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

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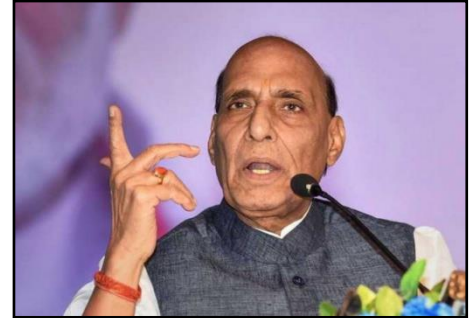
Wed, 03 Nov 2021

India to showcase achievements of defence research and development at Defence Expo, says Rajnath Singh

By Nikesh Mandal

New Delhi: Union Defence Minister Rajnath Singh on Monday said "the next edition of the Defence Expo will show what India has the potential to achieve by implementing modern technologies for defence research and development, production and military use". He also said that the 12th edition of India's largest defence exhibition of Defence Expo will be held in Gandhinagar, Gujarat from March 11-13 in 2022.

Addressing a meeting of ambassadors at the upcoming expo, Defence Minister Rajnath Singh said that India's defence exports have increased by 334 per cent in the last five years and India is now exporting military equipment to more than 75 countries. He said, 'Our export performance is a strong sign of the quality and competitiveness of our defence products.' He further added that he hopes that the exhibition will bring all modern technologies under one roof and provide innumerable opportunities to parties in the aerospace and defence industry.



The Defence Minister said, "The Defence Expo-2022 is going to show what India can achieve by implementing defence R&D and production, modern technologies, liberal collaborative policies. We have introduced these policies for a short period of five to seven years.

<https://english.newstracklive.com/news/rajnath-singh-said--india-will-show-achievements-of-defense-research-and-development-at-defense-expo-mc23-nu764-ta328-1189128-1.html>

Defence | Agni V is a real game changer in the regional strategic scenario

The DRDO must take the Agni programme to the logical next step: the development of a full-fledged ICBM with a range of 8,000 kilometres or more

By Prakash Chandra

The successful testing of the surface-to-surface Intermediate Range Ballistic Missile (IRBM), Agni-V, from APJ Abdul Kalam Island in Odisha on October 27 brings India closer to developing the Inter-Continental Ballistic Missile (ICBM) technology. The test-firing of the missile was conducted by its user agency, the tri-service Strategic Forces Command.



Representative image

The Agni-V has a range of 5000 kilometres, which is 500 kilometres short of an ICBM's range of 5,500 kilometres. Only a handful of countries in the world like the United States, Russia, China, France, Britain,

and — unofficially — Israel have the ICBMs in their arsenals. Not that nomenclature would be weighing heavily on the minds of India's defence planners as they celebrate this remarkable achievement.

At launch, the Agni-V's three-stage, solid fuel-engine powers it to an altitude of 500 kilometres before it follows a ballistic trajectory, traversing one-eighth of Earth's circumference of more than 40,000 kilometres in 20 minutes. This enables Agni-V to reach, and hit targets anywhere in Asia and Europe with great accuracy. As the Agni-V is canisterised, it is easy to store, and can be fired from mobile launchers, and trains from anywhere in the subcontinent, which makes it highly manoeuvrable, and hard to track by enemy missiles.

The Agni-V's Multiple Independently-Targeted Re-entry Vehicle (MIRV) capability also makes it an ideal test-bed for more powerful variants of the missile. A MIRV weapon consists of a number of nuclear warheads carried on a single ICBM, each warhead zeroing in on a separate target. It is extremely difficult for air defence systems to shoot down MIRV targets than to intercept single missiles. To further reduce the odds of MIRV warheads being intercepted, decoy re-entry vehicles can also be deployed. India's 'no first use' nuclear policy is based on second-guessing a full-fledged nuclear strike which could destroy most of the enemy's nuclear arsenal. MIRVs form a key second line of defence in such a scenario.

Taking into account India's potential strategic threats that lie within a range of 5,000 kilometres, the Agni-V has been developed with a China-centric focus, and is meant for an eastward launch rather than a westward one. The threat from Pakistan to the west is to be tackled by the Agni-Prime (Agni-P) variant that was test flown last June. Also canisterised, the Agni-P has a range of 2,000-kilometres, and it is earmarked for replacing the Prithvi, Agni I and Agni II missiles that were developed more than 20 years ago. The 3,000-kilometre range of Agni III and Agni IV covers only parts of China, and cannot target many Chinese strategic locations.

India began its indigenously-designed integrated guided missile development programme (IGMDP) in the early 1980s, and successfully developed the Prithvi, Akash, Nag, Trishul, and Agni series of missiles. But the Prithvi's maiden launch in 1988, followed by the Agni test three years later, caused exaggerated jitters in the west that led to the US and its allies imposing technology sanctions on India under the Missile Technology Control Regime (MTCR).

Washington and other western capitals alleged that India adapted its civilian satellite launch vehicle to build the Agni medium-range ballistic missile. While this was a serious setback for the Agni programme, Indian defence planners promptly responded by pooling the resources of the Defence Research and Development Organisation (DRDO) to make all the restricted missile components indigenously: one of the first 'Make in India' initiatives in the defence sector.

After Agni-III was unveiled in 2006, New Delhi decided to cap the IGMDF. The reasoning was that India needed to build only missiles with a range of around 5,500 kilometres, which was enough to target the whole of China — anything more than that would be redundant. But as it happened, this reduced the elbow room for India's defence planners to effectively adjust to the evolving regional strategic calculus.

So in hindsight, New Delhi did well to eventually reverse its earlier decision to let the crucial Agni programme drift. A powerful long range missile like the Agni-V is vital for giving credibility to India's deterrence posture. As the Ministry of Defence said in a statement last week, "The successful test of Agni-V is in line with India's stated policy to have credible minimum deterrence that underpins the commitment to no first use."

But for that to happen, the DRDO must take the Agni programme to the logical next step: the development of a full-fledged ICBM with a range of 8,000 kilometres or more. From all accounts, the next avatar of Agni-V, the Agni-VI, is already on the drawing board, and is expected to have that range.

Any deterrence posture which does not include global-range missiles such as ICBMs would merely give India a sub-strategic deterrent capability. India's security constraints today call for nothing short of powerful missiles, and these missiles are instruments of deterrence only when they carry what they are supposed to counter — weapons of mass destruction.

In that sense, Agni-V represents a real game changer in the regional strategic scenario.

<https://www.moneycontrol.com/news/opinion/defence-agni-v-is-a-real-game-changer-in-the-regional-strategic-scenario-7670131.html>

Top 10 Artificial Intelligence research centers in India to work with

By Disha Sinha

India has recognized the power of cutting-edge technologies such as artificial intelligence to boost productivity and enhance the domestic economy. The Government of India has started allocating an annual budget worth millions of dollars for the investment in artificial intelligence research and development. This has motivated groups of scientists and researchers to build artificial intelligence research centres or AI labs to promote this technology field in India. The youths are highly interested to join reputed AI research centres in India to contribute to this advanced field for the welfare of the country. AI research is thriving in the last few years and several educational institutes have started providing specializations in artificial intelligence. Let's explore the top ten artificial intelligence research centres in India to work with a proper team for R&D.



Top 10 artificial intelligence research centres in India

Robert Bosch Centre for Data Science and AI at IIT Madras

Robert Bosch Centre for Data Science and AI at IIT Madras is set to work on multiple projects by leveraging data science and artificial intelligence with the largest network analytics, NLP, deep learning, and many more. This artificial intelligence research centre has the vision to become a globally known centre for AI research as well as data science research with cutting across disciplines to create a significant impact on India.

NV AI Centre at IIT Hyderabad

NVIDIA has established the first-ever NV AI Centre at IIT Hyderabad to boost AI research on artificial intelligence and commercial applications. This is one of the top artificial intelligence research centres in India where IIT Hyderabad has procured three NVIDIA DGX-1™ systems and two NVIDIA DGX-2™ systems. This AI research is focused on accelerating work on multiple areas of AI.

Intel AI Research Centre at IIT Hyderabad

Intel AI Research Centre is collaborating between Intel India and IIT Hyderabad to apply artificial intelligence to scale problems in India and solve multiple challenges in the healthcare and smart mobility sectors. Intel has recognized the potential of AI in India and built an artificial intelligence research centre to train students on essential AI skills. It is a key milestone in the digitalization journey with advanced AI research.

AI Innovation Hub at Accenture

Accenture is well-known for providing one of the top artificial intelligence research centres in India in three cities— Bengaluru, Hyderabad, and Pune. This AI Innovation Hub provides access to AI research, labs, studios, and many more to innovation centres and delivery centres with real-life innovation. It also consists of advanced technology centres to deliver innovation through the power of the cloud, automation, artificial intelligence, blockchain, and many more. The AI lab helps to operate at the intersection of business and technology to meet customer satisfaction efficiently and effectively.

AI Research Lab at Wipro with IISc

AI Research Lab at Wipro is one of the top artificial intelligence research centres in India focused on healthcare diagnostics, machine learning, artificial intelligence, and deep learning technology. This AI lab is also set to work on digital interfaces to generate sophisticated diagnostic, ophthalmology imaging, and medical image reconstruction techniques efficiently and effectively. The researchers want to help the healthcare sector and doctors enhance patient outcomes with artificial intelligence. IISc is also a well-known educational institution for advanced scientific as well as a technology research lab in India.

SCAI by Microsoft Research India

The Centre for Societal impact through Cloud and Artificial Intelligence (SCAI) is launched by Microsoft Research India for creating and validating technologies to have a large-scale impact on India. The AI research centre is dedicated to providing access to researchers and expertise from Microsoft Research and other groups in the company. It is focused on providing financial grants and complete access to top-notch Microsoft researchers. It is known for working with Navana Tech to build text-free and voice-assisted technology.

Philips Innovation Centre in Bengaluru

Philips Innovation Centre in Bengaluru is focused on taking India's AI products to the global tech market. This AI research centre helps to transform ideas on artificial intelligence and machine learning into viable and tangible products to improve the economy of India efficiently and effectively. There are more than 2,500 researchers, doctors, engineers, data scientists, and software developers who are focused on healthcare transformation services. This AI lab has created a global innovation hub and a health tech platform to boost productivity and yield more revenue.

DAIR at IIT Delhi

Data Analytics and Intelligence Research at IIT Delhi is a well-known AI research group focused on combining as well as integrating multiple fields of data science and artificial intelligence to build intelligent software systems. The AI research centre helps to build applications of different national and international importance with solutions to fundamental scientific questions. IIT Delhi has started offering specialized courses on artificial intelligence at different levels.

CFILT Lab at IIT, Bombay

The Center for Indian Language Technology (CFILT) is one of the top AI labs in India that was set up with a generous grant from the Department of IT, Government of India in 2000 at IIT Bombay. There are around 30 research members in CFILT for PhD, Master's, Bachelors and many more with multiple stresses on semantics to research in lexical resources, shallow parsing, machine translation, cognitive NLP, and many more with the integration of artificial intelligence and NLP.

CAIR at DRDO, Ministry of Defence, Government of India

The Centre for Artificial Intelligence and Robotics (CAIR) is one of the top artificial intelligence research centres in India focused on R&D in cutting-edge technologies like artificial intelligence, robotics, and information and communication security. The AI research leads to the development of mission-critical products for battlefield secure communication and information management systems. The AI lab is focused on leveraging the developments in cognitive and AI systems for achieving increased autonomy in unmanned systems.

<https://www.analyticsinsight.net/top-10-artificial-intelligence-research-centers-in-india-to-work-with/>

China's hypersonic missile test got US, India racing. It exposes BMD vulnerability

What happens when initial nuclear weapons are fired? India must realise hypersonic missile is part of a larger power chase

By Lt General Prakash Menon, Edited by Humra Laeeq

China has carried out a test of a new space capability with a hypersonic missile, as reported first by *The Financial Times*. The test was supposedly carried out secretly in August 2021. The report relied on experts of the US intelligence community and could be a deliberate leak. It managed to touch the most sensitive cord of any nation's strategic community—potential vulnerability.

A barrage of commentaries soon littered the information landscape. It mattered little that the development did not create a vulnerability in the Ballistic Missile Defence (BMD) of the US or any other nation that is deploying it. The vulnerability already existed, and all the efforts of creating a BMD system have been chasing their tail since 2001—when the US had unleashed the BMD arms race as it withdrew from the 1972 Ballistic Missile Defense Treaty with the Soviet Union. *The Financial Times* report indicated that the US has now been disadvantaged by China's technological progress. It sits easily with the larger narrative of Beijing's growing technological and military capability.



File photo | Flags of the US and China fly along Pennsylvania Avenue in Washington | D.C Andrew Harrer/Bloomberg

Weakening of mutual vulnerability

One ought to read the article '*Cool Your Jets: Some Perspective on the Hying of Hypersonic Weapons*' published by *The Bulletin* of the Atomic Scientists in January 2020 to understand the barrage of hype that the report has now unleashed. The reality is that the development of the offensive capability to penetrate the BMD has continued to outpace its capability to defend.

The White House Statement of the George W. Bush administration, on the occasion of the withdrawal in 2002, is revealing—"With the treaty now behind us, our task is to develop and deploy effective defences against limited missile attacks. As the events of September 11 made clear, we no longer live in the Cold War world for which the ABM Treaty was designed. We now face new threats from terrorists who seek to destroy our civilization by any means available to rogue states armed with weapons of mass destruction and long-range missiles. Defending the American people against these threats is my highest priority as commander-in-chief."

The 1972 BMD Treaty was the outcome of sanity catching up with the unbridled nuclear arms race. It acknowledged mutual vulnerability as the pivot of strategic stability. The premise of the Treaty was that if any party constructed a BMD for protection, it would trigger the buildup of offensive capability by others and a perennial offensive-defensive arms race would ensue. The Treaty permitted the development of defences against short and medium-range ballistic missiles.

The attack on the World Trade Center in 2001 introduced the need to protect against terrorists who might come into the possession of missile capabilities. The urge to defend against the terrorist threat weakened the cornerstone of strategic stability—mutual vulnerability. Development of a plethora of missile defence systems ensued. But none of the systems has been able to provide any degree of assurance of protection. The development of offence capabilities has always been ahead of protection against it. The attack on one of Saudi Arabia's most critical oil facilities in September 2019 was indicative of the vulnerability of defence even against subsonic cruise missiles.

In 2018, Vladimir Putin announced the deployment of hypersonic weapons that were invulnerable to the US' defences. He noted that the developments were specifically carried out as a response to America's abrogation of the BMD. China has now joined the race. The US, especially with its military arms, has for long been the votary of hypersonic vehicles. With developments in Russia and China, the Pentagon's budget request for hypersonic-related research has been soaring. The race is on, and it still remains a chase of one's own tail. The chase is complicated further by the deliberate reach for ambiguity regarding the payload, which could be either conventional or nuclear.

India must remain in the race

India is also in the race. According to reports, it is developing a dual-capable hypersonic cruise missile as part of its Hypersonic Technology Demonstrator Vehicle programme. India had successfully tested a Mach 6 Scramjet in June 2019 and September 2020. Before that, in early 2000, after the Kargil conflict, the country had launched a programme to develop a BMD system that aimed to defend against threats from Pakistan. Recent reports have described its deployment. The acquisition of the S-400 Triumf from Russia and its operationalisation in a couple of years will augment India's BMD capability.

India has not had much choice in joining the race to protect itself from ballistic and cruise missiles. But it should be wary of the limitations of its efforts, as the ability to overpower the defence systems will remain the state of nature category. India must arguably be in the race till sanity returns from an impossible task, and an international dialogue attempts to arrest the present madness of seeking vulnerability in the name of strengthening deterrence.

India must balance capability demonstration with the outgo of scarce fiscal resources. It must view the international developments in missile capability as part of the ongoing dialogue of deterrence between nuclear powers. The dialogue is, in essence, an exchange that carries the message that 'Any nuclear strike will be responded to and your defences will not be able to protect you.' It is also the dialogue of the deaf, as everyone knows that there is no answer to the question—'What happens after the initial nuclear weapons are fired?' This has been the tale of the nuclear strategy chase that has been timelessly disproportionate to the efforts expended. Hypersonic vehicles are merely the offspring of that chase.

Lt Gen (Dr) Prakash Menon is the Director Strategic Studies Programme, Takshashila Institution, Bangalore and former Military Adviser, National Security Council Secretariat. He tweets @prakashmenon51. Views are personal.

<https://theprint.in/opinion/chinas-hypersonic-missile-test-got-us-india-racing-it-exposes-bmd-vulnerability/760091/>



Press Information Bureau
Government of India
Ministry of Defence

Tue, 02 Nov 2021 1:55PM

Defence Acquisition Council, headed by Raksha Mantri Shri Rajnath Singh, approves proposals worth Rs 7,965 crore for Armed Forces modernisation under ‘Make in India’

Key highlights:

- *Approval for procurement of 12 Light Utility Helicopters from HAL*
- *Lynx U2 Fire Control System from BEL to enhance detection tracking and engagement capabilities of Naval war ships*
- *Approval for Mid Life Upgradation of Dornier Aircraft from HAL to increase Naval capacity of coastal surveillance*
- *Global procurement case of Naval guns foreclosed; Guns’ quantity added to upgraded Short Range Gun Mount being manufactured by BHEL*

The Defence Acquisition Council (DAC), in its meeting of November 02, 2021 held under the chairmanship of Raksha Mantri Shri Rajnath Singh, accorded Acceptance of Necessity (AoN) for capital acquisition proposals for modernisation and operational needs of the Armed Forces amounting to Rs 7,965 crore. All of these proposals (100%) are under ‘Make in India’ with focus on design, development and manufacturing in India.

Key approvals of procurement from domestic sources include twelve Light Utility Helicopters from Hindustan Aeronautics Limited (HAL); Lynx U2 Fire Control System from Bharat Electronics Limited (BEL) which will enhance the detection tracking and engagement capabilities of Naval war ships and Mid Life Upgradation of the Dornier Aircraft from HAL to increase the Naval capacity of maritime reconnaissance and coastal surveillance.

As a further impetus to ‘Aatmanirbhar Bharat’, a global procurement case of Naval guns has been foreclosed with these guns’ quantity added to the upgraded Super Rapid Gun Mount (SRGM) being manufactured by Bharat Heavy Electricals Limited (BHEL). These SRGMs provide niche capabilities of engaging fast manoeuvring targets using guided munitions & range extensions and are to be fitted on the warships of the Indian Navy.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1768857>



पत्र सूचना कार्यालय
भारत सरकार
रक्षा मंत्रालय

Tue, 02 Nov 2021 1:55PM

रक्षा मंत्री श्री राजनाथ सिंह की अध्यक्षता वाली रक्षा अधिग्रहण परिषद ने 'मेक इन इंडिया' के तहत सशस्त्र बलों के आधुनिकीकरण के लिए 7,965 करोड़ रुपये के प्रस्तावों को मंजूरी दी

प्रमुख बिंदु:

- एचएएल से 12 लाइट यूटिलिटी हेलीकॉप्टरों की खरीद को मंजूरी
- बीईएल का लिक्स यू 2 फायर कंट्रोल सिस्टम नौसेना के युद्ध पोतों की आग का पता लगाने संबंधी क्षमताओं में वृद्धि करेगा
- तटीय निगरानी की नौसैनिक क्षमता बढ़ाने के लिए एचएएल से डोर्नियर विमानों के मिड लाइफ अपग्रेडेशन को मंजूरी
- नौसेना गन्स की वैश्विक खरीद का मामला बंद; बीएचईएल द्वारा निर्मित उन्नत शॉर्ट रेंज गन माउंट में गन्स जोड़ी गई

रक्षा अधिग्रहण परिषद (डीएसी) ने 02 नवंबर, 2021 को रक्षा मंत्री श्री राजनाथ सिंह की अध्यक्षता में आयोजित अपनी बैठक में सशस्त्र बलों की आधुनिकीकरण और अभियानगत आवश्यकताओं के लिए 7,965 करोड़ रुपये के पूंजी अधिग्रहण प्रस्तावों के लिए आवश्यकता की स्वीकृति (एओएन) को मंजूरी प्रदान कर दी। ये सभी प्रस्ताव (100%) भारत में डिजाइन, विकास और निर्माण पर फोकस के साथ 'मेक इन इंडिया' के तहत हैं।

घरेलू स्रोतों से खरीद की प्रमुख मंजूरी में हिंदुस्तान एयरोनॉटिक्स लिमिटेड (एचएएल) से बारह लाइट यूटिलिटी हेलीकॉप्टर; भारत इलेक्ट्रॉनिक्स लिमिटेड (बीईएल) से लिक्स यू2 फायर कंट्रोल सिस्टम, जो नौसेना के युद्ध पोतों की आग का पता लगाने संबंधी क्षमताओं में वृद्धि करेगा तथा एचएएल से डोर्नियर एयरक्राफ्ट के मिड लाइफ अपग्रेडेशन की मंजूरी शामिल है।

'आत्मनिर्भर भारत' अभियान को एक और प्रोत्साहन के रूप में भारत हेवी इलेक्ट्रिकल्स लिमिटेड (बीएचईएल) द्वारा निर्मित किए जा रहे उन्नत सुपर रैपिड गन माउंट (एसआरजीएम) में जोड़े गए इन तोपों की मात्रा के साथ नौसेना तोपों की वैश्विक खरीद के मामले को बंद कर दिया गया है। ये एसआरजीएम निर्देशित युद्ध सामग्री और रेंज एक्सटेंशन का उपयोग करके तेजी से युद्धाभ्यास लक्ष्यों को प्राप्त करने की विशिष्ट क्षमताएं प्रदान करते हैं और इन्हें भारतीय नौसेना के युद्धपोतों पर फिट किया जाना है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1769033>

Theaterisation of forces expedited, deadline advanced

The department of military affairs (DMA), headed by chief of defence staff (CDS) General Bipin Rawat, has asked the three services to expedite their ongoing studies on the creation of theatre commands, and submit comprehensive reports within six months, officials familiar with the developments said on Tuesday on the condition of anonymity

By Rahul Singh

New Delhi: The department of military affairs (DMA), headed by chief of defence staff (CDS) General Bipin Rawat, has asked the three services to expedite their ongoing studies on the creation of theatre commands, and submit comprehensive reports within six months, officials familiar with the developments said on Tuesday on the condition of anonymity.

The deadline for submitting reports focusing on finalising the joint structures has been advanced from September 2022 to April 2022, one of the officials said.

On Monday, Rawat held a meeting with the three service chiefs and top three-star officers, who are conducting the studies, to chart out a road map to accelerate the theaterisation plan, said a second official.

The current theaterisation model seeks to set up four new integrated commands — two land-centric theatres, an air defence command, and a maritime theatre command — to best utilise the military's resources for future wars and operations. The creation of theatre commands could take up to two years, the second official said.

Theaterisation refers to placing specific units of the army, the navy and the air force under a theatre commander. Such commands are to be led by an officer from any of the three services, depending on the roles assigned to them.

The earlier India sets up theatre commands, the better, said Lieutenant General Vinod Bhatia (retd), former director, Centre for Joint Warfare Studies (CENJOWS). "Setting a deadline for theaterisation is critical as delay will only cause disruption. We need to optimise our combat effectiveness in view of the emerging geostrategic equations," Bhatia added.

In June 2021, the government formed an eight-member panel under CDS to fine-tune the theaterisation plans and bring all stakeholders on board, especially IAF, for speedy roll-out of the new joint structures.

IAF's earlier reservations to the move revolved around asset split, leadership and dilution of the powers of the service chiefs. However, on October 5, IAF chief Air Chief Marshal Vivek Ram Chaudhari said that the air force was fully committed to tri-service integration and its concerns about the theaterisation model had been factored into the planning process. He hoped that the new structures would cater for joint planning of operations at all levels.

The armed forces currently have 17 single-service commands spread across the country, apart from the tri-service Andaman and Nicobar Command and the Strategic Forces Command. The army and IAF have seven commands each, while the navy has three. Creating theatres would involve merging the existing commands (except the Northern Command).



In June 2021, the government formed an eight-member panel under CDS to fine-tune the theaterisation plans and bring all stakeholders on board. (PTI file photo)

The army's Udhampur-based Northern Command is the only single-service command that will stay outside the scope of the military's theaterisation drive due to its unique role. It is responsible for guarding the country's borders with Pakistan and China in the north, and is also the nerve centre of counterterrorism operations in Jammu and Kashmir.

<https://www.hindustantimes.com/india-news/theaterisation-of-forces-expedited-deadline-advanced-101635878031046.html>



Wed, 03 Nov 2021

Army's Southern Command launches first regional technology node

The event was organised by Southern Command Headquarters in conjunction with the SIDM, a not-for-profit association that plays the role of an advocate, catalyst, and facilitator for the growth and capability-building of the defence industry in India.

Pune: To boost indigenous defence production and facilitate interaction with industry, Indian Army's Southern Command formally launched the first Regional Technology Node (RTN) in Pune at an event held Tuesday. It also included conduct of a start-up forum by the Society of Indian Defence Manufacturers (SIDM).

The event was organised by Southern Command Headquarters in conjunction with the SIDM, a not-for-profit association that plays the role of an advocate, catalyst, and facilitator for the growth and capability-building of the defence industry in India.

The event was live-streamed and attended by heads and representatives of more than 100 industries, start-ups and Army establishments from across the country. Delivering the Keynote Address, Southern Army Commander Lt Gen J S Nain emphasised on the timely absorption of cutting-edge technologies for military modernisation, achieving self-reliance in defence manufacturing and the role of Indian industry in the same. He exhorted the industry to come forward with their proposals and become a partner in the process.

"Keeping in step with Atmanirbharata and Make in India push of the government, the Ministry of Defence and the Army have taken large strides in indigenisation of defence equipment with the aim of reducing dependency on foreign suppliers and eventually emerge as an export hub for defence goods. With the Launch of the RTN at Pune, the reach of Army Design Bureau has been extended to the tech hubs of the Southern region. This will encourage industries, MSMEs and start-ups to come forward & propose solutions for the Army's modernisation requirements," read a press statement from the Indian Army.

<https://indianexpress.com/article/cities/pune/armys-southern-command-launches-first-regional-technology-node-7604940/>

HAL choppers get defence ministry nod in bid to replace Cheetah & Chetak, Kamov hangs in balance

The 12 helicopters, six each for the Army and the IAF, will be delivered in August 2022.

By Snehash Alex Philip

New Delhi: The Ministry of Defence Tuesday approved the procurement of 12 Light Utility Helicopters (LUH) from state-run Hindustan Aeronautics Ltd (HAL), a government statement said. The move will finally pave the way for the replacement of the ageing Cheetah and Chetak fleet of choppers.

These 12 new choppers will come under a limited series production configuration even as India's overall demand for LUHs, meant for transportation of men and supplies to high-altitude areas besides evacuation and reconnaissance, is estimated to be over 400.

While HAL is expected to meet at least half the total requirement, Indo-Russian Helicopters Ltd (IRGL), a joint venture between HAL and two Russian firms, Russian Helicopters and Rosoboronexport, will meet the rest. IRGL will manufacture Russian Kamov 226T helicopters in India.

However, the agreement for this joint venture product, which was the Modi's government's first government-to-government deal in 2015, hangs in balance over indigenous content and cost.

HAL's own project to supply the armed forces with LUH is expected to gather steam as the approval by the Defence Acquisition Council, which is headed by Defence Minister Rajnath Singh, paves the way for a formal contract.

Sources in the defence and security establishment told ThePrint that the nod for 12 choppers, six each for the Army and the Indian Air Force, looks small but it is under limited series production.

"The first LUH will be delivered in August 2022 after which the forces will use them and will give their feedback and place further orders," a source explained.

Sources said the ministry needs to clear Acceptance of Necessity for 175 more LUHs, a proposal that is pending. It is feared that without a sufficient order in time, capacities would idle and production would see delay due to non-availability of critical items.

Sources said the LUH has cleared all trials including in high-altitude regions like Ladakh during the ongoing stand-off with China. "The LUH has met all requirements of the armed forces as per what they sought. The production has already started at HAL's new helicopter factory in Tumakuru in Karnataka," a second source said.

These choppers will replace the Cheetah and Chetak fleet of helicopters that were designed in the 1960s.

LUH capable of high altitude operations

Even though the Cheetah and Chetak choppers are old and prone to crashes and high maintenance, they are a crucial lifeline for the armed forces, especially in high-altitude areas like the Siachen Glacier.

The LUH, which had received the Initial Operational Clearance for the Army from Centre for Military Airworthiness and Certification earlier this year, is powered by a single turbo shaft engine Ardiden 1U from Safran Helicopter Engine, France.



A file photo of HAL's indigenous LUH after completing high-altitude trials in Himalayas. | Photo: Twitter/@HALHQBLR

It has a service ceiling of 21,325 ft and a range of 500 km with internal fuel tanks. Capable of a maximum speed of 235 kmph, the two-crew helicopter has a maximum take-off weight of 3150 kg.

The LUH is also equipped with Smart Cockpit Display System (glass cockpit), health and usage monitoring system and is designed for various utility and armed roles.

<https://theprint.in/defence/hal-choppers-get-defence-ministry-nod-in-bid-to-replace-cheetah-chetak-kamov-hangs-in-balance/760653/>

R. REPUBLICWORLD.COM

Wed, 03 Nov 2021

Russia mulls exporting new S-500 Missile systems to India capable of hitting satellites

Russia's S-500 Prometey is designed for intercepting and destroying intercontinental ballistic missiles, as well as hypersonic cruise missiles and aircraft

By Anurag Roushan

The director of the Russian Federal Service for Military-Technical Cooperation (FSMTC), Dmitry Shugaev stated that Russia may deliver its cutting-edge S-500 anti-aircraft missile systems to India and China in the future. Speaking to *BBC news outlet*, he said that Russia is looking at India, China and all the other countries with which it has a long-standing partnership and predictable mutual relations as potential owners of this cutting-edge system, as reported by *news agency Sputnik*. The S-500 Prometey is designed for intercepting and destroying intercontinental ballistic missiles, as well as hypersonic cruise missiles and aircraft. It is a next-generation surface-to-air missile system with a range of around 600 kilometres (370 miles).



Image: AP/Representative

According to Shugaev, Russia may export them to other countries once the national armed forces receive enough of those systems. Meanwhile, on Monday, November 1, Russian President Vladimir Putin announced that the military will receive the first batch of S-500 missiles in the near future. He also emphasised the need to enhance the country's air defences following a surge in NATO military activity near Russia's border.

Putin also mentioned the recent deployment of NATO's US-led missile defence components in Eastern Europe and the military alliances' increased deployments near Russian waterways. He said this during a meeting with military leaders and arms makers in the city of Sochi, calling it a security threat to his country. Interestingly, Sochi is located on the Black Sea coast, and the Kremlin uses its waters to keep Georgia and Ukraine out of NATO, reported *ABC News*. A US warship has entered the Black Sea recently, and we can see it in binoculars or in the crosshairs of our defence systems," he was quoted as saying by the outlet.

Indian Navy's stealth frigate launched In Russia

Meanwhile, the 7th Indian Navy Frigate of the P1135.6 class was launched on October 28 at the Yantar Shipyard in Kaliningrad, Russia. According to the Navy, Datla Vidya Varma formally named the ship "Tushil" at the event. Tushil is a Sanskrit word that means "Protector Shield," it stated. On October 18, India and Russia signed a contract for the building of two ships based on an Inter-Governmental Agreement (IGA). The contract was signed for the construction of two Project 1135.6 ships in Russia and two ships in India at M/s Goa Shipyard Limited (GSL), reported *ANI*.

<https://www.republicworld.com/world-news/rest-of-the-world-news/russia-mulls-exporting-new-s-500-missile-systems-to-india-capable-of-hitting-satellites.html>

Satellite images appear to show China is making significant progress developing missile silos that could eventually launch nuclear weapons

By *Kylie Atwood and Jennifer Hansler*

Washington (CNN): Rapid construction at three suspected silo fields in China -- which could eventually be capable of launching long-range nuclear missiles -- appears to indicate that Beijing is putting substantial efforts and resources into the development of its nuclear capabilities, according to analysis of new commercial satellite images.

Experts from the Federation of American Scientists (FAS), a nonpartisan national security research and advocacy organization, found that China has made significant progress on suspected silo fields in the western part of the country.

"For China, this is an unprecedented nuclear buildup," wrote Matt Korda and Hans M. Kristensen, the authors of the FAS report released Tuesday.

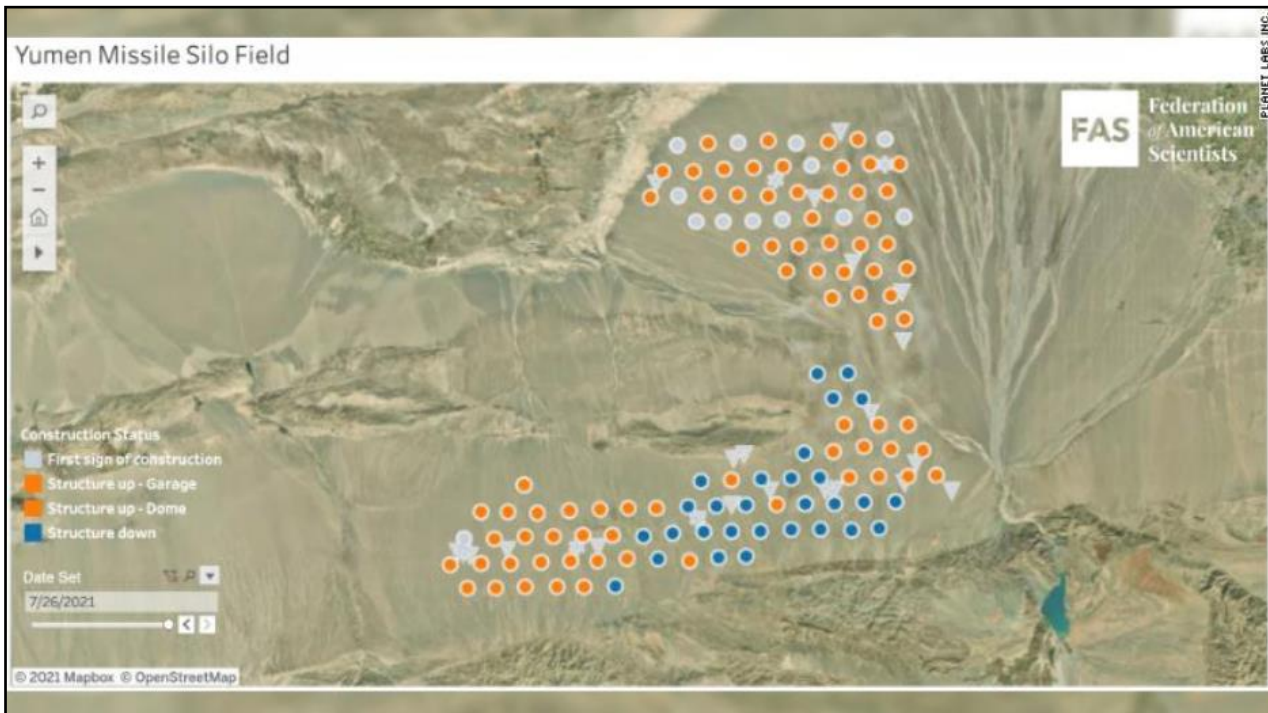


Different stages of construction underway by Chinese engineers on multiple silos at the possible Ordos missile silo field in August 2021. After clearing the space for the project, they use inflatable domes to protect the active construction on the silos.

The authors noted that "the missile silo fields are still many years away from becoming fully operational and it remains to be seen how China will arm and operate them."

However, recent reports of Chinese activities have added to concerns from US officials about China's rapid military progress. The suspected development of a first missile silo field was reported in late June. Following another report from FAS released in July on China's suspected development of a second silo field, US Strategic Command tweeted, "This is the second time in two months the

public has discovered what we have been saying all along about the growing threat the world faces and the veil of secrecy that surrounds it."



This graphic image shows the progression of silos under construction. Some of the silos just beginning the building progress, others in the midst of being developed under an inflatable dome and others have advanced so far that the dome has been cleared.

Navy Adm. Charles A. Richard, the commander of US Strategic Command, said in August that "we are witnessing a strategic breakout by China."

"The explosive growth and modernization of its nuclear and conventional forces can only be what I describe as breathtaking. And frankly, that word breathtaking may not be enough," he said.

The commercial satellite images from Maxar Technologies and Planet Labs analyzed by FAS offer some of the most detailed pictures yet of three suspected missile silo fields, where the Chinese appear to be constructing roughly 300 new missile silos.

"What's notable, of course, is the scale and the speed of this that this is so out of sync with what the Chinese have done on missile silos ever before," Kristensen told CNN.

CNN has reached out to the Chinese government for comment on new report.

China's ongoing development of the silos comes as the country is bolstering its military capabilities significantly.

The US has said that China tested a hypersonic weapon over the summer which Chairman of the Joint Chiefs of Staff Mark Milley called "very concerning." He also said that "Chinese military capabilities are much greater than that" single test.

However, China's Ministry of Foreign Affairs spokesperson Zhao Lijian said the August test was "a spacecraft, not a missile."

China has long committed to a minimum deterrence policy, meaning it keeps its nuclear arsenal at the minimum level necessary to deter an adversary from attacking. It is believed to have about one-tenth the nuclear weapons that Russia and the US have and has a no-first-use policy.

A change in China's approach?

Some experts and officials say recent developments raise questions about its commitment to that policy.

Nicholas Burns, the Biden administration's nominee to be US Ambassador to China, said during his confirmation hearing last month that the Chinese "are blasting past that definition (of a

minimum nuclear deterrent), and they're rapidly engaged in the buildup of their nuclear arsenal, including the disturbing reports of the hypersonic technology."

Benjamin Friedman, the policy director of Defense Priorities, a Washington-based think tank, said he believes China has not fundamentally changed policy, "but they seem to have decided that it takes a little more than it used to," and "we shouldn't take the development of more missiles necessarily as a different approach on the Chinese part, it might just be that they think the same approach takes more weapons than it used to."

"The United States has long continued to pursue a first strike capability against all nuclear adversaries -- that is the ability to have enough weapons, and nuclear weapons are most important in that, to destroy their entire arsenal in one go," said Friedman, adding that China probably feels "they might need a little more insurance against the prospect of the US disarming first strike for various reasons."

Kristensen of FAS said that the construction of the silo fields "likely has to do with the fact that the Chinese leadership has just decided that China has to be big militarily, and the nuclear forces have to match that."

He also noted that it "reduces the vulnerability that anyone can knock them out in a surprise attack."

It is unclear if the US will be able to know with certainty if these silos are filled with missiles, creating a conundrum for the US in determining how to counter or compete with China's buildup.

Some experts point out that this may be part of China's strategy.

"China may fill these out eventually but in the interim, when they are not all filled out, would the US be able to distinguish with certainty which silos are filled and which aren't and would we have to commit to destroying all of these no matter what? If that is the case then the US has to commit maybe twice the number of warheads to all of the silos," said Vipin Narang, a professor of political science focusing on nuclear proliferation and strategy at the Massachusetts Institute of Technology.

"If you are the US this forces you to re-think nuclear planning," he said.

The images in the report also reveal that China appears to be constructing other types of support facilities around the silos, Kristensen said. The report says they are almost the size of a football stadium -- to protect the silo construction area from severe environmental factors. The experts who compiled the report also noted that the shelters may have been constructed to "hide technical details from satellites."

<https://edition.cnn.com/2021/11/02/politics/china-suspected-silo-fields-report/index.html>



Press Information Bureau
Government of India

Ministry of Defence

Tue, 02 Nov 2021 2:32PM

Indian Astronomers find new method to study environment of extra solar planets using polarisation of light

Indian Astronomers have found a new method to understand the atmosphere of extra solar planets. They have shown that planets going around stars other than the Sun can be studied by observing the polarisation of light and studying polarisation signatures. These polarisation signatures or variations in scattering intensity of light can be observed with existing instruments and expanding the study of planets beyond the solar system using existing instruments.

In the recent past, astronomers have discovered that many other stars have planets going around them, like our Solar System. Till now, around 5000 such exoplanets have been detected. About a couple of decades ago, Sujan Sengupta, a scientist at Indian Institute of Astrophysics (IIA), Bangalore, an autonomous institute of the Department of Science & Technology (DST), Government of India, suggested that the thermal radiation of hot young planets and the reflected light of planets orbiting other stars, known as extra-solar planets or exoplanets would also be polarized and the measure of the polarization might unveil the chemical composition and other properties of the exoplanetary atmosphere. Subsequent confirmation of the prediction by the detection of polarization of many Brown Dwarfs, a kind of failed stars that have an atmosphere very similar to that of Jupiter, motivated

researchers all over the world to build highly sensitive polarimeters and use polarimetric methods to probe exoplanetary environment.

Recently, Aritra Chakrabarty, a postdoctoral researcher at IIA working with Sujan Sengupta, developed a detailed three-dimensional numerical method and simulated the polarization of exoplanets. Just like the Solar-planets, exoplanets are slightly oblate due to their rapid spin rotation. Further, depending on its position around the star, only a part of the planetary disk gets illuminated by the starlight. This asymmetry of the light-emitting region gives rise to non-zero polarization.

In the research published in 'The Astrophysical Journal,' the scientists have developed a Python-based numerical code that incorporates a state-of-the-art planetary atmosphere model and employed all such asymmetries of an exoplanet orbiting the parent star at different inclination

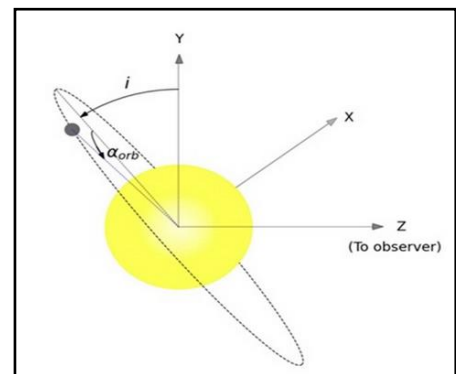


Figure 1: Schematic diagram of a planet at an orbital phase a_{orb} orbiting with an inclination angle i .

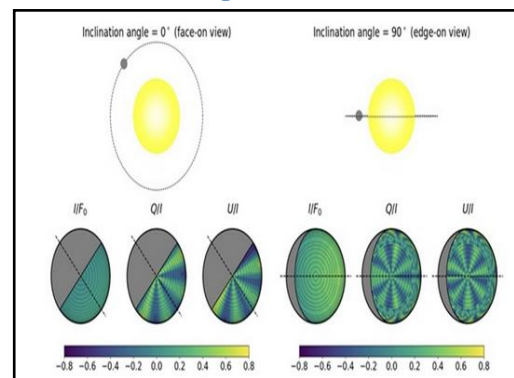


Figure 2: Intensity of the reflected light and the polarized light (Q/I and U/I) in the visible wavelengths at different points of the partly illuminated surface (orbital phase being 45°) of the Exoplanet orbiting at face-on and edge-on views, two extreme cases of orbital inclination. Positive (greenish) and negative (bluish) polarizations produced at different longitudes tend to cancel out each other. The net non-zero detectable disk-averaged polarization arises because of an incomplete cancellation owing to the geometric asymmetry.

angles. They calculated the amount of polarization at different latitudes and longitudes of the planetary surface defined with respect to the disk center and averaged them over the illuminated and rotation-induced oblate planetary surface. The polarization at different wavelengths is sufficiently high and hence can be detected even by a simple polarimeter if the starlight is blocked. It helps study the atmosphere of the exoplanets along with its chemical composition.

“Even if we cannot image the planet directly and the unpolarized starlight is allowed to mix up with the polarized reflected light of the planet, the amount should be a few ten parts of a million, but still can be detected by some of the existing high-end instruments such as HIPPI, POLISH, PlanetPol, etc. The research will help in designing instruments with appropriate sensitivity and guide the observers,” said Aritra Chakrabarty.

Unlike the traditional and popular methods such as Transit Photometry and Radial Velocity methods that can detect planets that are viewed almost edge-on only, this polarimetric method can detect and probe exoplanets orbiting with a broad range of orbital inclination angles. Thus, polarimetric techniques in the near future will open up a new window for the study of the exoplanets and enable us to overcome many of the limitations of the traditional techniques.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1768876>



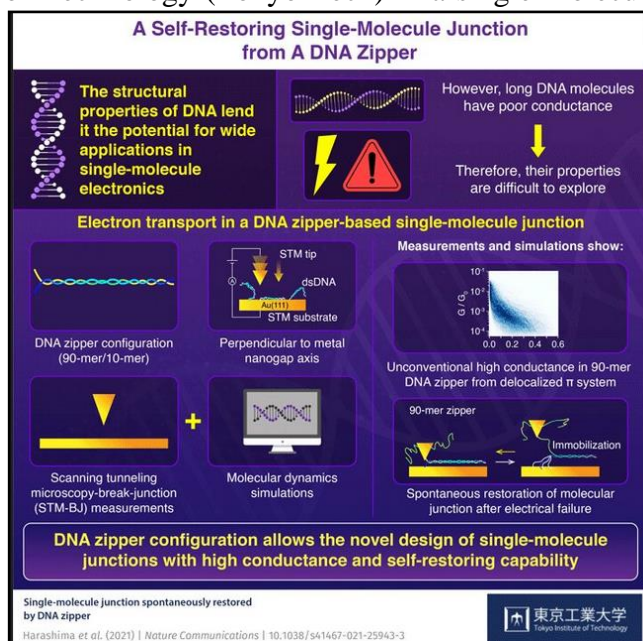
Wed, 03 Nov 2021

Toward self-restoring electronic devices with long DNA molecules

The potential of DNA structural properties in single-molecule electronics has finally been harnessed by researchers from Tokyo Institute of Technology (Tokyo Tech) in a single-molecule junction device that shows spontaneous self-restoring ability. Additionally, the device, based on a "zipper" DNA configuration, shows unconventionally high electrical conductivity, opening doors to the development of novel nanoelectronic devices.

In every advanced organism, the molecule called DNA (deoxyribonucleic acid, to use its full name) forms the genetic code. Modern-day technology takes DNA one step beyond living matter; scientists have established that the intricate structures of DNA have made it possible for it to be used in new-age electronic devices with junctions comprising just a single DNA molecule. However, as with any ambitious endeavor, there are impediments to overcome. It turns out that the single-molecule conductance falls off sharply with the length of the molecule so that only extremely short stretches of DNA are useful for electrical measurements. Is there a way around this problem?

There is, indeed, suggest researchers from Japan in a new breakthrough study. They have managed to achieve an unconventionally high conductivity with a long DNA molecule-based junction in a "zipper" configuration that also shows a remarkable self-restoring ability under



Credit: Tokyo Institute of Technology

electrical failure. These results have been published as a research article in *Nature Communications*.

How did the researchers achieve this feat? Dr. Tomoaki Nishino from Tokyo Tech, Japan, who was part of this study, explains, "We investigated electron transport through the single-molecule junction of a 'zipper' DNA that is oriented perpendicular to the axis of a nanogap between two metals. This single-molecule junction differs from a conventional one not only in the DNA configuration but also in orientation relative to the nanogap axis."

The team used a 10-mer and a 90-mer DNA strand (which indicate the number of nucleotides, basic building blocks of DNA, comprising the molecule length) to form a zipper-like structure and attached them to either a gold surface or to the metal tip of a scanning tunneling microscope, an instrument used to image surfaces at the atomic level. The separation between the tip and the surface constituted the "nanogap" that was modified with the zipper DNA.

By measuring a quantity called "tunneling current" across this nanogap, the team estimated the conductivity of the DNA junctions against a bare nanogap without DNA. Additionally, they carried out molecular dynamics simulations to make sense of their results in light of the underlying "unzipping" dynamics of the junctions.

To their delight, they found that that the single-molecule junction with the long 90-mer DNA showed an unprecedented high conductance. The simulations revealed that this observation could be attributed to a system of delocalized π -electrons that could move around freely in the molecule. The simulations also suggested something even more interesting: the single-molecule junction could actually restore itself i.e., go from "unzipped" to "zipped," spontaneously after an electrical failure. This showed that the single-molecule junction was both resilient and easily reproducible.

In the wake of these discoveries, the team is excited about their future ramifications in technology. An optimistic Dr. Nishino speculates, "The strategy presented in our study could provide a basis for innovations in nanoscale electronics with superior designs of single-molecule electronics that could likely revolutionize nanobiotechnology, medicine, and related fields."

More information: Takanori Harashima et al, Single-molecule junction spontaneously restored by DNA zipper, *Nature Communications* (2021). DOI: [10.1038/s41467-021-25943-3](https://doi.org/10.1038/s41467-021-25943-3)

Journal information: [Nature Communications](https://www.nature.com/news)

<https://phys.org/news/2021-11-self-restoring-electronic-devices-dna-molecules.html>



Wed, 03 Nov 2021

New technique provides detailed information on nuclear material

Whether soil contaminated with nuclear material or archaeological finds: Analyzing isotopes can help determining the age and origin of a sample very accurately. Researchers from Leibniz University Hannover (LUH) and Johannes Gutenberg University Mainz (JGU) have now developed a new technique suitable for obtaining information on the origin of microparticles by analyzing isotope distributions. The project was funded by the Federal Ministry of Education and Research (BMBF) and the Siebold Sasse Foundation by more than two million euros. Their findings have now been published in *Science Advances*.

The method was developed for nuclear forensics, thus, for nuclear material. Eventually, the method might be applied to non-nuclear samples, such as when determining the origin of samples via isotope distributions in archaeology, food or environmental pollutants. "Our method leaves microscopic particles virtually intact. In ideal settings, we only count several 10,000 ions. This enables us to conduct further studies with different techniques or, for example, conserve the sample

as evidence," explains project manager Prof. Dr. Clemens Walther from the Institute of Radioecology and Radiation Protection at LUH.

SNMS (resonant lasersecondary neutral mass spectrometry) provides insights into the origin and genesis of materials through measurements of their elemental and isotopic composition. For example, if material originates from a nuclear reactor, this allows researchers to draw conclusions about the type of reactor and its operating conditions, or to determine how long the material remained inside of the reactor (burnup). With this method, almost all elements can be identified. The research team focuses on the actinides uranium, plutonium, americium and curium, as well as fission products such as strontium, caesium or technetium. The publication demonstrates the capabilities of the method by investigating particles from Chernobyl released during the 1986 reactor explosion.

In contrast to conventional methods, SNMS mostly works in a quasi non-destructive manner. Therefore, the particle is available for further studies. For this purpose, a commercial TOF-SIMS finstrument (static secondary ion mass spectrometry) is combined with lasers in order to ionize various elements selectively. Unlike standard mass spectrometry methods, this technique suppresses isobars, therefore allowing to distinguish between elements such as uranium or plutonium, that have isotopes with the same mass, with an advantage over conventional mass spectrometers.

The same applies to the elements plutonium and americium. This is of great interest, since ^{241}Pu has a half-life of only 14 years, decaying into ^{241}Am . As an alpha emitter, ^{241}Am is highly radiotoxic and will become the predominating alpha exposure (radioactive contamination) in the Chernobyl area in a few years. In order to use and deal with contaminated areas in the future, it is vital to know how quickly and which isotopes can be released from particles that are present in large quantities.

Since the method does not require extensive sample preparation, such as chemical separation, researchers are able to identify a particle, separate it and measure isotope patterns of up to four different elements within one working day. Due to these features, this is a one-of-a-kind facility.

Members of the Quantum/LARISSA work group at the JGU Institute of Physics have contributed their expertise in several contexts with regard to experimental foundations of the trace analysis method used in the project. The laser system was developed at the Institute of Physics in Mainz and implemented into the analytical measuring system in Hannover. Moreover, optical excitation and ionization steps for the environmentally relevant actinides plutonium, americium and curium were tested via the laser mass spectrometry equipment of JGU while characterizing their suitability for spatially resolved analytics at the Institute of Radioecology and Radiation Protection.

Prof. Dr. Klaus Wendt, head of the work group, adds: "Working with the Institute of Radioecology and Radiation Protection has been particularly fruitful since this allowed us to contribute our fundamental research approaches in order to identify ultratrace elements. Together, we are now able to identify hazardous radionuclides—even in very small quantities on minuscule particles."

Their findings have now been published in *Science Advances*, titled "New horizons in microparticle forensics: Actinide imaging and detection of ^{238}Pu and ^{242m}Am in hot particles."

More information: Hauke Bosco et al, New horizons in microparticle forensics: Actinide imaging and detection of ^{238}Pu and ^{242m}Am in hot particles, *Science Advances* (2021). DOI: [10.1126/sciadv.abj1175](https://doi.org/10.1126/sciadv.abj1175)

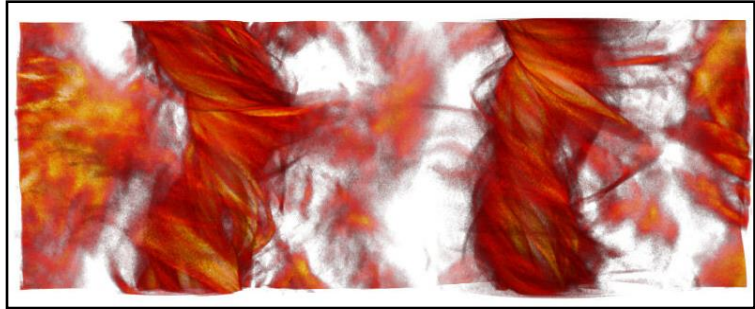
Journal information: [Science Advances](https://phys.org/news/2021-11-technique-nuclear-material.html)
<https://phys.org/news/2021-11-technique-nuclear-material.html>



Credit: Hauke Bosco / Leibniz University Hannover

3D simulations improve understanding of energetic-particle radiation and help protect space assets

A team of researchers used 3D particle simulations to model the acceleration of ions and electrons in a physical process called magnetic reconnection. The results could contribute to the understanding and forecasting of energetic particles released during magnetic reconnection, which could help protect space assets and advance space exploration.



3D simulations based on fundamental physics principles model the production of energetic ions and electrons. Credit: Los Alamos National Laboratory

"For the first time ever, we can use 3D simulations from fundamental physics principles to model the production of energetic ions and electrons in those magnetic explosions in space," said paper author Qile Zhang, of the Nuclear and Particle Physics, Astrophysics and Cosmology group at Los Alamos National Laboratory.

The research was published in *Physical Review Letters*.

Magnetic reconnection can cause magnetic explosions, which result in events such as solar flares and geomagnetic storms near Earth; these explosions produce energetic-particle radiation that is harmful to spacecraft and humans. The research team discovered the underlying mechanisms controlling particle acceleration enabled by the 3D kink motions of plasmas—the collection of charged particles—and magnetic fields.

They also revealed the processes governing the key properties of the energetic-particle energy distributions. The team's predicted distributions agreed with observations from solar flares and Earth's magnetic fields.

More information: Qile Zhang et al, Efficient Nonthermal Ion and Electron Acceleration Enabled by the Flux-Rope Kink Instability in 3D Nonrelativistic Magnetic Reconnection, *Physical Review Letters* (2021). DOI: [10.1103/PhysRevLett.127.185101](https://doi.org/10.1103/PhysRevLett.127.185101)

Journal information: *Physical Review Letters*

<https://phys.org/news/2021-11-3d-simulations-energetic-particle-space-assets.html>

Wed, 03 Nov 2021

Why COVID-19 can affect the inner ear and what that means for people with long COVID

- *New research suggests that the ear is yet another part of our bodies that is susceptible to infection with SARS-CoV-2, the virus that causes COVID-19.*
- *For this research, scientists developed novel cellular models of the inner ear and used hard-to-obtain adult human inner ear tissue.*
- *Researchers also found that the virus could infect two types of cells in the inner ear called Schwann and hair cells.*

Hearing loss after COVID-19 has already been observed, but new research from the Massachusetts Institute of Technology (MIT) and Massachusetts Eye and Ear has been able to break down what is happening when the coronavirus attacks the inner ear.

The study, recently published in the journal *Communications Medicine* Trusted Source, analyzed cellular models of the human inner ear and adult human inner ear tissue with SARS-CoV-2 infection to discover what effect it might have.

Findings suggest that the ear is yet another part of our bodies that is susceptible to infection with SARS-CoV-2, the virus that causes COVID-19.

“This article provides very compelling evidence that SARS-CoV-2 infects the inner ear, and may be causally related to the hearing and balance symptoms in a number of patients with COVID-19 infection,” Dr. Yuri Agrawal, a professor of otolaryngology-head and neck surgery at Johns Hopkins School of Medicine, who was not involved in the study, said in a statement.



Luis Alvarez/Getty Images

Findings could help us understand how SARS-CoV-2 and other viruses affect ear

For this research, scientists developed novel cellular models of the inner ear and used hard-to-obtain adult human inner ear tissue.

According to the study authors, limited availability of this tissue had hindered previous research into how SARS-CoV-2 and other viruses can damage hearing.

They found a pattern of inner ear infection consistent with symptoms observed in a study of 10 patients with COVID-19 who had reported a range of ear-related symptoms.

“Having the models is the first step, and this work opens a path now for working with not only SARS-CoV-2 but also other viruses that affect hearing,” Lee Gehrke, PhD, the Hermann L.F. von Helmholtz professor in MIT’s Institute for Medical Engineering and Science, who co-led the study said in a statement.

The study included 10 adult patients who tested positive for COVID-19 and developed symptoms that included hearing loss, tinnitus (ringing in the ear), or dizziness within 3 weeks of diagnosis.

Researchers analyzed inner ear tissue sourced from humans and mice to create in-vitro cellular models of the inner ear.

They discovered that both human and mouse inner ear tissue contained “molecular machinery to allow SARS-CoV-2 entry,” like the ACE2 receptor. Researchers also found that the virus could infect two types of cells in the inner ear called Schwann and hair cells.

“Our findings suggest that inner ear infection may underline COVID-19-associated problems with hearing and balance,” the study authors wrote.

Schwann and hair cells play vital roles

“Vestibular hair cells serve as sensory receptors in the inner ear that function to assess and monitor head motion, a sense of balance, allowing humans and animals to orient themselves,” Dr. Robert Glatter, an emergency physician at Lenox Hill Hospital in New York, told Healthline.

“Schwann cells, also found in the specialized apparatus of the inner ear known as the cochlea Trusted Source, are vital to hearing,” he continued.

According to Glatter, the takeaway is that this study found that vestibular hair cells and Schwann cells express proteins that are essential for SARS-CoV-2 to enter cells.

“These proteins include the ACE2 receptor, which is found on the surface of cells,” he said, “and two enzymes called furin Trusted Source and transmembrane protease serine 2 (TMPRSS2) Trusted Source, which allow SARS-CoV-2 to attach to the host cell.”

<https://www.healthline.com/health-news/why-covid-19-can-affect-the-inner-ear-and-what-that-means-for-people-with-long-covid#Schwann-and-hair-cells-play-vital-roles>

