in Science and Technology (IASST), under the Department of Science and Technology, are developing peptidomimetic drugs that mimic neurotrophins for treating neurodegenerative diseases. These synthetic compounds are more stable, last longer, and penetrate the brain better than natural neurotrophins, making them more effective in supporting neuron growth and survival. Led by Prof. Ashis K. Mukherjee, the team has optimised their receptor specificity to reduce side effects. Their study, published in Drug Discovery Today, also suggests potential applications in cancer treatment and new drug development.



New Insights into Catalyst Design Boost Green Hydrogen Efficiency

Hydrogen energy, clean tech, and fuel cell industries can utilise this catalyst design approach to scale efficient, low-cost green hydrogen production. It offers a strategic advantage for sustainable fuel development and integration into renewable energy systems.

Researchers at the Institute of Nano Science and Technology (INST), Mohali, have developed a CuO-CuWO₄ heterostructure catalyst that boosts green hydrogen production by using built-in electric fields (BIEF) and Gibbs free energy gradients. By analysing proton adsorption behavior across different regions of the p-n heterojunction, they found that differing proton affinities enable efficient adsorption and desorption, enhancing the Hydrogen Evolution Reaction (HER) in alkaline conditions. Published in Advanced Energy Materials (2025), the research provides critical insights for designing next-gen electrocatalysts with improved efficiency and reaction kinetics.



NECTAR-Backed Aerostatic Drone Offers Long-Endurance Surveillance for Border, Forest & Disaster Management

This drone offers strong potential for security, defence, telecom, infrastructure, and environmental monitoring industries. It supports real-time surveillance, emergency connectivity in remote areas, crowd monitoring at events, and non-intrusive wildlife tracking, making it a practical asset for multi-sectoral field operations.

The North East Centre for Technology Application and Reach (NECTAR), under DST, has showcased India's first aerostatic drone developed by Airbotix Technologies. This drone combines buoyancy and aerodynamics to stay afloat silently for over 4 hours, offering energy-efficient, high-endurance surveillance. It can be mounted on vehicles or deployed on-site and supports day-night cameras, thermal imaging, anti-drone payloads, and communication relays. Designed for modular deployment, it enables persistent monitoring across forest, border, wildlife, disaster zones, and public events. It is radar-evading, lightweight, and suited for use in difficult terrain with minimal infrastructure.



Climate Risks for Today's Youth: Urgent Implications for Policy, Infrastructure & Innovation Sectors

The findings offer critical insights for urban infrastructure, insurance, agriculture, and water management industries to design adaptive solutions and climate-resilient systems. Businesses can leverage this data to develop targeted risk mitigation strategies and sustainable products aligned with future climate exposure trends.

A major study by VUB and global partners reveals that under current climate policies, children born in 2020 may face lifetime exposure to extreme events like heatwaves, floods, droughts, and wildfires. At 3.5°C warming, 92% of 2020-born children, about 111 million, will face extreme heat, while 1.5 billion children aged 5–18 today will be similarly affected. Heatwaves could affect 1.5 billion, crop failures 431 million, droughts 116 million, river floods 191 million, wildfires 147 million, and tropical cyclones 163 million children under this high-emission scenario. Reducing warming to 1.5°C could protect 654 million children and significantly reduce these risks, especially for the socioeconomically vulnerable.

Novel Solar Method Yields Reliable Helium Estimation, Aiding Energy and Space Sectors

This refined understanding of solar element composition can benefit aerospace and energy industries, especially in improving solar models for satellite design, solar panel calibration, and fusion research. Accurate solar modelling enhances predictions of solar behavior, critical for space missions, telecommunications, and renewable energy forecasting.

For the first time, researchers from the Indian Institute of Astrophysics (IIA) have accurately estimated the abundance of Helium in the Sun's photosphere using a unique method involving spectral lines of neutral Magnesium (Mg) and Carbon (C), along with their hydrogenated molecules (MgH, CH, and C₂). Since Helium lacks visible spectral lines, previous estimates relied on indirect methods like solar wind analysis or helioseismology. This new approach models the impact of varying Helium-Hydrogen (He/H) ratios on the observed spectrum and found that a He/H ratio of 0.1 aligns with atomic and molecular absorption data, validating widely used assumptions. Their findings were published in the *Astrophysical Journal* and represent a reliable technique for refining solar composition models.



High-Precision Satellite Data Tracks Power Plant Emissions with Dual CO₂ and NO₂ Detection

This data-driven approach offers power generation and heavy industrial sectors a reliable tool for self-monitoring, regulatory compliance, and operational efficiency benchmarking. It can help industries adopt cleaner technologies and optimise combustion systems based on real-time emissions data.

For the first time, scientists from the Max Planck Institute and Heidelberg University have successfully used Germany's EnMAP satellite to simultaneously measure CO₂ and NO₂ emissions from individual power plants with a 30-m spatial resolution. This new technique allows direct tracking of industrial plumes over tens of kilometers, even from plants in regions like Saudi Arabia and South Africa. Unlike traditional satellites designed only for land imaging or coarse resolution, EnMAP now effectively captures fine-scale emission data. The study also enables precise calculation of NO_x/CO₂ ratios, offering insights into plant efficiency, technology type, and operating conditions. These measurements support detailed analysis of atmospheric chemistry and can improve independent global emissions monitoring.





New Process Converts Corn Waste into Affordable Sugar for Biofuel Production

This innovation benefits biofuel producers, biorefineries, and agri-tech companies by lowering input costs and boosting the economic viability of cellulosic ethanol. It supports a circular agriculture model by turning farm residue into valuable industrial inputs and soil nutrients.

Scientists at Washington State University, along with collaborators from major U.S. labs and universities, have developed a cost-effective method to convert corn stover, leftover stalks, husks, and residue into fermentable sugar for biofuels. Using potassium hydroxide and ammonium sulfite at mild temperatures, the team successfully pretreated the biomass to enable enzymes to break down cellulose into sugar, eliminating the need for costly chemical recovery. This patent-pending process can produce sugar at just 28 cents per pound, making it competitive with imported alternatives. It also generates fertiliser as a byproduct, creating a zero-waste system. The findings were published in Bioresource Technology and funded by the U.S. Department of Energy.



Alfalfa, Fruit Waste, and Microbes Combine to Boost Biogas Yields

This method benefits renewable energy providers, agricultural biogas plants, and livestock feed industries by maximising methane yields and minimising waste. It offers a low-cost energy source while converting agricultural residues into dual-purpose inputs: clean energy and enriched animal feed.

Researchers from Guizhou University have developed a cost-effective method to enhance biogas production from alfalfa by adding rose hip fruit waste (pomace) and the anaerobic microbe *Lactobacillus acidophilus*. This co-fermentation process led to a 33% increase in methane output within just 3 days compared to untreated samples, while also enriching the nutritional value of the leftover biomass for use as livestock feed. The mixture lowered pH rapidly and stimulated beneficial lactic acid bacteria, notably increasing *Lactiplantibacillus plantarum* while reducing other less efficient microbes. The technique reduces waste disposal costs and supports sustainable rural energy solutions.



Growing Health Risks from Ultra-Processed Foods Highlight Need for Industry Reform

This evidence can prompt reform in the food and beverage and packaged goods industries, encouraging manufacturers to invest in healthier formulations and transparent labeling. Industries embracing clean-label, minimally processed products may gain consumer trust and align with evolving health regulations.

A large-scale systematic review presented at ACC Asia 2025, covering over 8.2 million adults across 41 studies, found that increased consumption of ultra-processed foods (UPFs), including chips, cookies, sugar-sweetened beverages, and commercial breads, is linked to rising health risks. Every additional 100g/day of UPFs was associated with a 14.5% higher risk of hypertension, a 5.9% rise in cardiovascular events, 1.2% more cancer cases, a 19.5% increase in digestive diseases, and 2.6% higher all-cause mortality. The studies also noted elevated risks of obesity, diabetes, and mental health issues. UPFs, often rich in additives, sugar, salt, and unhealthy fats, alter gut microbiota, promote inflammation, and impair metabolic health.

Thank you for reading!

VeK is a policy advisory and research firm, distinguished by data-driven approach to analyse policy and regulatory developments in India and globally.

For Further Information, please contact: Abhilasha Nayal, Senior Associate at +91 9870143357 or Email at abhilasha@vekpolicy.com

[WEBSITE:www.vekpolicy.com](http://www.vekpolicy.com)



Disclaimer: Science & Technology Pulse is a monthly Newsletter published by VeK. The information and opinions contained in this Newsletter have been compiled from sources believed to be reliable and in good faith. While all efforts have been made to compile accurate information, VeK or its employees, affiliates, shall not be in any way responsible for any damage that may arise to any person from any inadvertent error in the information or omissions contained in the Newsletter.