

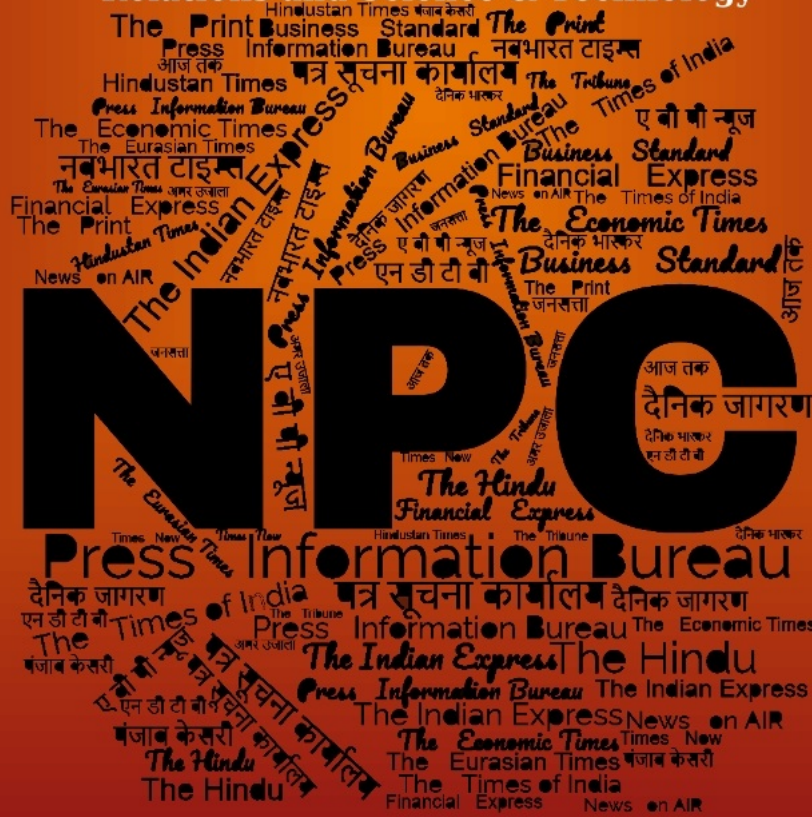
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# समाचार पत्रों से चयनित अंश Newspapers Clippings

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

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# CONTENTS

S. No.	Title	Source	Page No.
<b>DRDO News</b>			<b>1-2</b>
1	DRDO conducts Scramjet Engine Ground Test	<i>Press Information Bureau</i>	1
<b>Defence News</b>			
<b>Defence Strategic: National/International</b>			<b>2-9</b>
2	Aatmanirbhar Bharat: Rs 1,561 crore contract inked with Heavy Vehicles Factory, AVNL for 47 T-72 Bridge Laying Tanks for Indian Army	<i>Press Information Bureau</i>	2
3	Republic Day Celebrations 2025: Grand finale of National School Band Competition to be held at Major Dhyan Chand National Stadium, New Delhi	<i>Press Information Bureau</i>	3
4	India about to sell Russia-backed BrahMos cruise missiles	<i>The Economic Times</i>	5
5	What makes India's 'Pralay' missile, to be displayed for first time during Republic Day Parade, a deadly weapon	<i>The Week</i>	6
6	India joins Eurodrone Programme as newest OCCAR Observer State	<i>ANI</i>	7
7	Indian Army to finalise Rs 10,200 crore deal for indigenous Pinaka Rocket Systems	<i>Financial Express</i>	8
<b>Science &amp; Technology News</b>			<b>10-14</b>
8	Space economy has grown to \$8 billion and is projected to touch \$44 billion in the next decade- Dr. Jitendra Singh	<i>Press Information Bureau</i>	10
9	DNA from ancient viruses may be important for growth of embryo in womb, study suggests	<i>Hindustan Times</i>	11
10	What are solar storms, how do they affect Earth?	<i>News Nine</i>	12

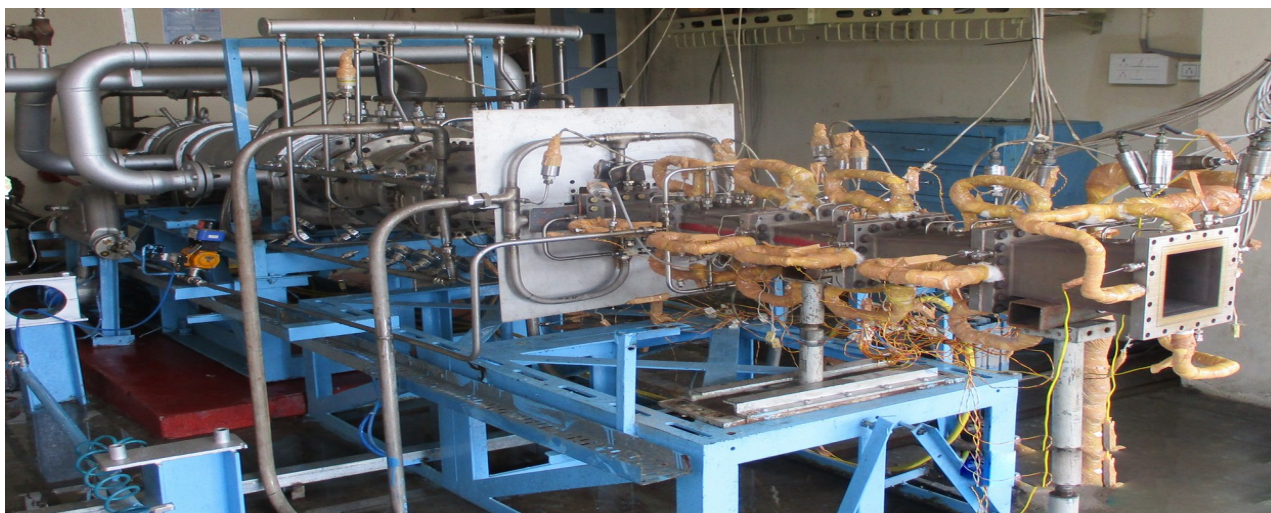
## DRDO News

### DRDO conducts Scramjet Engine Ground Test

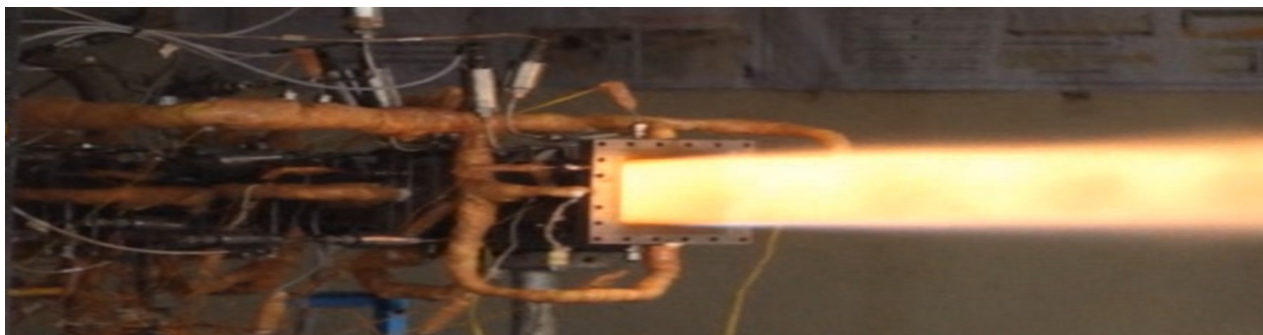
Source: Press Information bureau, Dt. 21 Jan 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2094886>

Defence Research & Development Laboratory (DRDL), a Hyderabad-based laboratory of Defence Research and Development Organisation (DRDO) has taken the initiative in developing a long-duration Supersonic Combustion Ramjet or Scramjet powered Hypersonic technology. DRDL recently developed these technologies and demonstrated a cutting-edge Active Cooled Scramjet Combustor ground test for 120 seconds for the first time in India. The successful ground test marks a crucial milestone in developing next-generation hypersonic missiles.



Hypersonic missiles are a class of advanced weaponry that travel at speeds greater than Mach 5 *i.e.*, five times the speed of sound or more than 5,400 km/hr. These advanced weapons have the potential to bypass existing Air Defence Systems and deliver rapid and high-impact strikes. Several nations including USA, Russia, India and China are actively pursuing Hypersonic technology. The key to hypersonic vehicles is Scramjets, which are air breathing engines capable of sustaining combustion at supersonic speeds without using any moving parts.



The ground test of scramjet combustor showcased several notable achievements, demonstrating its potential for operational use in Hypersonic vehicles, like successful ignition and stable combustion. Ignition in a scramjet engine is like ‘keeping a candle lit in a hurricane’. Scramjet

combustor incorporates an innovative flame stabilisation technique that holds continuous flame inside the combustor with air speed in excess of 1.5 km/s. Many novel and promising ignition & flame holding techniques were studied through many ground tests in arriving at Scramjet Engine configuration. Advanced Computational Fluid Dynamics (CFD) simulation tools were used for their evaluation & performance prediction.

The indigenous development of endothermic scramjet fuel, the first time in India, jointly by DRDL and Industry is central to this breakthrough. The fuel offers dual benefits of significant cooling improvement and ease of ignition. The team developed a special manufacturing process to achieve stringent fuel requirements of DRDL at Industrial scale.

Another key achievement is the development of state-of-art Thermal Barrier Coating (TBC) which is designed to withstand extreme temperatures encountered during hypersonic flight. A new advanced ceramic TBC having high thermal resistance & capable of operating beyond melting point of steel has been jointly developed by DRDL and Department of Science & Technology (DST) Laboratory. The coating is applied inside the Scramjet engine using special deposition methods that enhance their performance and longevity. With demonstrated capabilities in stable combustion, enhanced performance and advanced thermal management, this breakthrough sets the stage for next generation Hypersonic missiles.

Raksha Mantri Shri Rajnath Singh has complimented DRDO and the Industry for the successful Scramjet Engine Ground Test. “The achievement marks a crucial milestone in the development of next-generation hypersonic missiles,” he said.

Secretary, Department of Defence R&D and Chairman DRDO Dr Samir V Kamat congratulated DRDL team and industry for demonstrating capabilities in stable combustion, enhanced performance, and advanced thermal management test.

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## Defence News

### Defence Strategic: National/International

## **Aatmanirbhar Bharat: Rs 1,561 crore contract inked with Heavy Vehicles Factory, AVNL for 47 T-72 Bridge Laying Tanks for Indian Army**

Source: Press Information Bureau, Dt. 21 Jan 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2094857>

Ministry of Defence (MoD) has signed a contract with Heavy Vehicles Factory, a unit of Armoured Vehicle Nigam Limited, for the procurement of 47 Tank-72 Bridge Laying Tanks (BLT) for the

Indian Army at a total cost of Rs 1,560.52 crore. The contract was inked by the senior officials of MoD and HVE/AVNL in the presence of Defence Secretary Shri Rajesh Kumar Singh in New Delhi on January 21, 2025.



The BLT is a critical equipment which is employed to launch bridges during offensive/defensive operations by Mechanised Forces. It provides integral bridging capability to the Tank and Armoured Vehicle fleet enhancing the battlefield mobility and offensive capability. The present case being a Buy (Indian-Indigenously Designed Developed and Manufactured) will give impetus to the Make-in-India initiative in defence. This project will also play a pivotal role in boosting the overall economy and increasing employment avenues in the country.

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## Republic Day Celebrations 2025: Grand finale of National School Band Competition to be held at Major Dhyan Chand National Stadium, New Delhi

Source: Press Information Bureau Dt. 21 Jan 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2094834>

The grand finale of National School Band Competition 2024-25, organised as part of Republic Day Celebrations (RDC) 2025, will be held at the Major Dhyan Chand National Stadium, New Delhi on January 24 & 25, 2025. The prize distribution ceremony on 25<sup>th</sup> January will be graced by Raksha Rajya Mantri Shri Sanjay Seth, while the event will be inaugurated by Defence Secretary and Secretary, Ministry of Education.

A total of 16 band teams – four from each zone (East, West, North & South zone) – comprising 466 children will compete in the Grand Finale. It has been organised to rejuvenate and rekindle the spirit of patriotism & unity amongst children in schools throughout the country and motivate them on the path of holistic education. The list of 16 teams shortlisted as finalists is as under:

S No	School	Category
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(a)	North Sikkim Academy, Nangan, Sikkim (Eastern Zone)	
(b)	PM SHRI Kendriya Vidyalaya No. 2 Belagavi Cantt. Karnataka (Southern Zone)	
(c)	Rajarambapu Patil Military School & Sports Academy Islampur, Sangli, Maharashtra (Western Zone)	Pipe Band Boys
(d)	City Montessori School, Kanpur Road Lucknow, Uttar Pradesh (Northern Zone)	
(e)	St. Joseph's Convent Sr. Sec. School, Idgah hills, Bhopal, Madhya Pradesh (Western Zone)	
(f)	Government Sr. Sec. School West Point, Gangtok, Sikkim (Eastern Zone)	
(g)	St Joseph's Anglo Indian Girl's Higher Secondary School, Kozhikode, Kerala (Southern Zone)	Brass Band Girls
(h)	Gayatri Vidyapeeth, Shantikunj, Haridwar, Uttrakhand (Northern Zone)	
(i)	Shri Thakurdwara Balika Vidyalaya, Ghaziabad, Uttar Pradesh (Northern Zone)	
(j)	Bhonsala Military School Girls, Nasik, Maharashtra (Western Zone)	
(k)	Monte CBSE School, Kurnool, Pandipadu Village, Kallur Mandal Kurnool, Andhra Pradesh (Southern Zone)	Pipe Band Girls
(l)	PM Shri Kasturba Gandhi Balika Vidyalaya, Patamda, East Singbhum, Jharkhand (Eastern Zone)	
(m)	Pinegrove School, Subathu, District-Solan, Himachal Pradesh (Northern Zone)	Brass Band Boys
(n)	Prince Lotus Valley Academy, Sikar, Rajasthan (Western Zone)	
(o)	St. Xavier's English Medium School, Pathalgaon, Chhattisgarh (Southern Zone)	
(p)	St. Xavier's Higher Secondary School, Pathaliaghat, Sepahijala,	

Tripura (Eastern Zone)	
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The top three teams in each category will be given a cash prize (1st - Rs 21,000/-, 2nd - Rs 16,000/- & 3rd - Rs 11,000/-), a trophy as well as certificates. Consolation cash prize of Rs 3,000/- each will be given to the remaining team in each category. Their performances will be evaluated by the Jury appointed by Ministry of Defence including members from each wing of the Armed Forces.

From RDC 2023 onwards, the National School Band Competition is being jointly conducted by Ministry of Defence and Ministry of Education. A School Band evokes a feeling of oneness, belonging and pride in school children towards their school and country. The rhythm of a band rouses passion, courage and action in children and adults alike.

The Competition consists of three levels [State Level, Zonal Level, & National Level (final)] in four categories (Boys Brass Band, Girls Brass Band, Boys Pipe Band and Girls Pipe Band). Building on the success from last year's competition, the Competition garnered significant enthusiasm this year. Over 700 school band teams from 34 States/Union Territories (UTs) registered for the competition at State Level, in which 568 teams comprising around 14,000 children participated. At the zonal level, 84 teams comprising 2,337 students from 31 States/UTs participated, of which 16 finalists teams have been shortlisted for the grand finale.

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## **India about to sell Russia-backed BrahMos cruise missiles**

**Source: The Economic Times Dt. 22 Jan 2025,**

**URL: <https://timesofindia.indiatimes.com/india/india-france-to-jointly-track-indian-ocean-region-threats/articleshow/117408071.cms>**

India is considering a \$450 million deal to sell Russian-backed supersonic cruise missiles to Indonesia as the Southeast Asian country looks to bolster defenses, according to people familiar with the matter.

The sale of the BrahMos cruise missiles is expected to be announced as early as this week when Indonesian President Prabowo Subianto officially visits India, the people said, asking not be identified as discussions are private. Prabowo is set to attend the Republic Day celebrations as a special guest on Sunday.

A key hurdle for Indonesia is securing financing for the missile purchases given the nation's budget constraints, one of the people said. Funding is still being discussed with India and it's unclear when a deal can be finalized for the missiles, which have a firing range of at least 380 kilometers (186 miles).

If the sale goes through, Indonesia would be the second country after the Philippines to acquire the anti-ship cruise missiles. Southeast Asian nations are modernizing and bolstering their militaries as the South China Sea remains a flashpoint with an assertive China and President Donald Trump back in the White House.

India and Indonesia have been negotiating for about a decade for the sale of the BrahMos cruise missile, jointly developed by India and Russia. Rosoboronexport, Russia's state owned military hardware supplier, is part of the negotiations, the people said.

India's Defense Ministry and Ministry of External Affairs declined to comment on the missile deal. A spokesman with Indonesia's Defense Ministry also declined to comment. About a week before Prabowo's visit, Indonesia's Ministry of Foreign Affairs said the two countries will announce initial pacts for health, education, maritime safety and security. Indonesia is keen to have access to the missile technology so that it doesn't face shortages in spares and components, the people said. Last month, India's ambassador discussed a technology transfer offer with Indonesia's Defense Minister Sjafrie Sjamsoeddin.

The first Trump administration pressured Indonesia to abandon deals to buy Russian-made fighter jets and naval vessels from China. It was part of Washington's efforts to stop its biggest rivals from eroding US military supremacy and threatening its national security.

Prabowo, a former general, had played a key role in negotiating arms deals when he was defense minister under Joko Widodo's administration. He and his cabinet colleagues at the time decided to scrap the deals with China and Russia to avoid getting on the wrong side of the US.

Emerging markets including Indonesia are looking to bolster their economies as Trump returns to office with threats to roil global trade. Indonesia recently joined the BRICS group of developing nations — established by Brazil, Russia, India,

China and South Africa — which has positioned itself as an alternative to the US-led global order. Prabowo is likely to expand military and maritime security cooperation with India when he makes his official visit this week. It is expected to be a continuation of joint exercises and port visits by Indonesian warships, as part of Jakarta's focus on maritime security across Asia.

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## **What makes India's 'Pralay' missile, to be displayed for first time during Republic Day Parade, a deadly weapon**

Source: The Week, Dt. 21 Jan 2025,

URL: <https://www.theweek.in/news/defence/2025/01/21/what-makes-indias-pralay-missile-to-be-displayed-for-first-time-during-republic-day-parade-a-deadly-weapon.html>

The newly-developed tactical missile, 'Pralay', capable of carrying a conventional warhead, will be among the indigenous weapon systems to be displayed at the Republic Day parade on Kartavya Path on January 26.

This is the first time that the missile will be made available for public display.

'Pralay' is a short-range surface-to-surface missile with a payload capacity of 500 to 1,000 kg. The missile, with a range of 150 to 500 kms, is capable of carrying conventional warheads.

Developed by the Defence Research and Development Organisation (DRDO), the missile is powered with a solid propellant rocket motor and is equipped with advanced technologies. The



missile guidance system includes state-of-the-art navigation system and integrated avionics, making it capable of striking deep into enemy territory.

The ability of 'Pralay' to perform mid-air maneuvers makes it tough for enemy interceptors to target it effectively. It is a versatile asset for the Indian armed forces as it is designed for both conventional and nuclear roles.

The maiden test of the missile was successfully conducted in December 2021.

Defence Secretary Rajesh Kumar Singh said around 90-minute parade will comprise 31 tableaux, including 16 from states and 15 from the central ministries. "What is unique this time about the parade is that from a military character, we wanted to showcase a broader cultural aspect," he added.



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## India joins Eurodrone Programme as newest OCCAR Observer State

Source: ANI, Dt. 21 Jan 2025,

URL: <https://www.aninews.in/news/world/europe/india-joins-eurodrone-programme-as-newest-occar-observer-state20250121213744/>

The Government of India (/topic/india) has officially become the newest Observer State in the OCCAR (/topic/occar)-managed MALE RPAS (Eurodrone (/topic/eurodrone)) programme, led by Airbus Defence and Space (/topic/airbus-defence-and-space) as the industrial prime, an official statement noted. The Organisation for Joint Armament Cooperation (OCCAR (/topic/occar)), based in Bonn, Germany (/topic/germany) and overseeing several European defence programmes, has granted the Government of India (/topic/india), the Observer Status in the Programme following a formal request received in August 2024, the statement noted.

As per the statement, OCCAR (/topic/occar)-EA Director Joachim Sucker delivered the Letter of Approval signed by the former OCCAR (/topic/occar) Board of Supervisors (BoS) Chairman, Lt Gen Frederic Goetyneck, to the Ambassador of India (/topic/india) to Germany (/topic/germany), Ajit Gupte at the India (/topic/india)n Embassy in Berlin. This move is taken by OCCAR (/topic/occar) as a first step that shows India (/topic/india)'s willingness to explore opportunities to potentially collaborate on subjects of common interest between the country and Europe. India (/topic/india)'s interest follows the Government of Japan, which was recognised as the first official OCCAR (/topic/occar) Observer State in the MALE RPAS (Eurodrone (/topic/eurodrone) Programme in November 2023.

As the Eurodrone (/topic/eurodrone) development progresses steadily, interest in the Programme continues to grow in Europe and around the world. Following the Government of Japan becoming an OCCAR (/topic/occar) Observer State in the MALE RPAS (Eurodrone (/topic/eurodrone)) Programme in November 2023, the Government of India (/topic/india) officially requested.

OCCAR (/topic/occar)-managed MALE RPAS (Eurodrone (/topic/eurodrone)) Programme. The Chairmanship of the BoS was officially handed over officially on a yearly rotational basis, amongst the six OCCAR (/topic/occar) Member States, from Belgium to Spain in December 2024. Joachim Sucker expressed the BoS's appreciation and positive support for the Government of Japan's interest in OCCAR (/topic/occar) and highlighted that the BoS has taken note of India (/topic/india)'s willingness to explore opportunities to develop subjects of common interest and its recognition of the importance of cooperation between India (/topic/india) and Europe.

The OCCAR (/topic/occar)-EA Director congratulated the Government of India (/topic/india) on committing to commence this special relationship and expressed his hope that this first step will lead to a long, fruitful and mutually beneficial cooperation, the statement observed. The Eurodrone (/topic/eurodrone) is an unmanned system, designed to carry-out long endurance Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) missions developed by Airbus Defence & Space GmbH (prime contractor), Leonardo Spa, Dassault Aviation and Airbus Defence & Space SAU for Germany (/topic/germany), France, Italy and Spain as well as other interested nations

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## **Indian Army to finalise Rs 10,200 crore deal for indigenous Pinaka Rocket Systems**

**Source: Financial Express, Dt. 20 Jan 2025,**

**URL: <https://www.financialexpress.com/business/defence/indian-army-to-finalize-rs-10200-crore-deal-for-indigenous-pinaka-rocket-systems/3720281/>**

The Indian Army is set to make a significant stride in artillery modernization by securing a massive Rs 10,200 crore order for ammunition related to the Pinaka multi-launch artillery rocket system. This development highlights the Army's commitment to enhancing its indigenous defense capabilities, as it moves towards full deployment of the Pinaka system across its regiments.

### **Breaking Down the Deal**

Army Chief General Upendra Dwivedi confirmed that two contracts are scheduled to be signed by the end of the current fiscal year on March 31. These contracts include a Rs 5,700 crore deal for high-explosive pre-fragmented ammunition and a Rs 4,500 crore deal for area denial munitions. These orders will provide the necessary ammunition for the 10 Pinaka regiments already formed, with additional regiments in the pipeline.

The Pinaka rocket system has already proven its worth in the Indian Army, especially with some regiments deployed in high-altitude regions along the northern borders with China. The system's capability to deliver precise strikes at high altitudes has made it one of the most advanced artillery rocket systems globally.

### **Pinaka: A Game-Changer in Artillery Warfare**

Developed by the Defense Research and Development Organization (DRDO), the Pinaka rocket system has seen impressive advancements. It boasts an extended range of up to 75 km, with plans in place to enhance it further to 120 km and eventually 300 km. This extended range is expected to shift the focus entirely onto Pinaka, potentially phasing out alternative long-range weapon systems.

The Pinaka's operational versatility has been a major factor in its growing prominence. The system can launch a variety of munitions, including anti-tank and anti-personnel minelets, making it invaluable in both offensive and defensive operations. The Army is particularly keen on receiving more advanced ammunition to boost the strike capabilities of the system.

### **International Recognition and Export Potential**

In addition to domestic demand, the Pinaka system has attracted international interest. Armenia has recently placed an order for the Pinaka rockets, marking a significant milestone for India's defense exports. Several countries from regions like ASEAN, Africa, and Europe have expressed interest in acquiring the Pinaka system, further solidifying India's growing presence in the global defense market.

### **Future Outlook**

With the induction of the new regiments and the ongoing development of longer-range Pinaka rockets, the Indian Army is poised to enhance its artillery capabilities substantially. As the system evolves, it is expected to play a crucial role in India's defense strategy, both at home and on the international stage.

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## Science & Technology News

### Space economy has grown to \$8 billion and is projected to touch \$44 billion in the next decade- Dr. Jitendra Singh

Source: Press Information Bureau, Dt. 21 Jan 2025,

URL: <https://pib.gov.in/PressReleasePage.aspx?PRID=2094838>

Union Minister of State (independent charge) for Science and Technology, Dr. Jitendra Singh shared an in-depth conversation with Shri Vijay Tankha, Member of Rajya Sabha, during an exclusive programme on Sansad TV, India's biopharma and space sectors, and the nation's strides in governance and climate action.

Dr. Jitendra Singh highlighted India's transformation in the space sector, and credited PM Modi for these reforms, which opened the sector to private investment. The space economy has grown to \$8 billion and is projected to touch \$44 billion in the next decade. Milestones like the indigenous Gaganyaan Mission, the upcoming Chandrayaan-4 (2027), Shukrayaan (2028), and the Indian Space Station (2030) showcase India's robust trajectory.



*Union Minister of State, Dr. Jitendra Singh in an exclusive interview with Sansad TV at New Delhi*

He lauded startups and FDI for fuelling innovation, with missions like SPADEX enabling docking capabilities, marking a leap in technological advancement. The Vyom Mitra robo mission was highlighted as a precursor to human space exploration.

Dr. Jitendra Singh claimed that Biomanufacturing and bio foundries will foster the Fourth Industrial revolution. "India's bio-economy, backed by abundant resources from the Himalayas to its shores, was spotlighted as a growth driver. As one of the first nations with a dedicated bio-economy policy, India is set to lead global innovation in recycling, manufacturing, and startups in this sector. Dr. Singh reaffirmed the government's support for knowledge pooling, public-private collaborations, and startup participation to sustain growth." He added that India is one pioneer country who has prepared its BIO-E3 policy.

Dr. Jitendra Singh emphasized the shift to citizen-centric governance under PM Modi. Initiatives like Mission Karmayogi are redefining bureaucracy by prioritizing role-based capacity building. Digital innovations like the face-recognition-enabled digital life certificate and dynamic online modules have eased citizens' lives.

India's commitment to combating climate change and addressing its heterogeneous climatic challenges was reiterated. Dr. Jitendra Singh recalled the PM's Mission LiFE, promoting sustainable living. He also highlighted India's leadership in preventive healthcare, meeting global standards in addressing health and environmental concerns.

India has emerged as a reliable partner on the world stage, driven by collaborative efforts, transparency, and innovation. The conducive environment created under PM Modi's leadership has made the nation a hub for startups, businesses, and industries, cementing its position as a leader in technology, sustainability, and governance.

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## **DNA from ancient viruses may be important for growth of embryo in womb, study suggests**

Source : Hindustan Times, Dt. 21 Jan 2025,

URL: <https://www.hindustantimes.com/science/dna-from-ancient-viruses-may-be-important-for-growth-of-embryo-in-womb-study-suggests-101737458524845.html>

DNA from ancient viruses that form a part of the human genome may be contributing in the early development of an embryo in the womb, according to a study. Ancient viral DNA, also called 'transposable elements', are said to have infected our primate ancestors millions of years ago, remnants of which are present in the human genome.

Researchers, led by those at Helmholtz Munich and Ludwig-Maximilians-Universität, Germany, found that once dismissed as the "dark side" of the genome, remnants of the ancient viral DNA are re-activated during the first hours and days following fertilisation when a sperm and egg unite and pregnancy starts.

The findings, published in the journal Cell, are "significant because these early-stage cells can differentiate into all body cell types", said corresponding author Maria-Elena Torres-Padilla, director of the Institute for Epigenetics and Stem Cells, Helmholtz Munich.

"By understanding how these cells regulate ancient viral elements, we gain crucial insights into the mechanisms of cellular plasticity," Torres-Padilla said.

Cell plasticity refers to how cells can change their identity and function in response to changes in environment. It is seen in varied contexts, including development of an embryo, healing of a wound and also cancer.

For the study, the authors created a map of an embryo, by comparing multiple ones from different mammal species, including mouse, cow, pig, rabbit, and the non-human primate, rhesus macaque.

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## What are solar storms, how do they affect Earth?

Source : News nine, Dt. 22 Jan 2025,

URL : <https://www.news9live.com/science/what-are-solar-storms-how-do-they-affect-earth-2802576>

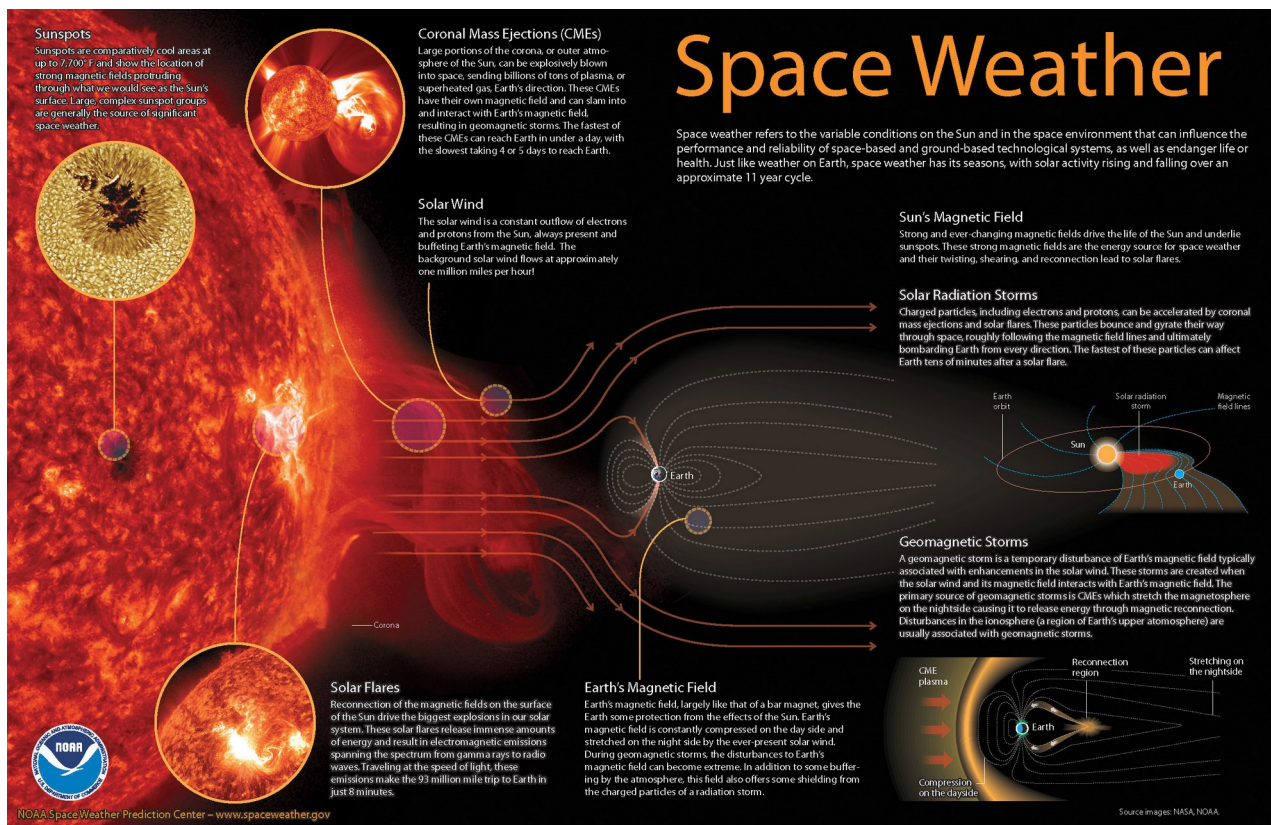
The Sun is a ball of hot gas or plasma. Energetic particles stream out of the Sun, causing what is known as the solar wind, that has an influence on the entire Solar System. This solar wind darkens and weathers the surface of Mercury, through a process known as space weathering. On Venus, it strips away oxygen and hydrogen from the ionosphere. On the Moon, it causes outgassing from the rocks, providing the Moon with a wispy atmosphere. On Mars, it strips away the tenuous atmosphere. Even as far away as Neptune, solar activity is linked to the formation of clouds. When there are violent solar outbursts, they result in severe space weather in the form of solar storms.

Clusters of sunspots are the active regions from where these energetic outbursts originate. Solar flares are sudden releases of energetic X-ray and ultraviolet (XUV) light, that can occasionally outshine the entire Sun. These solar flares are measured by the intensity of their X-rays on a scale that goes through the letters A, B, C, M and X. X-class flares are the most powerful category of solar flares. A piece of the Sun can be violently hurled outwards in the form of coronal mass ejections (CMEs). There can also be coronal holes where energetic particles stream out in a steady high speed stream, that are not as chaotic and violent as CMEs, but can cause solar storms nonetheless. Strands of plasma suspended in the atmosphere of the Sun, known as filaments, can also erupt and be launched into space. All of these events result in Solar Storms.

### How Solar Storms affect the Earth

Initially, these violent outbursts results in a solar radiation storm, where particles are accelerated to close to the speed of light. Particularly damaging are the relativistic protons that can damage orbital assets, and cells of living organisms. Passengers in jets and astronauts are exposed to higher levels of radiation, and these events can cause radio blackouts on the sunlit side of the Earth. Following the solar radiation storms are CMEs, that can take days or weeks to reach the Earth, as they travel much slower. The faster CMEs slow down while the slower CMEs accelerate in interplanetary space. CMEs can also interact with each other or pile up, resulting in so-called 'cannibal' CMEs. These CMEs can adversely impact many elements that modern civilisation depends on.

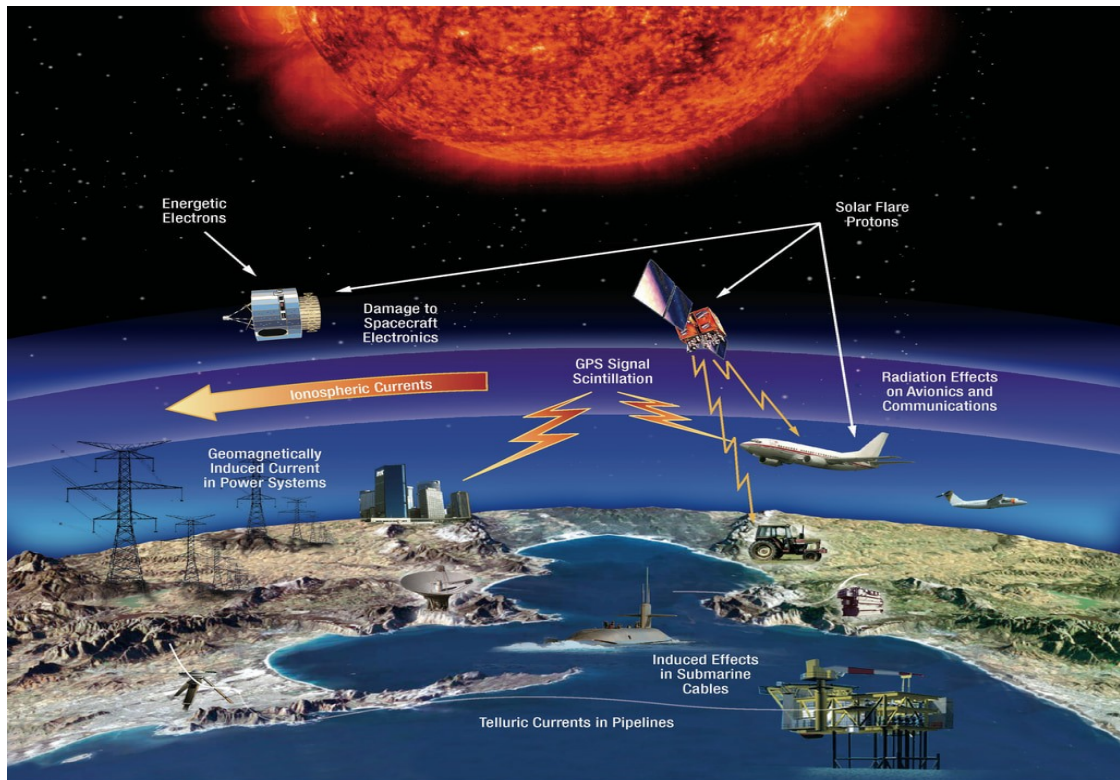
The interaction between the CMEs and the geomagnetic field of the Earth can cause geomagnetic storms. The injection of heat inflates the atmosphere much like a hot air balloon, increasing the drag on satellites and dragging them downwards. Currents can be induced along any long conductors on the ground, including in power distribution networks and oil pipelines, causing equipment failure and potentially blackouts. Navigation and communications infrastructure can be adversely affected. Scientists do not fully understand the behaviour of the Sun, the underlying processes that drive violent outbursts, and find it challenging to predict and prepare for solar storms. Scientists also have to protect the hardware on Mars from solar activity.



The processes driving space weather.

### How Solar Storms affect the Earth

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**How solar storms affect the Earth. (Image Credit: NASA SVS).**

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