

April
2022

समाचार पत्रों से चयित अंश Newspapers Clippings

A Daily service to keep DRDO Fraternity abreast with DRDO
Technologies, Defence Technologies, Defence Policies,
International Relations and Science & Technology

खंड : 47 अंक : 81 29 April 2022

Vol. : 47 Issue : 81 29 April 2022



रक्षा विज्ञान पुस्तकालय

Defence Science Library

रक्षा वैज्ञानिक सूचना एवं प्रलेखन केंद्र

Defence Scientific Information & Documentation Centre

मेटकॉफ हाउस, दिल्ली - 110 054

Metcalf House, Delhi - 110 054

CONTENTS

S. No.	TITLE		Page No.
	DRDO News		1-2
	DRDO Technology News		1-1
1.	Anti-ship version of Brahmos missile destroys targets at sea; boost for Navy	<i>Hindustan Times</i>	1
2.	One day workshop on “Recent trends in development of power cartridges and canopy severance system” held at ARDE, Pune	<i>Pune Newskar</i>	1
	DRDO On Twitter		2-2
	Defence News		3-10
	Defence Strategic: National/International		3-10
3.	भारतीय वायु सेना ने राष्ट्रीय स्तर की एक लॉजिस्टिक संगोष्ठी 'लॉजिसेम वायु - 2022' का आयोजन किया	<i>Press Information Bureau</i>	3
4.	IAF conducts national level logistics seminar 'Logisem Vayu - 2022'	<i>Press Information Bureau</i>	4
5.	India's offset requirements major hurdle in defence trade: Ex-Pentagon official	<i>The Times of India</i>	5
6.	Thales-CS Group team to build new counter-drone systems for French military	<i>Defence News</i>	6
7.	India's First Indegenous OTP Memory	<i>Research Matters</i>	7
8.	INDIA'S Tapas UAV on path to user evaluation trials	<i>India Defence News</i>	8
9.	India's first indigenou aircraft carrier INS Vikrant to be handed over to Navy in May	<i>The New Indian Express</i>	9
	Science & Technology News		10-16
10.	Mars probe discovers ‘shocking’ new aurora	<i>The Indian Express</i>	10
11.	First Gaganyaan uncrewed module to be Injected in 170 x 408 km orbit; indicates human spaceflight profile	<i>India Defence News</i>	11
12.	Laser-based ultrasound detects defect-producing features in metal 3D printing	<i>Phys.Org</i>	13
13.	How can we reduce the carbon footprint of global computing?	<i>MIT News</i>	14



Fri, 29 Apr 2022

Anti-ship version of Brahmos missile destroys targets at sea; boost for Navy

Anti-ship version of Brahmos missile was successfully test-fired jointly by the Navy & the Andaman & Nicobar Command. In a tweet, the Andaman and Nicobar Command confirmed ‘successful’ test-firing of the Brahmos missile. The anti-ship version of Brahmos missile destroyed its target at sea. DRDO congratulated the Indian Navy & Andaman & Nicobar Command for the successful test-firing.

<https://www.hindustantimes.com/videos/news/antiship-version-of-brahmos-missile-destroys-targets-at-sea-boost-for-navy-101651200332012.html>



Thu, 28 Apr 2022

One day workshop on “Recent trends in development of power cartridges and canopy severance system” held at ARDE, Pune

Pune, 28th April 2022: In line with GOI’s guidelines, DRDO is opening up new era of Defense Critical technologies to the intellectual citizens especially to researchers, faculty members, bright students, start-ups, MSMEs and Entrepreneurs for motivating them to contribute towards ‘Atmanirbhar Bharat’. In a series of workshops/ seminars, group discussions as a part of ‘Azadika Amrit Mahotsav’ ARDE, a premier DRDO Establishment in Pune had arranged one-day workshop on ‘Recent Trends in Development of Power Cartridges and Canopy Severance System’ on 25 April 2022. The event was attended by over 250 participants from engineering and science colleges, representatives from MSME & start-ups, service officers from Indian Navy and Indian Air force, ordnance factories and DRDO.

Theory, design, manufacturing, quality, reliability, test and evaluation of various steps of power cartridges were deliberated. Case study of Transfer of Technology of ‘Canopy Severance

System' were discussed along with the prospective of design agency ADA, manufacturing agency HAL and the Indian Air Force. Topics included the state-of-the-art canopy severance system, various power cartridges technology for life saving of pilots in emergency, bomb and store release mechanisms, harness cutting, stage separation cartridges, signal cartridges for military and space applications.

The workshop was inaugurated by Dr. BHVS Narayana Murthy, Director General (Missiles and Strategic Systems) Hyderabad, in the auspicious presence of Shri. P K Mehta, DS & DG (Armament and Combat Engineering), guest of honor Dr. Satish Kumar, Former DS & DG (MSS) and former Director NIT- Kurukshetra, Shri. KPS Murthy, OS & Director HEMRL and Dr. V Venkateswara Rao, OS & Director ARDE. Shri Pravin W Sonawane, Scientist 'G' & Convenor of the workshop proposed the vote of thanks.

<https://www.punekarnews.in/one-day-workshop-on-recent-trends-in-development-of-power-cartridges-and-canopy-severance-system-held-at-arde-pune/>

DRDO On Twitter





पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Thu, 28 Apr 2022 5:55 PM

भारतीय वायु सेना ने राष्ट्रीय स्तर की एक लॉजिस्टिक संगोष्ठी 'लॉजिसेम वायु - 2022' का आयोजन किया

वायु सेना सभागार में रसद (लॉजिस्टिक्स) प्रबंधन पर एक राष्ट्रीय संगोष्ठी का 28 अप्रैल, 2022 को नई दिल्ली में आयोजन किया गया। वायु सेना प्रमुख एयर चीफ मार्शल वीआर चौधरी ने इस संगोष्ठी का उद्घाटन किया और अपना प्रमुख भाषण दिया। उन्होंने अपने संबोधन में उन्नत डिजिटल तकनीकों का उपयोग करने की जरूरत पर जोर दिया, जो परिचालन की सहायता के लिए लॉजिस्टिक्स क्षमता को बनाए रखने में सहायता करेगा। वायु सेना प्रमुख ने आईएएफ के हितधारकों से राष्ट्रीय रसद नीति (एनएलपी) और भारत सरकार के आत्मनिर्भरता संबंधित लक्ष्यों के व्यापक उद्देश्यों को प्राप्त करने की दिशा में काम करने का भी अनुरोध किया।

वहीं, इस संगोष्ठी में प्रमुख वक्ताओं और विषय के विशेषज्ञों ने राष्ट्रीय रक्षा में एनएलपी और लॉजिस्टिक्स पर अपने विचारों को साझा किया। इसके अलावा उद्योग जगत के विख्यात सलाहकारों ने आपूर्ति श्रृंखला प्रबंधन में नई तकनीकों के बारे में जानकारी दी। भारतीय वायु सेना के चुनिंदा लॉजिस्टिक्स परिचालकों ने 'आईएएफ के युद्ध अभियानों और भविष्य की जरूरतों के लिए लॉजिस्टिक्स' पर अपने विचार प्रस्तुत किए। इन 'वार्ताओं' ने संगोष्ठी के प्रतिभागियों के बीच काफी रुचि उत्पन्न की, जिसका भारतीय वायु सेना के सभी इकाइयों में सीधा प्रसारण किया गया।

आईएएफ के लॉजिस्टिक्स के दर्शन पर 'टेनेट्स ऑफ लॉजिस्टिक्स' शीर्षक से एक दस्तावेज और आईएएफ में लॉजिस्टिक्स के इतिहास पर एक पुस्तक 'फुटप्रिंट्स इन सैंड्स ऑफ टाइम' शीर्षक से जारी की गई। आईएएफ में 'टेनेट्स ऑफ लॉजिस्टिक्स' रसद परिचालन की अवधारणा के संदर्भ में रसद प्रमाण,

मुख्य कार्यात्मक क्षेत्रों, व्यावसायिक प्रक्रियाओं के संचालन के लिए तकनीक का लाभ उठाने और सहयोगी सेवाओं के साथ संयुक्तता की जरूरत को रेखांकित करता है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1821072>



Press Information Bureau
Government of India

Ministry of Defence

Thu, 28 Apr 2022 5:55 PM

IAF conducts national level logistics seminar 'Logisem Vayu - 2022'

A national seminar on Logistics Management was held on 28 April 2022 at Air Force Auditorium, New Delhi. Chief of the Air Staff inaugurated the seminar and delivered the keynote address. He emphasized on the need for exploiting advancements in digital technologies, which would aid in sustaining logistics stamina in support of operations. CAS also urged stakeholders in IAF to work towards achieving the broad aims of the National Logistics Policy (NLP) and Atmanirbharta goals of Govt of India.

Prominent speakers and subject matter experts shared their views on NLP and Logistics in National Defence. Renowned consultants from the industry spoke about new technologies in Supply Chain Management. Selected logisticians of IAF presented their views on 'Logistics for Combat Operations and Futuristic needs of IAF'. These 'talks' generated a lot of interest amongst the participants of the seminar, which was live streamed pan-IAF.

A document on logistics philosophy of IAF titled 'Tenets of Logistics' and a book on history of Logistics in IAF titled 'Footprints in Sands of Time' were released. The 'Tenets of Logistics' in IAF outlines the logistics credo in terms of concept of logistics operations, core functional areas, leveraging technology for conduct of business processes and necessity for jointness with sister services.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1821002>

THE TIMES OF INDIA

Thu, 28 Apr 2022

India's offset requirements major hurdle in defence trade: Ex-Pentagon official

"We have challenges with things like the S-400 (Russian anti-aircraft missile system being bought by India) being on contract and so forth. Additionally, the challenge of doing business, I can tell you in India is enormous because of offset requirements there to be able to provide a local business," Lord said. Under India's offset policy, foreign defence entities, for all contracts worth Rs 2,000 crore or more, are mandated to spend at least 30 per cent of the total contract value in India through procurement of components, transfer of technologies or setting up of research and development activities. However, the offsets are not applicable to procurements under 'fast track procedure' and in 'option clause' cases if the same was not envisaged in the original contract.

Over the past decade, the volume of defence trade between the two countries has increased from almost zero to USD 18 billion. Major American companies like Boeing, Lockheed Martin and General Atomics are eyeing the Indian market now, which is projected to grow exponentially over the next decade. "So, enormous potential, but I would say the opportunity and the challenge is to work with the Indian government to streamline policies and procedures, make them consistent so that it is a pretty predictable venue for US business and government to invest in," Lord said responding to Senator Mark Kelley, who recently returned from a trip to India. "From our recent discussions, I believe there is a willingness to strengthen the US-India security and industry partnerships. What thoughts do you have on how we can accomplish that? And do you agree this will also benefit US strategic interests at a time when Russia is looking to shore up their own ties with India," Kelley asked.

"So, this is an opportunity for us to build some ties through the sale of some of our military equipment, which I'd like to see," Kelley said. Senator Kirsten Gillibrand, who just returned from a trip to India and Nepal, said both countries would love to acquire US-produced helicopters and other weaponry. "The challenge is that it just takes too long. It is so cumbersome to create any acquisition fluidity with these countries that it's easier to buy from Russia or not in those cases but China," she said. "I think we have to understand that our cumbersome nature in acquisitions is highly problematic from the way we project power worldwide, but also so that our warfighters can have the most lethal and most effective technology possible," Gillibrand said. Lord conceded that this delay is because of the bureaucracy in the Pentagon and the State Department. "We have a very risk-averse workforce that is extremely concerned about media attention or congressional hearings, pointing out when things didn't go well. This is leading to a group that does not want to do anything other than what there's precedent for before. So, I think we need to encourage and train to use things," Lord added.

<https://timesofindia.indiatimes.com/india/indias-offset-requirements-major-hurdle-in-defence-trade-ex-pentagon-official/articleshow/91140253.cms>

Fri, 29 Apr 2022

Thales-CS Group team to build new counter-drone systems for French military

The French Ministry of Defense has chosen Thales and CS Group to build deployable anti-drone systems and have them in place by 2023, ahead of the nation's hosting of two major international sports events. The €350 million (\$377 million) deal includes an initial six copies, with the option to acquire several dozen more at a later date. The ministry issued the procurement notification on April 26, spokesman Herve Grandjean told reporters during a Thursday press conference. The program, dubbed PARADE for the French "protection déployable modulaire anti-drone," was initiated in May 2021. Thales partnered with CS Group, a command-and-control (C2) information systems builder, to produce technology capable of detecting and neutralizing microdrones and small UAS platforms, Grandjean said. Microdrones are typically classified as having the dimensions of a large insect, while small UAS tend to measure between 50 centimeters and 2 meters long.

Each system will include a goniometer capable of detecting the drone's angle of approach, a radar, an optronic system, and a jamming system, Grandjean told reporters. The deployable counter-UAS systems will be capable of detecting and neutralizing drones, whether or not they emit electromagnetic waves, he added. While the systems will be used for overall national security purposes, the intent is to have them in place ahead of "major international events on national territory," Grandjean noted. France is scheduled to host the 2023 Rugby World Cup as well as the 2024 Summer Olympics. The six initial systems are scheduled to be delivered in early 2023, while the contract will allow the ministry to procure additional systems at a later date. The program was designed to be "agile and evolving," allowing the ministry to adapt to future threats, Grandjean said.

"If there is a need for new solutions because there are new drone technologies, then we will be capable ... of contracting services to integrate these new solutions on the systems." He added that such new technologies could be a laser weapon. "We can perfectly imagine ... integrating this type of service." French media reports state that European consortium MBDA also competed for the PARADE program.

<https://www.defensenews.com/global/europe/2022/04/28/thales-cs-group-team-to-build-new-counter-drone-systems-for-french-military/>

Thu, 28 Apr 2022

India's First Indigenous OTP Memory

Silicon chip-based electronic circuits, the ones used in mobile phones, laptops, wifi routers and of late in smart devices, mostly have logic circuits. Some also need memory elements to hold data, such as device identity or security key. A security key is essential to keep data safe, whether for financial transactions, subscriptions such as Netflix or our personal data. Prof Udayan Ganguly at the Department of Electrical Engineering, IIT Bombay and his team are leading an effort to demonstrate indigenous semiconductor memory for secure applications. They have the credit for making the first indigenous memory technology translated from Lab to Fab.

In partnership with Semiconductor Labs, Chandigarh, Prof Ganguly, and his team have demonstrated a one-time programmable memory technology. It can be used in secure memories, hardware encryption and artificial intelligence. The work was presented at the IIT R&D Fair 2021 by Kumar Priyadarshi and Udayan Ganguly from IIT Bombay. Today, memory innovation is driving semiconductors. Data encryption is needed to protect your critical private information every time you upload your pictures and videos onto the cloud. Artificial intelligence provides a new future that opens vistas of amazing possibilities. So commercial memory needs are driving business and innovation for memory technologies globally. Strategic needs for India stress having indigenous memory extremely critical. We need to secure identities for e-commerce, data security to store information in the cloud and ultimately, artificial intelligence that will make sense of it all. With secure memory being so critical, the question is, can India build her own memory technology?

The team proposed a nanoscale structure for a memory cell in this context. A very thin layer of Silicon Oxide is sandwiched between two metal layers. The silicon oxide layer is just 2.5 nanometers, only 15 atoms thick! The structure forms a nanocapacitor and does not let electrical current pass. This pristine or undisturbed silicon oxide thus forms the state zero. Prof Ganguly notes that the research began in 2015 with a PhD thesis that detailed the method of making OTP memory. This idea was placed in front of SCL Engineers, who realised that this could be placed into their fabrication line. IIT Bombay and SCL collaborated, and by 2019, they were working vigorously as a team to scale the IIT Bombay technology to 200-millimetre wafers for production. By 2021, they had created a set of specifications to enable an 8-bit calibration or trimming application. They have recently demonstrated a 97 per cent yield in the Fab. The next step is to enable the manufacturing of products based on these technologies. Collaboration between IIT Bombay, a nano fab facility and an academic institution, and manufacturing partners, SCL Chandigarh fructified, thus resulting in the lab outcomes reaching all the way to the fab towards a manufacturing innovation.

From 2015 till today, technology development has been possible with funding from different agencies, including the Department of Science and Technology, the Ministry of Electronics and Information Technology, and the Office of the Principal Scientific Adviser to the Government of India. It's also been helped along by fantastic collaborators from IIT Delhi, SETS Chennai and DRDO, enabling different applications or serving with their expertise to enable various

capabilities. After going through several manufacturing readiness levels, the technology is ready for production. The engineers identified basic manufacturing implications, all the way down to eight steps, where the pilot line capability is. They demonstrated a low rate of production. Now the capability is in place for the full rate of production.

Now that this technology has been established, there is a reasonably rich application roadmap. There is a veritable roadmap. The primary application is the trimming or calibration, which will be able to upload small calibration constants to correct any shifts in analogue design. Other applications include hardware encryption that enables authentication and secure data, secure memory that enables memories to have encrypted data, radiation hard memory for space applications and neural network chips based on OTP technology. After achieving the technology milestone, the logical next step is to put out applications in the strategic and commercial space. It is a journey that has to go out of the academic space into the commercial space. A deep-tech startup called Numelo Technologies (neural networks, memory and logic technologies) was incubated in 2021 to venture into commercial space. While this journey is daunting, they have wonderful partnerships with SCL, DRDO, and some foreign foundries. Partnerships with other academic and research agencies are also thriving.

The OTP memory technology has a total addressable market size estimated at the US \$140 million. Significant applications are government identifications like e-passports, consuming about 40 million chips per year. Mobile phones with near field communication and touchless, cashless transactions can also use OPT memory. Then there are secure NaVIC ICs, GPS, and embedded systems for strategic applications. And finally, there is this whole vista of edge and autonomous security AI chips for strategic applications. So this is indeed a large market for a new technology based on a secure memory. India-owned technology and design enable and ensure national security.

<https://researchmatters.in/news/indias-first-indegenous-otp-memory>



Fri, 29 Apr 2022

INDIA'S Tapas UAV on path to user evaluation trials

HAL is preparing to produce five TAPAS MALE UAVs for user validation trials to start in October 2022. India's Tactical Airborne Platform for Aerial Surveillance (TAPAS) medium-altitude long-endurance (MALE) unmanned aerial vehicles (UAVs) have completed a series of flight trials and are moving towards user evaluation trials. Sources in Hindustan Aeronautics Limited (HAL) and the Aeronautical Development Establishment (ADE) said that eight prototypes of the TAPAS UAV have been built so far and the platform has completed 143 test flights. "We are currently in the process of design validation," an ADE source said. "The final design configuration will be frozen in June or July."

The source added that flight trials for user validation will likely start in October 2022. According to HAL, it is prepared to manufacture five UAVs for evaluation by the military. ADE will integrate the first two aircraft. The remaining three UAVs are to be integrated by HAL. "This is

to help HAL acquire expertise in the platform,” the ADE source said, and added that HAL will also be the beneficiary of a transfer of technology for future production of the platform. HAL is expected to deliver all five aircraft by April 2023. The TAPAS is an intelligence, surveillance, and reconnaissance (ISR) UAV. It is an evolution of the Rustom II armed combat UAV, which was previously being developed by the ADE. The agency is a branch of the Defence Research and Development Organisation (DRDO).

ADE told Janes that the name ‘Rustom II’ was cancelled in 2019. The system was rebranded as TAPAS. The change reflects the platform's transition from a combat-oriented platform to a surveillance UAV.

<http://www.indiandefensenews.in/2022/04/indias-tapas-uav-on-path-to-user.html>



Thu, 28 Apr 2022

India's first indigenous aircraft carrier INS Vikrant to be handed over to Navy in May

The Cochin Shipyard Limited (CSL) will hand over India's first Indigenous Aircraft Carrier (IAC) which will be named 'INS Vikrant' to the Indian Navy next month. This was revealed by CSL Director (Technical) Bejoy Bhasker here on Thursday in a press conference held to announce the Shipyard's 50th anniversary. According to Bejoy, IAC will be out for the final sea trial in the next few weeks. "The final sea trial was scheduled for this month but faced a slight delay. We will hand over the IAC to Indian Navy next month after which the ship will take the name of INS Vikrant. India's first aircraft carrier will be commissioned on Independence Day in August this year," he said.

CSL officials said a new aircraft carrier of IAC specifications can be built by the shipyard in just five years. According to them, IAC is 60 per cent indigenously made, while the remaining 40 per cent of its components are imported "We have gained experience in the IAC project. If the Indian Navy asks us to bring out another aircraft carrier of 45,000-ton category like INS Vikrant, we can do it in five years. IAC uses ski-jump technology for launching the aircraft from the carrier. We can also make aircraft carriers that use the Electromagnetic aircraft launch system (EMALS) adopted in aircraft carriers of the US Navy. Similarly, we are expanding the capacity of our dry dock here and we can make an aircraft carrier of up to 70,000 tonnes now. We can also manufacture Jack-up rigs and LNG vessels here," Bejoy said.

CSL has obtained a contract for eight Anti-Submarine Warfare Shallow Water Crafts. CSL has been declared as the lowest bidder for the New Generation Missile Vessel (NGMV) project. Similarly, CSL will be handing over the remaining four ferries of the Kochi Water Metro by May or June this year. The first vessel was handed over to authorities a few months ago. "Covid has caused delays in completing the work for vessels of the water metro project. The components for the vessels had to arrive from 23 countries. The aluminium procured from a company in Australia had to be sent back due to issues regarding the certification given to the company. Similarly, a major challenge was regarding the technology used in the vessel which is the first of

its kind in the world. It is a hybrid system with both diesel and electrical generators used. Synchronising these two generators was the most difficult part in the manufacturing of the vessels," Bejoy said.

Regarding the manufacturing of more vessels for Kochi Water Metro, CSL officials said that specifications for the new vessels are yet to be revealed. "CSL can make big vessels like aircraft carriers to small boats here," he said.

CSL is expecting to complete the work for the International Ship Repair Facility (ISRF) at Wellington Island in Kochi by 2023. Major ships would be repaired at ISRF. CSL is also looking to tap the market for small-sized cruise vessels that can operate in inland waters. CSL has consistently achieved positive growth since 1994, the last year it witnessed negative growth. The gross income of CSL was Rs 3,012.76 crores in 2020-21 and net profit in the same period was Rs 610.10 crores. Its net worth in 2020-21 was Rs 3978 crores. The union government holds a 72.86 per cent stake in the company.

<https://www.newindianexpress.com/good-news/2022/apr/28/indias-first-indigenous-aircraft-carrier-ins-vikrant-to-be-handed-over-to-navy-in-may-2447580.html#:~:text=KOCHI%3A%20The%20Cochin%20Shipyard%20Limited,the%20Indian%20Navy%20next%20month.>

Science & Technology News

 **The Indian EXPRESS**

Thu, 28 Apr 2022

Mars probe discovers ‘shocking’ new aurora

At first glance, it looks just like our own northern lights on Earth. But this aurora is over 55 million kilometers (40 million miles) away on Mars. And the researchers who spotted it say it is something quite extraordinary — even “shocking.” The aurora was photographed by the Emirates Mars Mission (EMM) probe, Hope. Soon after Hope entered its orbit of Mars, the probe started imaging the planet’s auroras. The researchers decided to focus more closely on the planet’s so-called discrete auroras than originally planned.

“We knew we had unveiled [a] potential to make observations never before possible on this scale,” said EMM Science Lead Hessa Al Matroushi in a statement. Now, about a year later, the researchers say they have discovered a “huge, worm-like aurora that extends halfway around the Red planet” — one that has never been seen before. They are calling it a “sinuous discrete aurora.”

Auroras tell us about Mars’ atmosphere

One of Hope’s main objectives has always been to gather data on Mars’ atmosphere. And the images of the auroras on Mars are shedding new light on the atmosphere’s interactions with the planet’s magnetic fields and solar wind. The researchers say they want to provide data that will

help the international science community create a global weather map for Mars, understand the planet's weather cycles and track the movement of hydrogen and oxygen between the different layers of the atmosphere. Al Matroushi said they can scan almost the entire globe, capturing "synoptic snapshots" — images that provide a full overview of the planet — which will enable the researchers to investigate those atmospheric phenomena. "We are seeing discrete auroral effects on a massive scale and in ways we never anticipated," said the scientist.

Other auroras on Mars

Scientists have previously detected three types of auroras on Mars. First, there are diffuse auroras, which are produced by intense solar storms. Second, there are the discrete auroras, which Hope has been investigating since the start of its mission. Discrete auroras are produced by magnetized minerals embedded in the planet's crust. Diffuse and discrete auroras tend to be observed on Mars' nightside. That is the side of a planet that faces away from its star, and in Mars' case, that is Earth's sun. Then there are proton auroras, which are observed on Mars' dayside (the side facing the sun). Proton auroras appear to be a product of interactions between Mars' solar wind and hydrogen in the planet's exosphere — the outermost layer of a planet's atmosphere.

'Shocking:' Sinuous discrete aurora

And now we have this fourth type of aurora on Mars — the sinuous discrete aurora. The researchers say sinuous discrete auroras consist of "long worm-like streaks of energized electron emissions in the upper atmosphere." And they extend many thousands of kilometers from the dayside into the nightside of Mars. Rob Lillis of the University of California at Berkeley says they have made a "shocking discovery." Lillis is part of a team behind Hope's Emirates Mars Ultraviolet Spectrometer. "[It] has us scratching our heads and going back to the drawing board. We have ideas, but no solid explanation for why we are observing intense aurora of this shape and at planetary scales. We now have the opportunity to re-examine prior observations and unpick what is happening here," Lillis said in a statement.

The Emirates Mars Mission is the first of its kind to be launched by an Arab nation and one of three Mars missions that launched in 2020, including one by China. Hope completes one orbit of Mars every 55 hours and captures a full planetary data sample every nine days. Its mission is expected to run at least another year.

<https://indianexpress.com/article/technology/science/mars-probe-discovers-shocking-new-aurora-7891834/>



Fri, 29 Apr 2022

First Gaganyaan uncrewed module to be Injected in 170 x 408 km orbit; indicates human spaceflight profile

In a likely indication of the eventual human spaceflight (Gaganyaan) mission profile, ISRO has finalised several aspects of mission planning for the first uncrewed mission or G1 — planned for next year — which will see the launch vehicle inject the orbital module into a 170 X 408km

orbit reports Times News Network. The G1 mission will be followed by G2, the second uncrewed mission, both of which are precursors to the eventual human/crewed mission or H1 as named by ISRO. Just as H1, the G1 too will be launched by a Human-Rated GSLV-MK-III or the HRLV (Human-Rated Launch Vehicle). As per ISRO: “The specification for injection parameters for HRLV during G1 has been revised from 170 X 395 to 170 X 408 kilometre in order to ensure adequate propellant margin in the service module propulsion system.”

Also, the circularisation manoeuvre — for moving from an inserted orbit to a more circular orbit — is planned in the third orbit apogee (farthest point) instead of the fourth, in order to reduce the residency period of the perigee (closest point) to a lower altitude of 170km. ISRO said a mission interface committee is constituted to review and finalise all the data flow interfaces between participating entities or teams in the ground segment and added that different types of SNAP (separation) scenarios — various abort conditions — in the overall (including crewed) mission were identified for which different sequences of operations are worked out depending upon the separation scenario. “Mission plans for touchdown under nominal and contingency scenarios have been worked out. The corresponding communication network availability for different options was also worked out. Mission sequence documents for the descent phase in G1 mission have been finalised for on-board implementation,” ISRO said.

The mission sequence documents for the descent phase in G1 will be similar to the TV-D1 — the special test vehicle’s (TV) first demonstration (D1) mission. After TV-D1, which is expected later this year, ISRO will also launch TV-D2 and G1 and G2 are only scheduled for 2023. “Various touchdown locations for nominal descents, ascent phase aborts and on-orbit phase abortion have been worked out as per the latest mission plan and presented to the inter-agency committee for recovery operations (ICRO). The requirements for communication equipment on-board the recovery ships for ensuring real-time communication with the mission control centre have also been presented,” ISRO added. With the objectives and configuration for G1 having been defined and design of the orbital module — consisting crew module and service module — complete with all fabrication drawings having been generated, ISRO has begun procurement of raw materials and realisation of sub-assemblies.

“Propulsion system configuration has been finalised and realisation is in progress. System demonstration tests for qualification of the propulsion system have been initiated and five ground tests have been completed for the module propulsion system,” ISRO said. Also, HRLV design has been completed and hardware realisation is in the advanced stages both for stage systems and certain tests have been completed, while raw materials have been procured for a majority of the systems. “The realisation of three sets of hardware namely for qualification tests, TV-D1 mission and G1 is taken up parallelly,” ISRO said, adding that qualification tests for the crew escape system (CES) solid motors have been initiated and static tests of two motors have been completed.

<http://www.indiandefensenews.in/2022/04/first-gaganyaan-uncrewed-module-to-be.html>

Laser-based ultrasound detects defect-producing features in metal 3D printing

Lawrence Livermore National Laboratory (LLNL) researchers have developed a new all-optical ultrasound technique capable of performing on-demand characterization of melt tracks and detecting formation of defects in a popular metal 3D printing process. In a paper published by *Scientific Reports*, lab researchers propose a diagnostic using surface acoustic waves (SAW), generated by laser-based ultrasound, that can reveal tiny surface and sub-surface defects in laser powder bed fusion (LPBF) metal 3D-printing. The team reported the system they developed can effectively and accurately evaluate laser melt lines—the tracks where the laser liquifies metal powder in LPBF printing—by scattering acoustic energy from melt lines, voids and surface features that can be quickly detected. The team validated the findings using optical microscopy and X-ray computed tomography (CT).

"We hope that this work demonstrates the potential for an all-optical ultrasound system capable of rapid, on-demand in situ characterization of LPBF processes and powders," said LLNL engineer and principal investigator David Stobbe. "The demonstrated laser-based ultrasound, surface acoustic wave system showed excellent sensitivity to surface and near-surface features, including breaks in the LPBF melt line, metal surface splatter and subsurface air voids." Surface acoustic waves have historically been used to characterize surface and near-surface features such as cracks, pits and welds in engineering materials, and are used in geology—at a much larger length scale—for detecting subterranean features such as caves. Due to their surface and near-surface sensitivity, SAWs are well-suited for characterizing melt lines in LPBF printing, according to researchers.

To test this potential, the LLNL team carried out experiments by producing laser melted lines using a fiber laser directed into a vacuum chamber and produced samples of titanium alloy for analysis with 100-watt, 150-watt and 350-watt powered lasers. Next, they developed a method for producing and detecting surface acoustic waves, using a pulsed laser to generate ultrasound and measured the displacement with a photorefractive laser interferometer. The team also performed simulations to inform the experimental measurements and assist with interpreting the results. They simulated and measured the displacement from the pulsed laser and showed scattering from the melt line, as well as breaks in the melt line, metal splatter adjacent to the melt line and subsurface air voids under the melt line. The team measured the same features experimentally and observed excellent agreement between simulation and experiment.

The results from laser-based ultrasound (LBU) experiments were validated with optical microscopy, for the surface features, and X-ray computed tomography for the sub-surface features. Researchers reported that in comparison with X-ray CT, the LBU system is "better posed to perform real-time inspection and can acquire and process data at a faster rate." "Utilizing the laser-based ultrasound significantly shortened the time for subsurface void detection compared to conventional X-ray CT from days to minutes," said LLNL engineer and lead author Kathryn Harke. "While more development would need to be done before

implementation of this diagnostic for in-process monitoring, our team is excited by these initial findings."

Lab researchers said while the method is well-suited for in situ implementation in LPBF printing, there are limits on the size and depth of detectable voids, and in situ monitoring or post-build inspection would require further development."A system like this may find use for rapidly qualifying new LPBF machines and in-service machines after changes to metal powder feedstock or modifications to the melt laser power or scan speed," Stobbe said. Laboratory co-authors included Joe Tringe, who conceived of the idea and the LDRD project, and Nick Calta, who designed the LPBF samples and performed optical microscopy.

<https://phys.org/news/2022-04-laser-based-ultrasound-defect-producing-features-metal.html>



Thu, 28 Apr 2022

How can we reduce the carbon footprint of global computing?

The voracious appetite for energy from the world's computers and communications technology presents a clear threat for the globe's warming climate. That was the blunt assessment from presenters in the intensive two-day Climate Implications of Computing and Communications workshop held on March 3 and 4, hosted by MIT's Climate and Sustainability Consortium (MCSC), MIT-IBM Watson AI Lab, and the Schwarzman College of Computing. The virtual event featured rich discussions and highlighted opportunities for collaboration among an interdisciplinary group of MIT faculty and researchers and industry leaders across multiple sectors — underscoring the power of academia and industry coming together.

"If we continue with the existing trajectory of compute energy, by 2040, we are supposed to hit the world's energy production capacity. The increase in compute energy and demand has been increasing at a much faster rate than the world energy production capacity increase," said Bilge Yildiz, the Breene M. Kerr Professor in the MIT departments of Nuclear Science and Engineering and Materials Science and Engineering, one of the workshop's 18 presenters. This computing energy projection draws from the Semiconductor Research Corporations's decadal report. To cite just one example: Information and communications technology already account for more than 2 percent of global energy demand, which is on a par with the aviation industries emissions from fuel. "We are the very beginning of this data-driven world. We really need to start thinking about this and act now," said presenter Evgeni Gousev, senior director at Qualcomm.

Innovative energy-efficiency options

To that end, the workshop presentations explored a host of energy-efficiency options, including specialized chip design, data center architecture, better algorithms, hardware modifications, and changes in consumer behavior. Industry leaders from AMD, Ericsson, Google, IBM, iRobot, NVIDIA, Qualcomm, Tertill, Texas Instruments, and Verizon outlined their companies' energy-

saving programs, while experts from across MIT provided insight into current research that could yield more efficient computing. Panel topics ranged from “Custom hardware for efficient computing” to “Hardware for new architectures” to “Algorithms for efficient computing,” among others.

The goal, said Yildiz, is to improve energy efficiency associated with computing by more than a million-fold. “I think part of the answer of how we make computing much more sustainable has to do with specialized architectures that have very high level of utilization,” said Darío Gil, IBM senior vice president and director of research, who stressed that solutions should be as “elegant” as possible.

For example, Gil illustrated an innovative chip design that uses vertical stacking to reduce the distance data has to travel, and thus reduces energy consumption. Surprisingly, more effective use of tape — a traditional medium for primary data storage — combined with specialized hard drives (HDD), can yield a dramatic savings in carbon dioxide emissions. Gil and presenters Bill Dally, chief scientist and senior vice president of research of NVIDIA; Ahmad Bahai, CTO of Texas Instruments; and others zeroed in on storage. Gil compared data to a floating iceberg in which we can have fast access to the “hot data” of the smaller visible part while the “cold data,” the large underwater mass, represents data that tolerates higher latency. Think about digital photo storage, Gil said. “Honestly, are you really retrieving all of those photographs on a continuous basis?” Storage systems should provide an optimized mix of HDD for hot data and tape for cold data based on data access patterns.

Bahai stressed the significant energy saving gained from segmenting standby and full processing. “We need to learn how to do nothing better,” he said. Dally spoke of mimicking the way our brain wakes up from a deep sleep, “We can wake [computers] up much faster, so we don't need to keep them running in full speed.” Several workshop presenters spoke of a focus on “sparsity,” a matrix in which most of the elements are zero, as a way to improve efficiency in neural networks. Or as Dally said, “Never put off till tomorrow, where you could put off forever,” explaining efficiency is not “getting the most information with the fewest bits. It's doing the most with the least energy.”

Holistic and multidisciplinary approaches

“We need both efficient algorithms and efficient hardware, and sometimes we need to co-design both the algorithm and the hardware for efficient computing,” said Song Han, a panel moderator and assistant professor in the Department of Electrical Engineering and Computer Science (EECS) at MIT. Some presenters were optimistic about innovations already underway. According to Ericsson’s research, as much as 15 percent of the carbon emissions globally can be reduced through the use of existing solutions, noted Mats Pellbäck Scharp, head of sustainability at Ericsson. For example, GPUs are more efficient than CPUs for AI, and the progression from 3G to 5G networks boosts energy savings. “5G is the most energy efficient standard ever,” said Scharp. “We can build 5G without increasing energy consumption.”

Companies such as Google are optimizing energy use at their data centers through improved design, technology, and renewable energy. “Five of our data centers around the globe are operating near or above 90 percent carbon-free energy,” said Jeff Dean, Google's senior fellow and senior vice president of Google Research.

Yet, pointing to the possible slowdown in the doubling of transistors in an integrated circuit — or Moore’s Law — “We need new approaches to meet this compute demand,” said Sam Naffziger, AMD senior vice president, corporate fellow, and product technology architect. Naffziger spoke of addressing performance “overkill.” For example, “we’re finding in the gaming and machine learning space we can make use of lower-precision math to deliver an image that looks just as good with 16-bit computations as with 32-bit computations, and instead of legacy 32b math to train AI networks, we can use lower-energy 8b or 16b computations.” Other presenters singled out compute at the edge as a prime energy hog.

“We also have to change the devices that are put in our customers’ hands,” said Heidi Hemmer, senior vice president of engineering at Verizon. As we think about how we use energy, it is common to jump to data centers — but it really starts at the device itself, and the energy that the devices use. Then, we can think about home web routers, distributed networks, the data centers, and the hubs. “The devices are actually the least energy-efficient out of that,” concluded Hemmer. Some presenters had different perspectives. Several called for developing dedicated silicon chipsets for efficiency. However, panel moderator Muriel Medard, the Cecil H. Green Professor in EECS, described research at MIT, Boston University, and Maynooth University on the GRAND (Guessing Random Additive Noise Decoding) chip, saying, “rather than having obsolescence of chips as the new codes come in and in different standards, you can use one chip for all codes.”

Whatever the chip or new algorithm, Helen Greiner, CEO of Tertill (a weeding robot) and co-founder of iRobot, emphasized that to get products to market, “We have to learn to go away from wanting to get the absolute latest and greatest, the most advanced processor that usually is more expensive.” She added, “I like to say robot demos are a dime a dozen, but robot products are very infrequent.” Greiner emphasized consumers can play a role in pushing for more energy-efficient products — just as drivers began to demand electric cars. Dean also sees an environmental role for the end user.

“We have enabled our cloud customers to select which cloud region they want to run their computation in, and they can decide how important it is that they have a low carbon footprint,” he said, also citing other interfaces that might allow consumers to decide which air flights are more efficient or what impact installing a solar panel on their home would have. However, Scharp said, “Prolonging the life of your smartphone or tablet is really the best climate action you can do if you want to reduce your digital carbon footprint.”

Facing increasing demands

Despite their optimism, the presenters acknowledged the world faces increasing compute demand from machine learning, AI, gaming, and especially, blockchain. Panel moderator Vivienne Sze, associate professor in EECS, noted the conundrum. “We can do a great job in making computing and communication really efficient. But there is this tendency that once things are very efficient, people use more of it, and this might result in an overall increase in the usage of these technologies, which will then increase our overall carbon footprint,” Sze said. Presenters saw great potential in academic/industry partnerships, particularly from research efforts on the academic side. “By combining these two forces together, you can really amplify the impact,” concluded Gousev.

<https://news.mit.edu/2022/how-can-we-reduce-carbon-footprint-global-computing-0428>

