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FROM THE **EDITOR'S DESK**

**"Public transport is like a magnifying glass that shows
you civilisation up close."**

As we are well aware, transport is the most determinative sector of any economy. Tianshan Shengli Tunnel in China is an engineering marvel featuring the world's deepest vertical shaft for a highway tunnel. It uses a "three tunnels plus four shafts" design to traverse complex geologically sensitive zones. With the area experiencing temperatures dropping to - 42°C, the tunnel significantly improves logistics and transport efficiency in the region, smoothing the movement of goods and stimulating economic development.

The National Highways Authority of India established four consecutive Guinness World Records for rapid highway construction on the Bengaluru–Kadapa–Vijayawada Economic Corridor in Andhra Pradesh. These records were for the longest continuous bituminous concrete laying and highest quantity of bituminous concrete laid within 24 hours. With these NHA has outshined previous global standards for highway construction, improving infrastructure development under the Bharatmala Pariyojana. These achievements highlight India's capabilities in high-speed, high-quality road construction, utilising modern machinery and sustainable materials.

Kashi Ropeway in Varanasi, India's first urban public transport ropeway is designed to reduce traffic congestion in the city's narrow, congested lanes. Often quoted as the first of its kind in India (and potentially Asia), will be a major, sustainable addition to urban mobility in the city.

Read, reflect and revert with your thoughts and feelings.

We look forward to your support and suggestions.



- Editorial Team

Dear Readers,

There have been requests from quite a few readers for hard copies of Prajya. We understand that quite a high percentage of our young readers keep revisiting some articles, and a handy print version within reach induces one to read more often, highlight things and make notes. This also partly contributes to students spending less screen time. The Prajya team is happy to bring to you the issue in print.

However, there are few things that we want to be careful about:

- A. We don't want to print more than what is required and
- B. Keep the cost of the print version (plus postage) within reasonable limits.

Please note that the access to free online e-version will continue.

So, it will greatly help us if you could fill in the details in the link provided.

<http://bit.ly/Prajya>

Happy Reading !

Watch out for the Monthly Prajya Quiz online

Visit <https://davchennai.org/publications/prajya-news-magazine/>



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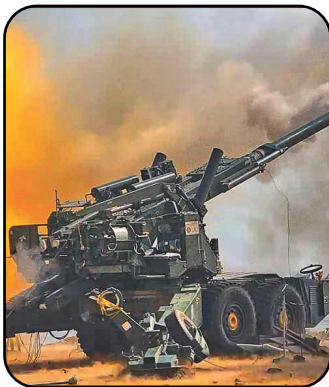


International Current Affairs

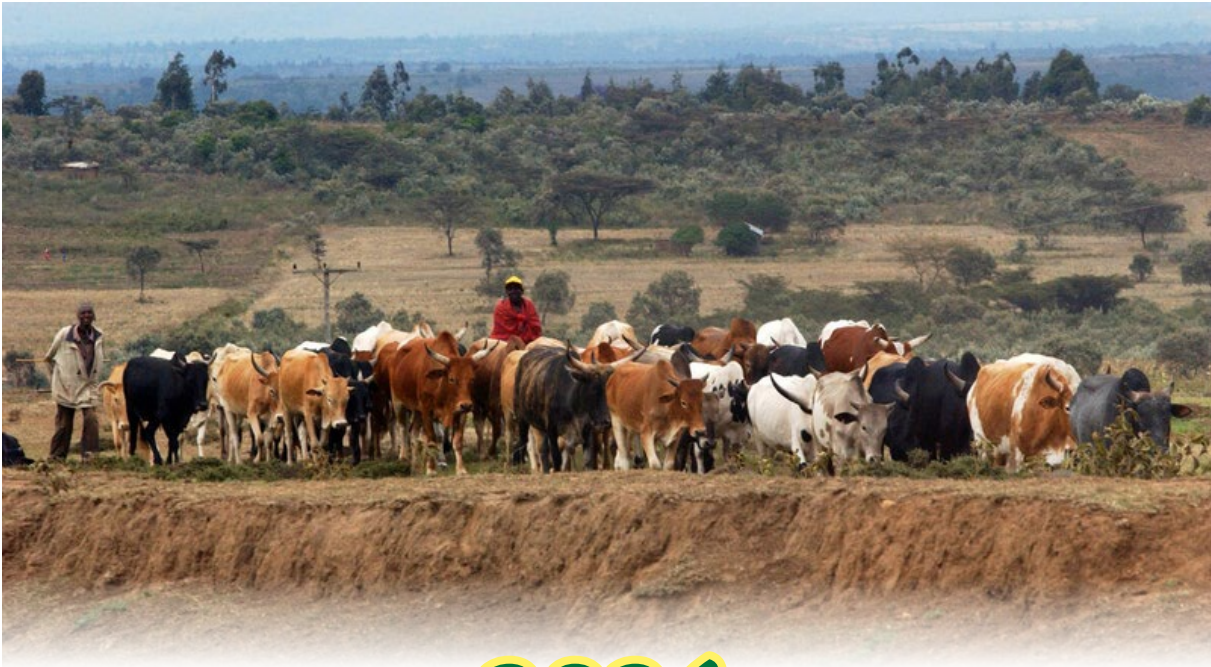
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2026

International year of rangelands and pastoralists

The rangeland ecosystems are under increasing pressure from droughts, floods, land degradation, animal diseases and competing land uses, limiting pastoralists' mobility and threatening their way of life.

The International Year of Rangelands and Pastoralists – 2026 (IYRP), implemented by Food and Agriculture Organisation of the United Nations (FAO) aims to raise awareness and advocate healthy rangelands and sustainable pastoralism. These ecosystems are under increasing pressure from droughts, floods, land degradation, animal diseases and competing land uses, limiting pastoralists' mobility and threatening their way of life.

The 12 global themes of IYRP

1. **Rangelands as essential ecosystems:** Highlights their extent (covering 54% of Earth's land) and crucial role in biodiversity, carbon sequestration and water

management. These include The Steppes of Central Asia, the African savanna, the Alps and the Pyrenees in Europe, Andes in South America and the Great Plains of the United States.

2. **Pastoralists as sustainable managers:** As key custodians, they manage around 1 billion animals worldwide from sheep and goats to cattle, camelids, yaks, horses, reindeer and buffaloes, contributing to food security, cultural heritage and indigenous knowledge.
3. **Economics and livelihoods:** This showcases the economic power of pastoralism and its contribution to local and national economies.



4. **Food security and nutrition:** This emphasises the role of livestock products in providing high-quality, nature-based protein.
5. **Climate change resilience:** This focuses on how rangelands and pastoral systems can adapt to and mitigate climate change.
6. **Biodiversity conservation:** This highlights the role in supporting diverse flora and fauna.
7. **Land degradation neutrality:** This addresses the challenges of degradation and the need for sustainable management practices.
8. **Pastoralist women:** This focuses on the specific roles and empowerment of women in pastoralist societies.
9. **Youth and innovation:** This highlights how youth are merging traditional knowledge with new technologies to secure the future of pastoralism.
10. **Governance and tenure rights:** This addresses the need for legal recognition of land rights, mobility and community-based management.
11. **Cultural heritage and knowledge:** This recognises the diverse cultures, traditions and knowledge systems of pastoralists worldwide.
12. **The future of pastoralism:** This creates a forward-looking, 50-year vision for sustainable, resilient pastoral systems.



These monthly themes will be supported by global events, including a planned Global Pastoralist Gathering and events at the United Nations Convention to Combat Desertification (UNCCD COP17) in Mongolia from 17th to 28th August 2026.

Camelids are animals belonging to the **Camelidae** family which comprises camel, guanaco, llama, vicuña and alpaca.



Nature news



New species of pumpkin toadlet discovered in Brazil

Scientists have discovered a brand-new species deep in the cloud forests of Brazil. The tiny amphibian lives in the Serra do Quiriri mountain range and belongs to a group of miniature frogs called Brachycephalus. With this discovery, there are now 43 known species in this special group.

The new frog is incredibly small, measuring only about 9 to 13 millimetres in length. That is smaller than a paperclip, making it one of the tiniest four-legged animals in the world. Its bright orange colour helps it stand out among leaves; and its body is dotted with small greenish-brown spots on its sides and belly.

The frog is unusual in another way too. Even though it makes sounds to communicate, it is deaf to its own calls. Instead of listening, it uses visual signals to talk to other frogs. It puffs up its throat, opens its mouth and waves its arms to get attention.

Scientists named the frog *Brachycephalus lulai* in honour of Brazil's president, Luiz Inácio Lula da Silva. They hope this will bring attention to the need to protect the Atlantic Forest, where the frog lives. This forest is one of the most threatened ecosystems in the world.

The frog lives in the leaf litter of forests above 750 metres. Although it is currently listed as "least concern," its habitat is at risk due to deforestation, mining and tourism. Researchers say protecting its environment is essential for its survival.

This discovery reminds us how much there is still to learn about Earth's biodiversity—and how important conservation truly is.





Amazon stingless bees get legal rights

In an amazing first for the world, stingless bees living in the Peruvian Amazon rainforest have been granted legal rights. These tiny insects, unlike the honeybees common in Europe, do not sting—but they play a huge role in keeping the rainforest alive.

The decision was made by the provincial municipality of Satipo in Peru, after years of work by scientist Rosa Vásquez Espinoza and the Earth Law Center. They worked closely with indigenous communities who have protected

and respected these bees for generations.

The new law recognises the bees' right to exist, thrive and live in a clean, healthy environment. It also says they have the right to healthy habitats and stable climate conditions. Even more importantly, the bees can now be legally represented if their survival is threatened.

Stingless bees are among the oldest bee species on Earth and are essential pollinators. They help



pollinate more than 80% of plants in the Amazon, including crops people around the world enjoy, such as coffee, chocolate, avocados and blueberries.

Sadly, these bees are under threat from deforestation, climate change, pesticides and competition from invasive bee species. Conservationists hope this new law will protect them and inspire other regions to take similar action.

Experts say this law marks a new way of thinking—where humans recognise that nature also deserves protection and rights.



Michaela Benthaus, a 33-year-old paraplegic German aerospace and mechatronics engineer at the European Space Agency, blasted off on a dream-come-true rocket ride with former space engineer Hans Königsmann of Germany and four US entrepreneurs, Joey Hyde, a retired physicist and quantitative investor; Neal Milch, a business executive and entrepreneur, Adonis Pouroulis, an entrepreneur and mining engineer; and Jason Stansell, a computer scientist. She became the first paraplegic to travel past the Kármán Line.

Severely affected by a spinal cord injury during a mountain biking accident seven years ago, she had lost hope of her childhood dream of becoming an astronaut.

The mission NS-37 is the 16th suborbital space tourism launch carried out by Blue Origin. The New Shepard NS-37 was launched off from a Jeff Bezos property in West Texas at 8:15 a.m. The passengers experienced a brief moment of weightlessness as part of the trip. The flight was just 10 minutes but the capsule still managed to soar



FIRST WHEELCHAIR USER IN SPACE


105 kilometres up, skimming into space.

The space-skimming flight required only minor adjustments to accommodate Benthaus because the autonomous New Shepard capsule was designed with accessibility in mind. An elevator was in place at the launch pad to ascend the seven storeys to the capsule perched atop the rocket. Blue Origin added a patient transfer board so Michaela

Benthaus could scoot between the capsule's hatch and her seat. The recovery team also unrolled a carpet on the desert floor following touchdown, providing immediate access to her wheelchair, which she left behind at lift-off.

The space tourism company Blue Origin, owned by Amazon founder Jeff Bezos, has operated 16 human spaceflight missions, including the most recent one. The New Shepard programme has flown people with blindness, low vision, hearing difficulties, limb differences or mobility limitations



DO YOU KNOW 

Karman Line a common demarcation for outer space that lies 100 kilometres above sea level.



Postal stamp on **Ashwagandha**

As the world is turning towards Ayurveda for sustainable and preventive healthcare, “Ashwagandha” (medicinal herb) has emerged as a global leader in natural wellness.

With so many of us juggling busy lives and looking for natural ways to support our health, it is no surprise that ashwagandha is getting a lot of attention, for its potential benefits - from easing stress to boosting energy and supporting overall wellbeing.

This herb has been a key part of Ayurvedic medicine for thousands of years, and today, it is being rediscovered for its wide range of potential health benefits.

Highlighting the importance of traditional medicine at the second WHO Global Summit, Prime Minister Modi released the commemorative postal stamp of Ashwagandha recently, reinstating the herb’s significance in promoting immunity and wellness globally.

Ashwagandha was a major focus at the Summit, where international experts explored its scientific validation and safety standards to integrate it into global healthcare.

Commonly called by the Sanskrit name, "Ashwagandha", the plant's roots are said to smell like a wet horse (“ashwa” for horse and “gandha” for smell). It is also sometimes known as winter cherry or Indian ginseng. Also known as the "King of adaptogens", ashwagandha (*Withania somnifera*) helps the body maintain homeostasis while resisting the body's biological, physical and chemical stressors. Its potent ability also lowers cortisol and boosts energy. It has been used for over 3,000 years to enhance strength, vitality and resilience against physical and mental exhaustion. The herb also has sleep-inducing and neuroprotective properties.

Created by the Department of Posts and the Ministry of Ayush,

the stamp release took place at the summit in Bharat Mandapam, New Delhi.

The five rupee denomination stamp is intended to highlight the global recognition and resonance of the herb as an integral part of traditional medicine system.

DO YOU KNOW ?

Ayurveda has several classical texts like *Charaka Samhita*, *Sushruta Samhita*, *Bhela Samhita* etc., comprising of codified and organised medicinal wisdom covering all branches of medicine and surgery.

WHO has established its first and only **Global Centre for Traditional Medicine (GCTM)** in Jamnagar, Gujarat with the support of the Government of India.



Guinea's new President

Country	Area in sq.kms. (Ranking)	Population (millions)	Language	Capital	Currency (For 1 USD)	Economy (Ranking) (Nominal/PPP)
Guinea	2,45,857 (77)	14.3 (85% Muslims)	French (official and indigenous languages)	Conakry	Guinean Franc (8758)	Minerals (bauxite, gold and diamonds) rich. (153/155)

Guinea is a coastal nation bordering the Atlantic Ocean, with four distinct geographic regions. The country approximately has a coastline of 320 kms and forest cover of 23%.

Guinea received its independence from France in 1958. Sékou Touré was their first President. The country had one-party rule until 1984. His socialist experiment with Soviet/Chinese assistance was an economic failure. His leaning towards West came too late in the 1970s and had very little impact.

Col. Lansana Conté's military rule from 1984 to 2008 was marked

by corruption and civil unrest in the later years. Since then Guinea only undergoes series of military coups and dictatorship.

General Mamady Doumbouya (41) is a military general now serving as the 5th president of since January 2026. He won a landslide victory with 87% votes. Earlier in September 2021, Doumbouya as member of the Special Forces Group had led a coup that overthrew the previous president, Alpha Condé to become Interim President.

Mamady Doumbouya allows Chinese investment and funding mostly in the mining sector, in spite

of risks in debt traps, economic dependance and environmental impact, in addition to locals losing jobs to Chinese labour.

Rule in African countries are frequently disturbed by military coup and dictatorship. Out of 54 African countries, 22 could be considered democratic or democratic-leaning and only half of the 22, truly democratic. Reasons are often specific to each individual country, but one common denominator is colonial powers ripping off minerals and natural wealth, leaving the innocent people to fight among themselves for scarce resources.



Archaeological discoveries play a crucial role in uncovering the hidden stories of the past and deepening our understanding of ancient societies, their beliefs and their way of life. The recent unearthing of ancient Kushan coins belong to the era of emperor Vasudeva, one of the last great Kushan rulers.

The discovery site

The excavation took place at Bhir Mound in Rawalpindi, an important archaeological location near the historic city of Taxila. This site has long been associated with ancient settlements and learning centres.

Historical background

The Kushan Empire was one of the most powerful dynasties in early Indian history, flourishing between the first and third centuries CE. It played a major role in promoting trade, culture and learning across Central and South Asia.

Details of the discovery

The excavation team uncovered bronze coins (2nd century AD) along with pieces of lapis lazuli (6th century BC), a highly valued semi-precious stone.

Coin imagery and religious pluralism

According to archaeologists,



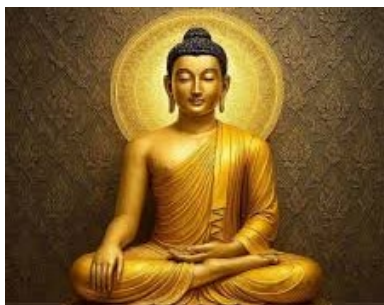
2,000-year-old Kushan coins discovered

the front side of the coins portrays King Vasudeva, while the reverse displays a female religious deity. This symbolic representation highlights the religious tolerance of the Kushan era, during which rulers supported diverse faiths. Moreover, Kushan coin designs often combined artistic elements from Indian, Iranian, Greek and Buddhist traditions, offering valuable insights

into the empire’s inclusive and multicultural religious outlook.

Trade and economic significance

The discovery of precious stone fragments alongside the coins suggests well-established trade routes connecting distant regions, promoting cultural interaction and economic growth.



Origin	Nomadic people from the Central Asian steppes near China
Extent	The Oxus River in Central Asia to the Ganga
Founder of the empire	Kujula Kadphises unified the Kushans and displaced the Sakas.
Culture	Developed the Gandhara School of Art
Greatest ruler	Kanishka; held 4 th Buddhist Council



Prof. Shrinivas Kulkarni receives the RAS Gold Medal

The world of science celebrated a proud moment when Prof. Shrinivas Kulkarni, a Maharashtra-born astrophysicist, was awarded the Gold Medal of the **Royal Astronomical Society (RAS)**—one of the highest honours in astronomy.

With this prestigious recognition awarded since 1824, Kulkarni joins legendary scientific minds such as Stephen Hawking, Jocelyn Bell Burnell, Albert Einstein and Edwin Hubble.

The journey of a cosmic detective

Prof. Kulkarni received his Master's from IIT Delhi in 1978, earned his PhD from UC Berkeley in 1983, and has been based at Caltech for over 40 years. But what makes him extraordinary isn't just where he studied—it's what he discovered.

As a graduate student, he co-discovered the first millisecond pulsar, an ultra-fast-rotating neutron star. Recalling the moment, Kulkarni described it as "the most fun achievement in my life," saying the excitement kept him awake for several days.

In 1997, Kulkarni and his collaborators demonstrated that gamma-ray bursts originate outside the Milky Way, fundamentally changing how we understand these powerful cosmic explosions.

Building "gizmos" that changed astronomy

The RAS citation specifically recognises his "sustained, innovative and ground-breaking contributions to multi-wavelength transient astrophysics"—studying things in space that suddenly appear, explode or vanish.

Prof. Kulkarni has built ten instruments in his career, guided by a simple maxim. He states, "My motto has been to build a big enough gizmo and things will happen."

He led the development of the Zwicky Transient Facility (ZTF), which surveys the entire Northern sky every two nights, catching thousands of cosmic events as they happen in real time.

Currently, he is developing NASA's Ultraviolet Explorer (UVEX) mission, targeted to launch in 2030.

When asked about the honour, Kulkarni humbly said, "I was very surprised to hear the news, especially given the stellar list of past winners."

His story, from Kurundwad to Caltech, from student to Gold Medal laureate proves that curiosity, passion and the courage to build something new can literally reveal the secrets of the universe.



New airport launched



Navi Mumbai International Airport

Synopsis

- ▶ The new airport will play a major role in establishing the region as Asia's largest connectivity hub.
- ▶ NMIA, developed by AAHL and CIDCO, marks a landmark milestone in India's aviation and infrastructure journey.

- ▶ Designed by Zaha Hadid Architects.
- ▶ Inspired by the Lotus, the airport combines cultural identity, modern design, sustainability and robust cargo infrastructure to strengthen India's growing economy.

NMIA has been developed as a landmark **public-private**

partnership (PPP) between **Mumbai International Airport Limited (MIAL)**, a subsidiary of **Adani Airport Holdings Limited (AAHL)** and the **City and Industrial Development Corporation (CIDCO)**. The project represents a major stride in India's infrastructure-building vision, reflecting the Government's agenda of **Viksit Bharat 2047**.



Envisioned as part of a dual-airport system for the Mumbai Metropolitan Region (MMR), NMIA will complement Chhatrapati Shivaji Maharaj International Airport (CSMIA).

With an initial capacity of 20 million passengers per annum (MPPA), the airport will eventually expand to manage 90 MPPA, making it one of the largest passenger-handling airports in India.

Nature themed terminal at Lokapriya Gopinath Bardoloi Airport

Prime Minister Modi inaugurated the new terminal of Lokapriya Gopinath Bardoloi International Airport in Guwahati. The bamboo orchid-themed terminal boosts Assam's connectivity and tourism.

It marks a major milestone in the infrastructure development of the Northeast. Along with the terminal the Prime Minister also unveiled an 80-foot statue of Gopinath Bardoloi, Assam's first Chief Minister, outside the airport premises.

HIGHLIGHTS

The new terminal is spread across nearly 1.4 lakh square metres

and is designed to handle up to 1.3 crore passengers annually. It significantly enhances the airport's capacity and improves the overall travel experience.

Major upgrades include improved airside infrastructure, modern passenger facilities and systems designed for smoother aircraft and passenger movement, positioning Guwahati as a major regional aviation hub.

Nature-inspired Design: "Bamboo Orchids"

The new terminal draws inspiration from Assam's biodiversity and cultural heritage, built around the theme "Bamboo



Orchids." The design reflects the state's close relationship with nature and tradition.

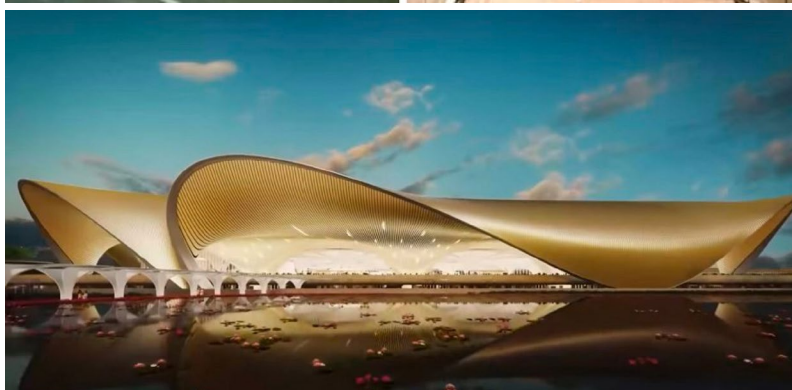
Architectural elements showcase

- ▶ Extensive use of bamboo-inspired structures
- ▶ Motifs reflecting Assam's flora and cultural symbols
- ▶ Interiors that combine modern design with local identity.

This approach aligns with the Prime Minister's vision of "Vikas bhi, Virasat bhi" development along with heritage.

Who is Lokapriya Gopinath Bordoloi?

Lokapriya Gopinath Bordoloi was a pivotal Indian statesman, freedom fighter and the **first Chief Minister of post-Independence Assam**, renowned for his visionary leadership, dedication to Assam's development (establishing universities like Guwahati University), and efforts to protect the Northeast's interests, earning him the title "Lokpriya" (beloved by all) and a posthumous Bharat Ratna in 1999.





India wins maiden Squash World Cup

India made history on 14th December 2025 by winning the Squash World Cup for the first time, defeating top-seeded Hong Kong 3-0 in the final held at the Express Avenue Mall in Chennai. The victory marked a landmark success for Indian squash and made **India the first Asian nation to lift the prestigious mixed-team title.**

Veteran **Joshna Chinappa** set the tone for the final with a strong 3-1 win over Hong Kong's **Lee Ka**

Yi. Reflecting on her performance and the significance of the moment, Chinappa said, "It feels great playing here in Chennai. I am still so thankful that I can still be a part of the India national team. Playing here with the home support made all the difference."

India's top-ranked men's singles player **Abhay Singh** followed with a clinical 3-0 victory over Alex Lau in just 19 minutes, extending India's lead. Singh spoke about the experience of winning on home soil, saying, "An unbelievable evening. I am so privileged to be able to do this with some really legendary teammates. For me to be a Chennai boy and do this in my city makes me speechless."

The tie was sealed by 17-year-old **Anahat Singh**, who delivered a

composed 3-0 win against Tomato Ho to complete the clean sweep for India. After the match, Anahat said, "I just wanted to play my best squash. To finish the tie for India is unbelievable."

India's squad was unbeaten throughout the tournament, winning every tie without dropping a match as they progressed to the final. Their dominant run included victories over Switzerland, Brazil, South Africa and Egypt before facing Hong Kong.

The World Cup triumph improves on India's bronze medal finish in the 2023 edition and comes as squash prepares for its Olympic debut at the Los Angeles 2028 Games, a development seen as a boost for the sport's profile in the country.

<p>VEDEVAN SENTHIL KUMAR RANK 45 7 7 7 RANK 296 6 6 5 vs ROBIN GADOLA + • MATCH 1</p>	<p>ANAHAT SINGH RANK 28 7 7 7 RANK 186 1 4 2 vs CELINE WALSER + • MATCH 2</p>
<p>ABHAY SINGH RANK 29 7 7 7 RANK 156 0 5 2 vs LOUAI HAFEZ + • MATCH 3</p>	<p>JOSHNA CHINAPPA RANK 79 7 5 7 7 RANK 250 1 7 2 0 vs STELLA KAUFMANN + • MATCH 4</p>



Fertiliser plant in Dibrugarh

PM Modi laid the foundation stone of a ₹10,601 crore ammonia urea fertilizer plant at Namrup in Dibrugarh district, Assam. The project developed under the Assam Valley Fertiliser and Chemical Company Limited (AVFCCL).

HIGHLIGHTS

- ▶ **Joint venture** between central and state entities - Assam Government, Oil India



Limited, National Fertilisers Limited, Hindustan Urvarak & Rasayan Limited and Brahmaputra Valley Fertiliser Corporation Limited (BVFCL).

- ▶ **Annual production:** 12.7 lakh metric tonnes of urea.
- ▶ **Expected commissioning:** 2030
- ▶ This collaboration ensures financial strength, technical expertise and long-term sustainability.

Significance

- ▶ Namrup has been a centre for fertiliser production for decades; and houses BVFCL which is the oldest fertiliser unit in the Northeast.
- ▶ Traditionally, it has served

farmers in Assam and neighbouring states.

- ▶ With rising demand and ageing infrastructure there was a pressing need for a modern, high capacity plant.
- ▶ This would ensure uninterrupted urea supply, reduce dependence on imports and strengthen the region's agricultural resilience.
- ▶ A major step towards fertiliser self-reliance, boosting farmer's welfare and accelerating industrial growth in Northeast India.

Prime Minister inaugurated the Grand International Exposition of Sacred Piprahwa Relics in New Delhi. The Piprahwa relics, discovered in 1898, are among the earliest archaeological remains directly associated with Lord Buddha.

Sacred Piprahwa relics in global buddhist exposition

The exposition displays rare Buddhist relics connected to Buddha, many of which were recently repatriated to India.

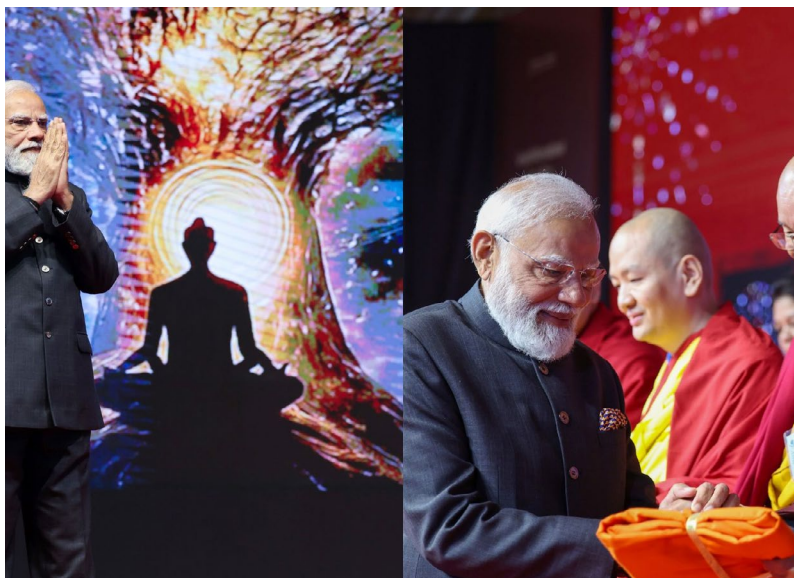
The event reflects the country's continued focus on preserving heritage while sharing it with the world.

HIGHLIGHTS

- ▶ Titled “**The Light and the Lotus: Relics of the awakened one**”, the exposition is being held at the Rai Pithora Cultural Complex.
- ▶ For the first time, the exhibition brings together Piprahwa relics preserved at the National Museum and the Indian Museum.

Significance

- ▶ The exposition highlights India's deep civilisational links with Buddhism, which originated in the subcontinent and spread across Asia.



- ▶ It reflects India's role as the spiritual homeland of Buddhism and strengthens cultural diplomacy.
- ▶ The event also aligns with the **Prime Minister's emphasis on promoting India's soft power through heritage, spirituality, and shared Asian cultural traditions.**
- ▶ Such efforts not only preserve national heritage but also make it accessible to scholars, devotees and the general public.



Technological news

From breakthroughs in supercomputing to homegrown medical devices and strides in space missions and sustainable engineering, 2025 has been a transformative year for India's technology landscape. Indian innovators have delivered achievements that demonstrate not just advancement but self-reliance, achieving milestones that echo a commitment to innovation, economic strength and strategic autonomy.

Across research labs, defence institutions, space centres and startup ecosystems, India has shown that major technological progress can be achieved with domestic ingenuity and global vision. Here are five developments that capture the impact of India's technological surge over the last year and the first week of 2026 too!

PARAM Rudra System becomes operational at IIT Bombay

The Indian Institute of Technology (IIT) Bombay has inaugurated a new high-performance supercomputing facility known as the **PARAM Rudra system** as part of the Government's National Supercomputing Mission. The system was inaugurated on 8th January 2026 by Professor Abhay Karandikar, Secretary of the Department of Science and Technology,

Government of India. **PARAM Rudra has a computing capacity of three petaFLOPS** (a measure of a computer's processing speed, specifically the ability to perform one quadrillion (10^{15}) floating-point operations per second) and is built on indigenously designed Rudra servers developed by the Centre for Development of Advanced Computing (C-DAC).

It is expected to benefit more than 200 faculty members along with nearly 1,200 students.

Sunita Verma, Group Coordinator at the Ministry of Electronics and Information Technology (MeitY), highlighted the importance of this achievement in India's technological trajectory, and emphasised the need for more investment in indigenous development.

This installation continues the expansion of India's supercomputing ecosystem, with a total of 38 supercomputers commissioned across the country under the National Supercomputing Mission.



DHRUV64: A fully indigenous 64-bit microprocessor

India has marked another significant milestone in its semiconductor development with the launch of **DHRUV64**, the nation's **first fully indigenous 1.0 GHz, 64-bit dual-core microprocessor**. Developed by C-DAC under the Government's Microprocessor Development Programme, the chip represents a strategic step in domestic processor capability, **crucial for reducing our dependence on foreign computing hardware**.

DHRUV64 is a reliable, homegrown processor platform much like the ones running our many computers and smart devices. DHRUV64's design is based on open-source RISC-V architecture which will provide a dependable platform for industrial systems, 5G networks, automotives and consumer electronics. And **all of this will be openly accessible to not just Indian scientists and**

developers but to anyone across the world.

This milestone not only adds a valuable component to India's processor portfolio but also lays the groundwork for future high-end chips that can be produced at home.

DHRUV64 is not just a chip. It is a building block for next-generation homegrown semiconductor technologies.

VoxelGrids unveils India's first indigenous MRI scanner

In a breakthrough for medical technology, Bengaluru-based startup VoxelGrids has developed India's first fully indigenous 1.5



Tesla MRI scanner. The scanner was built at the **Chandrapur Cancer Care Foundation** near Nagpur.

This development dramatically shifts India's position in advanced diagnostic imaging by reducing dependence on expensive imported MRI systems.

The VoxelGrids system is built with a helium-free design, which lowers manufacturing and operating costs by almost 40 % compared to conventional imported MRI machines. It also incorporates energy-efficient electronics and maintains industry-standard size for clinical use across all health centres.

Founder Arjun Arunachalam said that the company's long-term effort involved more than a decade of research. "We have been able to make the electronics around the magnet extremely well-packaged while maintaining the same bore-size, making it far more power efficient and reducing operating costs," he explained.

In addition to cost and energy advantages, VoxelGrids also offers





flexible pricing models such as pay-per-use, which could make MRI services more accessible to smaller hospitals and in regions which do not currently have access to expensive technology found in metros.

This innovation reflects a major leap in India's medical technology capabilities and supports broader goals of domestic manufacturing in health tech.

BlueBird Block-2 satellite launch on ISRO's 'Baahubali' rocket

The Indian Space Research Organisation (ISRO) successfully launched the **BlueBird Block-2 satellite** aboard its heavy-lift **LVM3-M6**, commonly referred to as the 'Baahubali' rocket, from Satish Dhawan Space Centre in Sriharikota recently. The satellite, developed by AST SpaceMobile in the United States, was successfully placed into Low Earth Orbit post its

launch marking the success of the 'Baahubali' rocket.

This mission is one of the heaviest commercial payloads launched from Indian soil, showcasing India's growing capability in global commercial space services. On the successful

deployment, ISRO Chairman V Narayanan announced, "I am extremely happy that LVM3-M6 launch vehicle has successfully and precisely injected BlueBird Block-2 communication satellite in the intended orbit." Prime Minister Modi remarked, "This is also reflective of our efforts towards an **Aatmanirbhar Bharat**," further congratulating space scientists and engineers.

The BlueBird Block-2 satellite is designed to expand space-based cellular broadband connectivity, providing direct-to-smartphone communication services in areas that lack traditional ground infrastructure.

The mission showcased the reliability of India's space launch capabilities and strengthened the country's role in global satellite deployment market.

SWaDeS enhances water security with portable sea water desalination

India's Defence Research and Development Organisation





(DRDO) has developed a portable **Sea Water Desalination System** known as **SWaDeS**, aimed at turning saline seawater into potable drinking water for troops and remote communities. The system was unveiled in January 2026 by DRDO's Defence Laboratory, Jodhpur.

SWaDeS can operate both manually and with engine support,

enabling soldiers in coastal, high-altitude or arid regions to independently generate safe drinking water without heavy infrastructure. The engine-operated version can reduce seawater salinity to drinkable standards and support the needs of up to 20 to 25 personnel.

The system is a practical solution to one of the most persistent challenges of field operations: access

to clean water in remote areas where conventional supply lines are unavailable.

The manual version's portability makes it useful for patrols and emergency deployments. **SWaDeS also highlights how defence-led technologies can have broader civilian applications in settings where water scarcity is a critical challenge.**



A look ahead

These milestones represent India's rising confidence and capability in technology domains once dominated by global incumbents. Whether in supercomputing, semiconductors, medical imaging, space services or sustainable engineering, India's approach is clear: build locally, scale globally and empower tomorrow's innovators.

Collectively, these achievements underscore the progress and promise of an India that is not just participating in the global technological race but shaping its direction.



Smt Meenakshi S

An innovative satellite internet concept developed by an Indian team has earned global recognition at the NASA Space Apps Challenge 2025. The project aims to bridge India's digital divide by delivering broadband connectivity to remote and underserved regions.

The Chennai-based team: **Photonics Odyssey**, proposed a sovereign, phased-array satellite internet infrastructure to expand broadband access across remote regions and won the **Most Inspirational Award**. The project aims to reduce ground dependency and help connect more than 700 million people in India who currently lack access to broadband connectivity. **This technology offers several advantages over conventional satellite systems like faster signal acquisition, lower latency, higher reliability and better scalability for large populations.** A key factor behind the global recognition is their interdisciplinary approach that combined expertise in photonics, satellite communications, systems design and problem-solving. **The winning team members are Manish D., M. K., Prasanth G., Rajalingam N., Rashi M., and Sakthi R.**



INDIA shines at NASA's Space Apps Challenge

The NASA International Space Apps Challenge is an annual global hackathon organised to encourage collaborative problem-solving using open-source data provided by space agencies. Since its launch in 2012, the challenge has grown into a powerful ecosystem fostering innovation, entrepreneurship and real-world problem-solving using space science and technology.

It has grown into one of the world's largest collaborative platforms for STEM innovation.



NASA said the 2025 edition of its **flagship global hackathon brought together more than 1 lakh 14 thousand participants across 551 local events in 167 countries and territories.** Indian American students and participants of Indian origin also featured prominently among the winners, reflecting the strong presence of the Indian diaspora in global science and technology innovation. This recognition not only celebrates a single project but also symbolises India's broader innovation ecosystem, which increasingly contributes solutions to global challenges.





INSV Kaundinya's first voyage

A tribute to indigenous knowledge systems

Inspired by the ancient Indian ship building tradition and techniques, Kaundinya was constructed entirely using stitched – plank techniques.

In July 2023 a tripartite MOU was signed by the **Ministry of Culture, Indian Navy** and a Goa-based ship building company **M/S Hodi Innovations Private Ltd.** The agreement was to build a sailing vessel using sewn ship technique. The design of the ship is based on a 5th century CE merchant ship depicted in the murals of Ajanta caves. This ship was named Kaundinya after the legendary first century Indian mariner who sailed to Southeast Asia.

The project

The project was conceived by Sanjeev Sanyal - an economist, author and historian, to revive ancient Indian maritime heritage – shipbuilding, seafaring and cultural. The concept was realised by naval

architect Cdr Hemanth Kumar and the project was funded by the Ministry of Culture.

The ship

After the MOU was signed the keel was laid in September 2023. Inspired by the ancient Indian ship building tradition and techniques, Kaundinya was constructed entirely using stitched – plank techniques. The wooden planks of the ship are stitched together using coconut coir ropes and sealed with natural resins. **With such ships Indian mariners have undertaken long-distance voyages to West Asia, Southeast Asia and Africa, long before the advent of modern navigation.** Built by traditional artisans under the guidance of **master shipwright Babu Sankaran and builder**

Prathamesh Dandekar, the ship is fully sea worthy and fit for oceanic navigation. They were supported by extensive research and testing by the Indian Navy and the Department of Ocean Engineering, IIT Madras. It is a 19.6 m long and 6.5 m wide vessel and is equipped with square sails and steering oars which are entirely alien to modern day ships. Despite using ancient techniques the vessel is equipped with modern satellite communication. This engineless, wind powered ship was launched in February 2025 and commissioned in May 2025.

The symbolism

The ship is also very rich in its cultural symbolism with the following symbols:

Gandabherunda – A two headed eagle associated with the Kadamba dynasty, symbolising power and protection.

Sun motifs on sails- representing vitality, divinity, navigation and auspicious beginnings.

Simha yali on the bow- A mythical lion-like creature symbolising strength and guardianship over the ship.

Harappan – style stone anchor on deck as a tribute to Indus valley maritime trade networks and early anchoring technology.

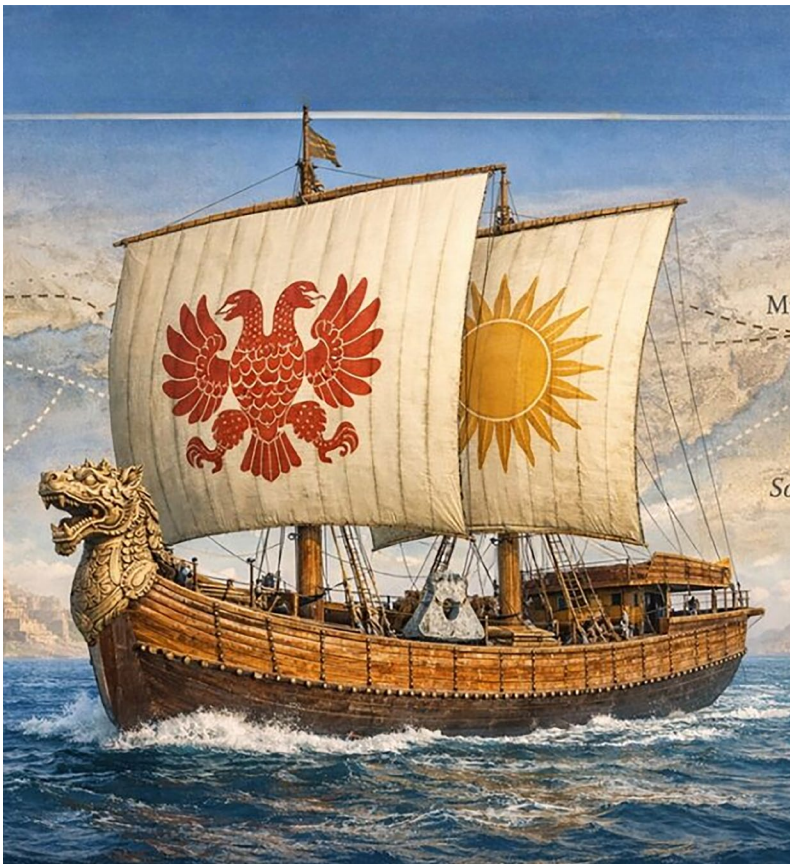
The voyage: Kaundinya embarked on her maiden voyage from Porbandar, Gujarat to Muscat, Sultanate of Oman 29th December 2025. The voyage celebrates the more than five millenia old maritime, cultural and civilisational ties between India and Oman and is a tribute to India's seafaring legacy. The voyage retraces the ancient maritime routes that once connected the western coast of India with Oman. The arrival of Kaundinya in Muscat symbolises a



shared maritime heritage that long predates the modern nation-state. **It was an 18-day journey that ended on 14th January 2026.**

Cdr Vikas Sheoran led the vessel while Cdr Hemant Kumar who was associated with the project since the conceptualisation, was the officer-in-charge of the expedition. The crew comprised four officers and thirteen naval sailors.

This voyage from Porbandar to Muscat is not only important from a bilateral relations perspective but also from a strategic perspective. Today, the Indian Ocean has re-emerged as a theatre of intense geopolitical competition. China's growing naval presence and expanding partnerships among extra-regional powers have heightened the strategic value of reliable regional partners. For India, whose trade and energy lifelines traverse these waters, Oman's location near the Strait of Hormuz makes it strategically important. The concept, the techniques, the symbols and the selection of the destination for the maiden voyage are all rooted in *Bharatiyata*. **INSV Kaundinya** is thus a convergence of *Bharatiya* history, craftsmanship and naval expertise.





Liquid nanoclay turns deserts green

At the beginning of March, a small team travelled to the deserts of Dubai and planted watermelon, zucchini and pearl millet in what looked like lifeless sand. Five months later, that same land was covered in healthy green plants and fresh vegetables. This surprising success was made possible by an invention called Liquid Nanoclay.

Liquid Nanoclay is a special mixture made from just water and clay. It is created by a Norwegian company called **Desert Control**. When sprayed onto dry, sandy soil, the liquid soaks in and sticks to the sand particles. This helps the soil hold water better and provides nutrients that plants need to grow.

The technology was invented by scientist **Kristian Olesen** and later developed into a product by Desert Control. The clay particles are made extremely tiny, allowing the liquid to spread easily through

the sand. It can be applied using sprinklers or regular irrigation systems. According to the company, **the treatment can turn desert land into usable farmland in just a few hours and reduce water use by more than half.**

This invention is especially important for countries like the United Arab Emirates, which imports about 90% of its food. Growing food locally in the desert could improve food security and reduce dependence on imports. Since 2018, Desert Control has been working with the International Center for Biosaline Agriculture (ICBA) in Dubai to test the technology on real crops.

Scientists believe Liquid Nanoclay could help many dry regions around the world grow more food. **However, some experts warn that deserts are fragile ecosystems; and any new technology must be used carefully to avoid harming nature.**

One challenge is cost. Treating land currently costs several dollars per square metre, but the company is developing machines that can produce much more liquid nanoclay at lower prices. If the cost drops, this invention could have a huge impact on global food supplies.

Liquid nanoclay shows how science and innovation can help solve real-world problems—like feeding a growing planet.





Flora & fauna news

A rare all-black tiger spotted in Odisha

A rare all-black tiger has been sighted, surprising wildlife experts and conservationists.

The melanistic tiger, distinguished by its unusually dark coat, was reportedly observed in a forested region of the state during routine wildlife monitoring activities. Such sightings are extremely uncommon, as true black

tigers are believed to result from rare genetic mutations affecting pigmentation.

Forest department officials said the animal appeared healthy and was moving freely within its natural habitat. Camera trap images and eyewitness accounts are currently being reviewed to confirm details of the sighting and to better understand the tiger's behaviour.

Odisha is known for its rich biodiversity and is home to several

protected tiger reserves, though sightings of melanistic big cats are exceptionally rare. Wildlife experts say the discovery highlights the ecological significance of the region and underscores the importance of continued conservation efforts to protect endangered species and their habitats.

Rare eastern imperial eagle spotted at Mudumalai Tiger Reserve

A rare migratory bird of prey, the eastern imperial eagle, was sighted in Tamil Nadu during the 2025-26 winter season. The sighting has drawn attention to Mudumalai's growing importance as a safe winter home for birds of prey that migrate long distances to the Indian subcontinent.

The eastern imperial eagle, a winter visitor to India, was recorded by wildlife photographer Murali Moorthy in the Nilgiris landscape. One of the photographs also showed the eagle alongside an endangered Egyptian vulture, making the



Image tweeted by @ParveenKaswan



NHAI introduces India's first wildlife-safe road

India has taken an important step towards eco-friendly road development with the launch of its first wildlife-safe highway on National Highway 45 (NH-45) in Madhya Pradesh. The project, introduced by the National Highways Authority of India (NHAI), aims to reduce accidents involving wild animals while ensuring smooth travel through forest areas.

sighting especially important for conservationists. Experts say such observations help track the movement and survival of rare migratory birds.

The species breeds in parts of Central and Western Asia and travels south during the winter months. Only a small number reach India each year, making sightings uncommon. The eagle is a large bird of prey and a top predator that feeds on rodents and small animals, helping maintain balance in nature. Its presence is often seen as a sign of a healthy ecosystem.

Wildlife researchers say Mudumalai provides ideal conditions for migratory raptors.

The reserve has open grasslands for hunting, forest edges, tall trees for resting, and plenty of prey. Studies conducted between 2011 and 2022 recorded around 58 species of raptors in the area. Low human disturbance and diverse habitats make it suitable for wintering birds.

Mudumalai Tiger Reserve covers about 321 square kilometres. It is located at the meeting point of Tamil Nadu, Karnataka and Kerala, and forms part of the Western Ghats and the Nilgiris Biosphere Reserve. Conservationists, however, warn that increasing tourist activity could disturb sensitive habitats. They stress the need for responsible tourism to protect both migratory and resident wildlife.

The wildlife safe road is located on the 11.96-kilometre **Hiran Sindoore stretch** of NH-45, **connecting Bhopal and Jabalpur**. Situated about 60 kilometres from Jabalpur, the highway passes through a dense forest corridor between the Nauradehi Wildlife Sanctuary and the Veerangana Durgavati Tiger Reserve. This region is home to tigers, deer, sambar, jackals and other animals; and frequent crossings have earlier led to accidents.

The main feature of the project is the introduction of **'table-top red road markings'**, used for the first time in India. These slightly raised red surfaces slow down vehicles naturally without sudden braking. The bright red colour alerts drivers that they are entering a wildlife-sensitive zone. Nearly the entire forest stretch has been covered with these markings.

The highway also includes 25 wildlife underpasses and tall iron fencing to guide animals towards safe crossing points. Built under the Green Highways Policy, 2015, the ₹122 crore project could serve as a model for wildlife-friendly roads across India.





Drogue parachute tests for Gaganyaan

India's dream of sending astronauts to space took another confident step forward in December 2025, when ISRO successfully completed a crucial series of qualification tests for the Drogue parachutes used in the Gaganyaan crew module. These tests were conducted at the Rail Track Rocket Sled (RTRS) facility of the Terminal Ballistics Research Laboratory (TBRL) in Chandigarh.

The parachute system is one of the most important safety features of the Gaganyaan mission. It ensures that the Crew Module carrying astronauts slows down safely while returning to Earth. The complete deceleration system consists of 10 parachutes of four different types, deployed in a carefully planned sequence.

The descent begins with two apex cover separation parachutes, which remove the protective cover of the parachute compartment.

This is followed by the deployment of two drogue parachutes, whose main role is to stabilise the crew module and reduce its speed during re-entry. Once the drogue parachutes complete their task, three pilot parachutes are released to pull out three main parachutes, which finally slow the module enough for a safe landing.

Among all these stages, the drogue parachutes play a critical role. They must perform perfectly under extreme conditions, including high speeds and changing flight environments. The objective of this test series was to verify their performance, reliability and strength under such challenging conditions.

Both tests conducted at the RTRS facility were fully successful, achieving all planned objectives. **The results confirmed that the drogue parachutes remain robust even when there are significant variations in flight conditions.**

This achievement was made possible through the combined efforts of ISRO, Vikram Sarabhai Space Centre (VSSC), ADRDE (DRDO) and TBRL (DRDO).

The successful completion of these tests marks a major milestone in qualifying the parachute system for human spaceflight, bringing India closer to its historic Gaganyaan mission.

**DO YOU
KNOW** 

The Rail Track Rocket Sled facility allows scientists to simulate extreme speeds and forces on Earth without going to space. This makes it one of the safest and most cost-effective ways to test critical spaceflight systems like parachutes before real missions.



India's first urban public transport ropeway

India's first urban public transport ropeway will be rolled out by March 2026 in Varanasi, Uttar Pradesh, connecting the Cantonment Railway Station to Godowlia Crossing, with construction nearing completion. This project marks a significant shift towards using aerial cable car systems for daily urban commuting in India, rather than just for tourist or religious sites.



Highlights

- ▶ **Capacity:** Expected to carry nearly 1 lakh passengers daily using 148–150 gondolas, operating every 2 minutes with a maximum capacity of 3,000 passengers per hour per direction.
- ▶ **Stations:** Five major stations (Varanasi Cantonment, Vidya Peeth, Bharatmata Mandir, Girijaghar and Godowlia).
- ▶ **Cost:** Approximately ₹645 crore to ₹815 crore.
- ▶ **Technology:** The system features a 10-person gondola lift with high-speed capabilities.
- ▶ **Status:** Trial runs began in late 2025 and early 2026, aiming to ease severe congestion in the city's narrow, historic lanes.

The ropeway system in Varanasi promises to bring numerous benefits to the city and its residents. Chief among

them is improved accessibility to key destinations, including the renowned Kashi Vishwanath Temple and Dashashwamedh Ghat. **By offering an alternative means of transport, the ropeway will enable devotees and tourists to reach these significant sites with ease, saving both time and money.**

These cars will operate at a height of 45 metres, providing a scenic and efficient mode of transportation. The ropeway will be versatile, catering to the transportation needs of both goods and passengers, making it a unique addition to Varanasi's transportation landscape.

Covering an aerial distance of 4.2 kilometres, it will bypass road congestion, enabling a swift and hassle-free journey, drastically reduce travel time from 45 to just 16 minutes.

Varanasi is poised to lead India's adoption of ropeways for public transport, setting a remarkable precedent for other cities to follow.



ARCHITECTURAL NEWS

India's largest circular stone labyrinth discovered in Maharashtra

Archaeologists have uncovered the largest circular stone labyrinth in the **Boramani grasslands of Solapur district** which dates back nearly 2,000 years. It sheds new light on ancient trade routes and cultural links. It belongs to the Early Common Era (1st –3rd century CE)

Structure and design

Size: Approximately 50 feet × 50 feet

Circuits: 15 concentric stone rings (highest ever recorded in India)



Link to the Satavahana dynasty

- ▶ The Satavahana dynasty ruled large parts of the Deccan between the 1st and 3rd centuries CE
- ▶ Maharashtra played a key role in long-distance trade during this period.
- ▶ The region connected inland settlements with coastal ports.
- ▶ Trade flourished between India and the Roman Empire.

Evidence of Indo-Roman contact

- ▶ The circular pattern closely resembles labyrinth symbols found on ancient coins from Crete.
- ▶ Roman coins have been discovered in Indian port cities and trading centres from the same era.

- ▶ Such coins were commonly used in the Roman world.

Possible purpose of the Labyrinth

- ▶ Navigational marker for traders.
- ▶ Symbolic signpost along trade routes.
- ▶ Guide for merchants trading spices, textiles and precious stones.
- ▶ The placement of the structure in open grasslands, rather than settlements or temples, suggests it was meant to be visible from a distance.
- ▶ Wider network of trade structures.

Similar, smaller stone labyrinths have been found in nearby districts, Sangli, Satara and Kolhapur.

Together, these discoveries



indicate a network of stone markers across western Maharashtra, possibly outlining ancient inland trade routes connecting ports to the Deccan interior.

Ancient stupas and monastic structures from the Kushan period discovered in Kashmir

Context: The 2,000-year-old Buddhist stupas and monastic complex at Zehanpora in Baramulla dating to the Kushan period have been scientifically excavated.

What is Zehanpora stupa?

The Zehanpora site is a large Kushan-era Buddhist complex comprising multiple stupas, apsidal chaityas (prayer halls), viharas (monk residences), urban-type settlements and artefacts, spread over nearly 10 acres in Baramulla district located along the ancient Silk Route corridor.



What is Silk Road?

- ▶ It was a network of Asian trade routes active from the second century BCE until the mid-15th century spanning over 6,400 km on land.
- ▶ It played a central role in facilitating economic, cultural, political and religious interactions between the Eastern and Western worlds.

Historical background

- ▶ The site dates to the Kushan period (1st –3rd century CE).
- ▶ Kashmir was a major centre of Buddhist learning during this time under rulers like Kanishka and Huvishka.
- ▶ Buddhism in Kashmir began earlier under Ashoka (3rd century BCE) and flourished through Mahayana Buddhism, which later spread to Central Asia and China.

- ▶ Zehanpora was likely part of the Gandhara Buddhist network, a trans-regional system of monasteries, trade routes and learning centres.

Key characteristics

- ▶ **Stupa-like plateau/mounds:** The mounds appear as man-made raised platforms, resembling stupa bases that have been reduced by time but remain prominent.
- ▶ **Multiple mounds (clustered layout):** The landscape suggests more than one stupa, indicating a complex, not an isolated shrine.
- ▶ **Evidence of superstructure:** Indications of a wooden superstructure above the mound(s), imply layered construction.
- ▶ **Scientific mapping and survey:** Documentation used drones, remote sensing, aerial photography and ground mapping, indicating that the site is structurally dense beyond what is visible on the surface.
- ▶ **Signature-link potential:** The excavation narrative highlights comparing construction patterns/circuits/modus features across regional sites.

Significance

Experts note no other regional site matches Zehanpora's scale, making it a key addition to Kashmir's material history.

The complex strengthens Kashmir's position as a hub of Buddhist learning and monastic activity, linked to movement of monks, ideas and pilgrims.

Modus is a structured approach to building or a specific, consistent style, often relating to proportion, rhythm or a particular, established technique of creation.



NHAI shatters world records

The record breaking operation was underpinned by stringent quality assurance mechanisms and monitored by premier institutions, including IIT Bombay and original equipment manufacturers, ensuring that speed did not compromise safety or quality standards.

The National Highways Authority of India (NHAI), in association with concessionaire **Rajpath Infracon**, has established **four Guinness World Records**. The feats were accomplished during the construction of the **Bengaluru-Kadapa-Vijayawada Economic Corridor (NH-544G)**. The record-break happened in January 2026, near Puttaparthi, Andhra Pradesh, where the team established the first two global records. NHAI achieved **the longest continuous laying of bituminous concrete in a single day, covering 28.89 lane km (equivalent to a 3-lane wide section stretching 9.63 km)**. Simultaneously, a second record was set for the **highest quantity of bituminous concrete laid in a single day, totalling 10,655 metric tonnes**.

These marked the first time such figures have been recorded globally under a six-lane National

Highway project. Two additional Guinness World Records were set in the subsequent week. These included the **continuous laying of a massive 57,500 metric tonnes of bituminous concrete** and a record for **continuous paving of 156 lane km**. This stretch, equivalent to a 3-lane wide section of 52 km, significantly surpassed the previous world record which stood at **84.4 lane km**.

NHAI and Rajpath Infracon deployed a massive fleet of state-of-the-art construction equipment, including 70 tippers, five hot mix plants, one paver and 17 rollers. The operation was underpinned by stringent quality assurance mechanisms and monitored by premier institutions, including IIT Bombay and original equipment manufacturers (OEMs), ensuring that speed did not compromise safety or quality standards.

The Bengaluru-Kadapa-Vijayawada greenfield national



highway project has been designed for a safe, high-speed and scenic travel experience. It has recently gained momentum and is expected to significantly enhance Andhra Pradesh's connectivity with Bengaluru. The six-lane, access-controlled expressway is designed to reduce travel time between the Andhra Pradesh capital, Amaravati and Bengaluru from the current 11–12 hours to nearly 8 hours.

Traversing the Guntur, Prakasam, Kurnool and Kadapa districts before entering Karnataka, the expressway is being developed under **Bharatmala Phase-II**, combining greenfield and

brownfield sections. By bypassing congested towns and existing highways, the corridor aims to enable faster and uninterrupted movement for both passengers and freight. The project features 17 interchanges, 10 wayside amenities, a 5.3 km tunnel and a 21 km eco-sensitive section passing through forest areas.

The total length of the expressway is estimated at 518–624 km, at a projected cost of around ₹19,200–19,320 crore. The greenfield section spans approximately 342 kms while brownfield upgrades cover 186 kms.

The corridor will significantly

enhance regional connectivity by linking Bengaluru with Vijayawada, strengthening access between the Rayalaseema region and the coastal and northern regions of Andhra Pradesh, as well as the Kopardy Industrial Node.

These Guinness World Records stand as a testament to NHAI's commitment to deliver world-class National Highway infrastructure, aligned with the vision of the Government of India to build safe, efficient and globally benchmarked corridors that support economic growth and regional development across the country.



Greenfield projects involve building from scratch on unused land, offering total design freedom and modern infrastructure but with higher initial, longer and higher-risk development costs.

Brownfield projects involve redeveloping existing sites, offering faster, cheaper and more sustainable access to established infrastructure.



INDIA – First to commercially produce bio – bitumen

Bio-bitumen, which replaces up to 30% of conventional petroleum-based bitumen, aims to reduce India's import and combat pollution from stubble burning.

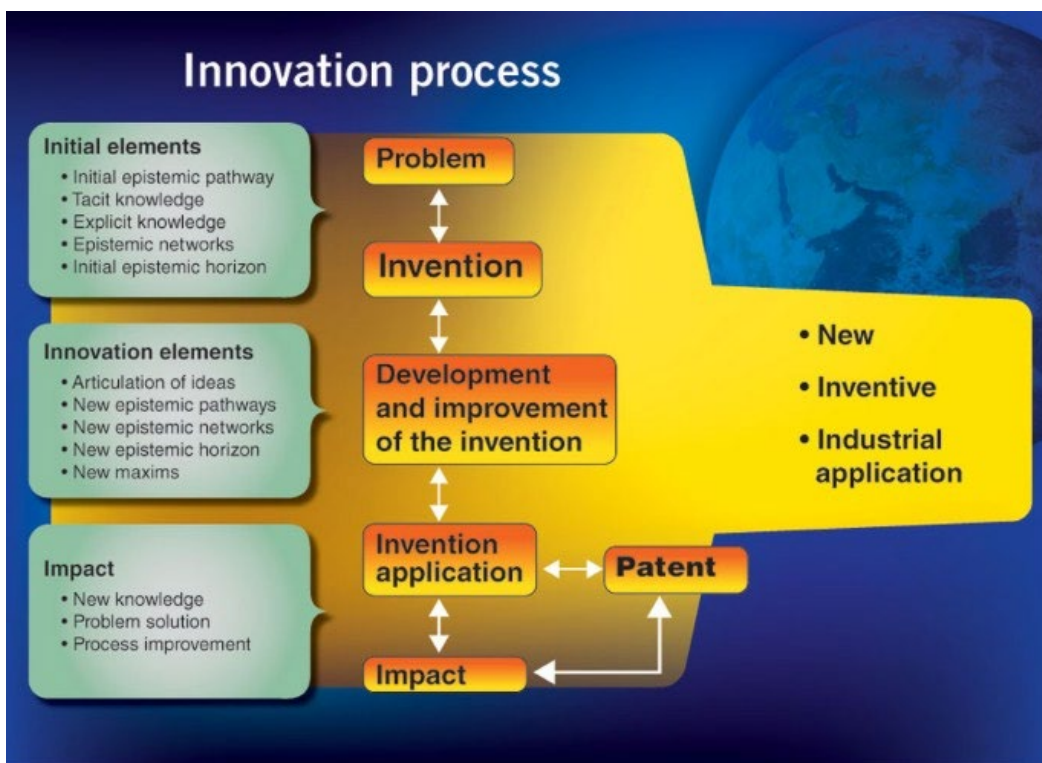
Bitumen is a highly viscous, black, sticky and waterproof hydrocarbon mixture derived from petroleum refining (residue from distillation) or natural deposits. It is used primarily as a road construction binder and waterproofing material. Classified into four main chemical fractions **Saturates, Aromatics, Resins and Asphaltenes (SARA)**, natural bitumen has been in use for thousands of years. The process of refining bitumen from crude petroleum in a laboratory or industrial setting was pioneered in the early 1900s in the United States.

Scientists from CSIR (Council for Scientific and Industrial Research), mainly **Central Road Research Institute (CRRI), New Delhi, and the Indian Institute**

of Petroleum (IIP), Dehradun, invented commercial bio-bitumen by developing a method to convert agricultural waste (such as rice straw and stubble) into a sustainable, high-performance binder for road construction. This innovation, which replaces up to 30% of conventional petroleum-based bitumen, aims to reduce India's import and combat pollution from stubble burning.

The invention process involved the following key scientific and technical steps:

1. Agricultural residues like paddy straw that are otherwise burnt causing environmental hazards, are processed into pellets.



- The biomass pellets are subjected to **pyrolysis**, a process of heating agricultural waste in the absence of oxygen at controlled temperatures.
- The yield of bio-oil is upgraded by chemical operations to create a stable high-quality binder.
- The resulting bio-binder is tested for mechanical, chemical and rheological properties, to ensure that it matches or exceeds the performance of traditional petroleum-based bitumen.
- The technology was validated through successful field trials, including a demonstration on the Jorabat–Shillong Expressway (NH-6). CSIR then transferred the technology to private firms for industrial-scale commercial production. The produced bio-bitumen at ₹40 per kg is 20% less expensive. Bio-



Bitumen at 15% blending would save ₹4500 crores in forex. This “waste-to-wealth” initiative, aims to improve air quality while strengthening rural economies and providing a sustainable alternative for highway construction. In this context, mention needs to be made about the efforts of Dr. Rajagopalan, Chemistry Professor at Thiagarajar College of Engineering, Madurai. Awarded Padma Shri in 2018, the Professor had patented a method

in 2002, which turned plastic waste into road building material and mixed with heated bitumen to create more durable, water-resistant roads. **Reducing requirements for bitumen, this technology has been used to build over 1,00,000 km roads in India and has been adopted internationally.**

Rheology is the study of the deformation and flow of matter, focusing on the relationships between stress, strain, temperature and time.



India's maritime sector has emerged as a vital pillar of the nation's economic growth, facilitating nearly 90% of the country's trade by volume and over 70% by value. In recent years, Indian ports have witnessed remarkable improvements in capacity, efficiency and technology. The achievement of a new port record in cargo handling and operational performance reflects India's growing strength in maritime logistics and its ambition to become a global trade hub. Reduced vessel turnaround time, faster clearance procedures and improved hinterland connectivity have contributed significantly to this achievement. The adoption of automated systems, real-time tracking and digital documentation has further streamlined port operations.

A major factor behind this success is the government's proactive policy framework. The **Sagarmala** programme has played a crucial role in modernising port infrastructure, enhancing coastal shipping and developing port-linked industrial clusters.

In 2025, India's maritime sector achieved historic milestones, with major ports handling a record 855 million tonnes of cargo. Mundra Port became the first in India to exceed 200 million metric tons of annual cargo, while Adani Gangavaram Port set a monthly record of 66 vessels.

Jawaharlal Nehru Port Authority (JNPA), India's leading container port and a key international trade gateway, achieved a historic milestone in calendar year 2025 by handling a record 7.9 million twenty-foot



India sets a new port record

equivalent units (TEUs). This marks a significant rise from the 7.05 million TEUs recorded in 2024. Alongside container growth, JNPA also registered its highest-ever cargo tonnage at 98.87 million tonnes, compared to 90.27 million tonnes in the previous year.

The achievement was driven by strong performances across all terminals.

- **Bharat Mumbai Container Terminals (BMCT)** - 2.6 million
- **APM Terminals (APMT)** - 2.17 million
- **Nhava Sheva International Container Terminal** - 1.3 million
- **Nhava Sheva (India) Gateway Terminal** - 1.09 million
- **Nhava Sheva Free Port Terminal** - 0.74 million

The growth of port-led development has also stimulated regional economic development, particularly in coastal states.

To sustain this momentum, India must focus on sustainability, skill development, and integrated logistics planning. It is imperative that with consistent efforts, Indian ports can play a transformative role

in supporting economic growth and realising the vision of making India a leading global logistics and maritime hub.



DO YOU KNOW ?

TEU or Twenty-foot Equivalent Unit is a standard measurement in shipping and logistics representing the volume of a 20-foot long, 8-foot wide and 8-foot high shipping container, used to quantify container ship capacity, port traffic and cargo volumes globally.

It is the basic unit for calculating shipping costs and tracking trade, where a 40-foot container equals 2 TEUs.



INS ANJADIP

Reincarnating a coastal sentinel

Rewind

The story of INS ANJADIP is best understood when the Ministry of Defence in April 2019 signed a contract with Garden Reach Shipbuilders and Engineers (GRSE) for eight Anti-Submarine Warfare Shallow Water Craft (ASW SWC). Conceived to replace the ageing Abhay-class corvettes, these Arnala-class ships were designed

to address a growing operational gap in coastal and littoral anti-submarine warfare.

INS ANJADIP, the third vessel of the series, was launched in June 2023 at L&T's Kattupalli facility (Tamilnadu). The ship's name revives the legacy of the earlier INS ANJADIP, a Petya-class corvette decommissioned in 2003 and draws its identity from island of the same

name off Karwar, an area of enduring maritime and strategic relevance. The re-incarnation is symbolic but the necessity is operational - being able to secure India's vast coastline against underwater threats in shallow waters.

Dock news

INS ANJADIP was delivered to the Navy at Chennai on 22nd December 2025 marking yet another milestone in indigenous warship construction. With this handover, it became the 115th warship built by GRSE and the 77th delivered to the Navy. It was formally inducted by the Eastern Naval Command, reinforcing steady momentum within the fleet. The delivery also capped a productive year for GRSE which had already handed over multiple frontline platforms across ship categories.

Public Private Partnership

A defining feature of the ASW SWC programme is its





Public-Private Partnership model. While GRSE leads the project, construction of four vessels has been subcontracted to L&T Shipyard. Designed and built under Indian Register of Shipping classification rules, this collaboration demonstrates how complex naval platforms can be delivered through shared industrial responsibility, schedule discipline and technology transfer setting a template for future defence shipbuilding.

Physical features, armaments and weaponry

At approximately 77 metres in length and around 900 tonnes displacement, INS ANJADIP is

among the largest Indian naval ships propelled by waterjets. A shallow draught of about 2.7 metres enables close-coast operations. The ship is equipped with state-of-the-art lightweight torpedoes, indigenously designed anti-submarine rockets and shallow-water sonar. A 30 mm indigenous naval surface gun further enhances its close-range combat capability. With a maximum speed of about 25 knots and endurance of 1,800 nautical miles, the platform is optimised for sustained littoral missions.

Boost to Atmanirbhar Bharat

INS ANJADIP embodies the **Atmanirbhar Bharat** vision

with approximately 80 to 88% indigenous content. From hull fabrication to combat systems, Indian industry and DRDO-linked ecosystems have driven the delivery. This reduces import dependence, strengthens domestic supply chains, and generates skilled employment across the defence manufacturing base.

Conclusion

INS ANJADIP strengthens coastal surveillance, anti-submarine defence and mine-laying capability. Industrially, it validates PPP-driven shipbuilding at scale. Strategically, it reinforces maritime security close to home waters.



World's first ramjet-powered artillery shells

Gunners shot

The Indian Army stands on the cusp of a historic milestone in artillery technology. It is poised to become the world's first military force to deploy ramjet-powered 155 mm artillery shells. This is an important story which needs to be followed up because it shows how science, innovation and military minds come together to strengthen our country's defence. Artillery, often called the "King of Battle," is once again evolving to meet the challenges of modern warfare.

Artillery modernisation in the Indian Army

Artillery modernisation has been a long-standing priority for the Army ever since the famous Bofors guns were contracted in the early 1980s. The current geo-political threat has brought the focus back on the mighty gunners to meet these challenges with increased range, improved accuracy and enhanced overall performance of munitions. Modern battlefields demand the ability to strike targets farther away with precision. Conventional artillery shells, though powerful,

have limits in range when compared to advanced missile systems. The new ramjet-assisted shell aims to bridge this gap.

The innovation

The key innovation lies in integrating ramjet propulsion into a standard 155 mm artillery shell. This development promises to extend the shell's range by 30 to 50% without reducing its destructive power. Instead of replacing existing guns or ammunition, the Army can upgrade what it already has, making the innovation both practical and cost-effective.

Ramjet technology

Ramjet technology has been used in missiles for many years, but applying it to artillery shells was a concept hitherto unknown. A ramjet is an air-breathing engine with no moving parts.

It begins working only after the shell reaches very high speed—around Mach 2 or twice the speed of sound.





At this stage, air entering the shell mixes with fuel and burns, producing thrust that pushes the shell farther during flight.

Academia–military collaboration

This project is presently being developed jointly by the Indian Army and IIT Madras with support from the Army Technology Board. Successful trials have already

been conducted at the Pokharan field firing ranges in Rajasthan. **This partnership highlights how academic institutions and the military can work together for national development.**

The team

The project has been led by a dedicated team of professors, engineers and retired senior military officers. Their combined expertise

in aerospace engineering, materials science and military operations has been crucial in turning a complex idea into a working system.

Atmanirbharta initiative and pay-offs

This development strongly supports India's self-reliance initiative.

By reducing dependence on foreign technology and upgrading existing ammunition, India strengthens its defence industry and saves resources. The innovation also opens possibilities for future exports and further technological progress.

Conclusion

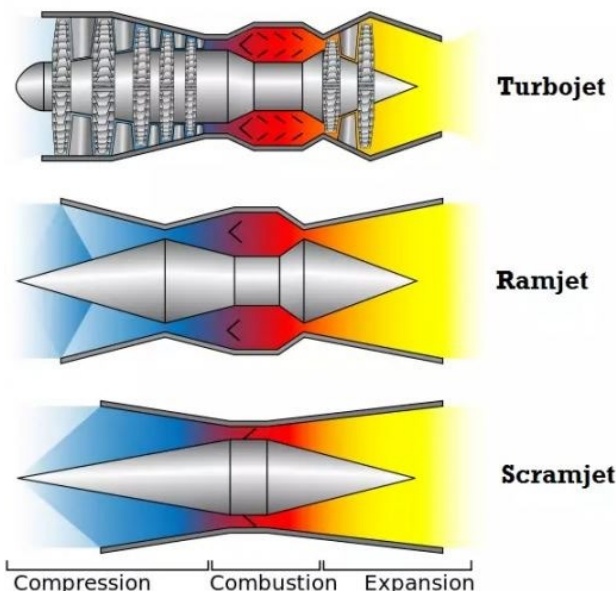
The ramjet-powered artillery shell is more than a military achievement. It is a lesson in innovation, education and national responsibility. It shows how science taught in classrooms can protect the nation in real life. **For students, it is an inspiring example of how knowledge can serve the country.**



Author's note

As a gunner, I have always believed that the gunner's strength lies not just in firepower, but in thinking ahead.

A new idea small in size but big in impact is quietly changing how far and how accurately our guns can strike. I have had the personal privilege of working with these experienced military minds behind this path-breaking project sometime in the past and let me confess this is going to be a game changer for Indian artillery once it is operationalised.





Missile news

Precision, credibility and a strategic message

The countdown

India's recent missile-related developments mark an important step in strengthening national security and technological confidence. The successful salvo launch of **two Pralay** missiles from the same launcher off the Odisha coast, followed by a submarine - launched ballistic

missile test in the Bay of Bengal, reflects steady progress in both conventional strike capability and strategic deterrence. Both these events highlight preparedness, indigenous innovation and credible strategic heft in a complex security environment.

What these tests mean

The salvo firing of two Pralay



missiles in quick succession demonstrates that India's missile systems can perform reliably under realistic operational conditions. Conducted as part of user evaluation trials, both missiles followed their intended trajectories and met all mission objectives, confirming the robustness of guidance, control and launcher systems.

The submarine-launched ballistic missile test, carried out



'With range of 3500-km,' India tests K-4 nuke-capable ballistic missile from INS Arighaat submarine

from a nuclear-powered submarine in the Bay of Bengal, reinforces India's ability to maintain a secure second-strike capability.

Pralay missile

Indigenously developed solid-propellant quasi-ballistic missile Pralay employs state-of-the-art guidance and navigation to ensure high precision.

Alongside the BrahMos supersonic cruise missile, Pralay is expected to play a key role in India's planned rocket force. It is reportedly comparable to China's Dong Feng 12 and Russia's Iskander missile,

the US Army's Precision Strike Missile (PrSM) and South Korea's Hyunmoo-2, Pralay can deceive anti-ballistic missile interceptors.

K-4 SLBM

The K-4 SLBM is India's nuclear-capable, intermediate-range missile (IRBM) developed by the DRDO for India's nuclear submarines, boasting a 3,500 km range and a 2-tonne payload, significantly enhancing India's undersea deterrence, which is part of its nuclear triad (land, air, sea).

These achievements are closely aligned with the vision of

Atmanirbhar Bharat in defence. Both the missile systems have been designed by our in-house DRDO, defence labs, industry partners and MSMEs to meet the strategic and tactical defence capabilities of our Armed Forces. Indigenous design and production reduce dependence on external suppliers and ensure continuity during crises.

Pay offs

Operationally, the Pralay missile enhances conventional deterrence through precision, flexibility and rapid re-engagement capability. With a range of 150-500 km and the ability to carry different types of warheads, it complicates adversary planning. Strategically, the successful SLBM test from INS Arighaat strengthens deterrence and by assuring retaliation capability thereby reducing any incentive for escalation by adversaries.

Technology demonstrator

Both tests function as technology demonstrators. The Pralay salvo validates launcher endurance, fire-control systems and terminal accuracy, while the SLBM test confirms complex dynamics such as underwater launch, transition to flight and long-range performance. Each test feeds valuable data back into the design loop, enabling incremental improvements and faster induction timelines.

Conclusion

India's recent missile tests are not isolated events but part of a deliberate, phased approach to building credible, indigenous military capability as part of long-term national security by combining precision on land with survivability at sea, thus reinforcing deterrence and retaining escalation control.

Killer K-4	
Strike range - 3,500 km	
Length - 12 mtr	
Width - 1.3 mtr	
Weight - 17 ton	
Warhead - 2 ton	
Engine - Solid-fueled	
Difficult to be tracked and destroyed by any anti-ballistic weapon	



KEY LEGAL EVENTS (2025) – Part-2

The Ministry of Labour and Employment rolled out CPPS under the Employees' Pension Scheme, 1995, to enable pensioners to receive their pensions from any bank/branch and to address accessibility challenges faced by pensioners and ensure an efficient disbursement mechanism.

In continuation of the previous edition of the series, below is a snapshot of some key legal events/changes which took place over the course of 2025.

- ▶ **Environment (Construction and Demolition) Waste Management Rules, 2025:** The Central Government notified these rules under the Environment (Protection) Act, 1986, to strengthen regulation of waste from construction, renovation and repair activities. The rules, proposed to come into force from 1st April 2026, lay down a framework for segregation, collection and processing of waste, with tighter regulation and risk for lapses/non-compliances.
- ▶ **Digital access part of Article 21:** The Supreme Court held

that digital access is an intrinsic part of the fundamental right to life and dignity under Article 21 of the Constitution and issued directions to make digital KYC/e-KYC/video-KYC inclusive for persons with disabilities. This potentially raises the expectation for banks and other institutions concerned, to equip themselves and address grievances on priority.

- ▶ **Centralised Pension Payment System (CPPS):** The Ministry of Labour and Employment rolled out CPPS under the Employees' Pension Scheme, 1995, to enable pensioners to receive their pensions from any bank/branch and to address accessibility challenges faced by pensioners and ensure an efficient disbursement mechanism.

EPFO

SOCIAL SECURITY FOR ALL



TRANSFORMING PENSION SERVICES

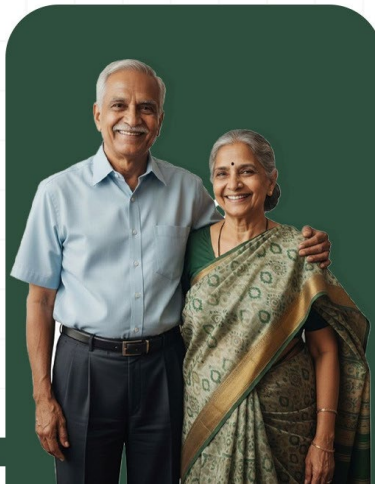
Centralised Pension Payment System (CPPS) implemented

Pensions

- from any bank anywhere, any branch across Nation

Over 70 lakh pensioners benefitted

Convenience at its best.



- ▶ **Implementation of the Uniform Civil Code (UCC):** Uttarakhand became the first state in India post-independence to implement the UCC. The UCC Act, which received presidential assent in 2024; and the UCC Rules notified in January 2025; cover various aspects including marriage, divorce and succession.
- ▶ **Secretary of the Department of Legal Affairs:** Dr. Anju Rathi Rana was appointed the

Secretary of the Department of Legal Affairs in the Ministry of Law and Justice, India, becoming the first woman to hold this position.

- ▶ **The Greenhouse Gases Emission Intensity Target Rules, 2025:** The Ministry of Environment, Forest and Climate Change notified these rules, which describe greenhouse gases emission intensity targets along with carbon-credit linked compliance concepts.
- ▶ **Appointment of Justice Surya Kant as CJI:** On 24th November, 2025, Justice Surya Kant was appointed the 53rd Chief Justice of India. He is set to serve until his retirement on 9th February, 2027.
- ▶ **SHe-Box Portal:** Based on the Supreme Court's judgement in Aureliano Fernandes v. The State of Goa and Ors., the Department of Women and Child Development, Government of Delhi has mandated all establishments to register with the 'SHe-Box portal' where women can file complaints regarding sexual harassment in the workplace, as a step towards safer workspaces for women.

KYC Know our Customer / Client is a mandatory verification process used by financial institutions, banks and other companies to authenticate a customer's identity, address and credentials. This process is crucial to prevent money laundering, fraud and illegal financial activities.



Holistic healing of muscle injuries

Naturopathy aims not only to relieve symptoms but also to address the root causes of muscular weakness and imbalance.

Muscle pull, muscle pain and strain are common health issues affecting people of all age groups. They often occur due to overexertion, improper posture, sudden movements, lack of warm-up before physical activity, nutritional deficiencies or prolonged stress. Naturopathy focuses on healing through Nature, supporting the body's inherent ability to repair itself by using natural therapies, proper nutrition, lifestyle regulation and mental well-being.

Understanding muscle pull and strain

A muscle pull or strain occurs when muscle fibres are overstretched or torn due to sudden force or excessive load. This leads to pain, stiffness, swelling and restricted movement.

Muscle pain may also arise from lactic acid build-up, dehydration, mineral imbalance or chronic inflammation. Modern lifestyles involving long hours of sitting, excessive screen time and reduced physical activity have increased the incidence of such problems in India. Naturopathy aims not only to relieve symptoms but also to address the root causes of muscular weakness and imbalance.

Hydrotherapy for muscle relief

Hydrotherapy is one of the most effective naturopathic treatments for muscle pain and strain. It involves the therapeutic use of water at different temperatures.

Hot water fomentation helps relax tight muscles and improves blood circulation.



Applying a hot compress or soaking in warm water for 15–20 minutes reduces stiffness and promotes healing. Cold water therapy, on the other hand, is useful during the initial stage of injury. Cold compresses reduce swelling and inflammation.

Contrast baths, alternating between hot and cold water, stimulate circulation and speed up tissue repair.

Mud therapy and earth healing

Mud therapy is a traditional naturopathic method widely practised in India. Natural clay or mud, rich in minerals, is applied to the affected area. It helps absorb toxins, reduce inflammation and improve circulation. Mud packs over strained muscles provide cooling relief and promote regeneration of tissues.

Massage therapy and oil application

Massage is an essential part of naturopathic and traditional Indian healing. Gentle massage improves lymphatic drainage, reduces muscle tension and restores flexibility. Natural oils such as sesame oil, coconut oil, mustard oil and castor oil are commonly used.

Herbal oils infused with eucalyptus, camphor, turmeric and ginger are especially effective for muscle pain.

Yoga and physical therapy

Yoga plays a vital role in preventing and managing muscle injuries.

Regular practice enhances flexibility, strengthens muscles and improves posture. *Asanas* such as *bhujangasana*, *tadasana*, *trikonasana*, *vajrasana* and *shavasana* are beneficial for relieving muscle tension and improving circulation.

Pranayama techniques like *anulom vilom* and *bhramari* help reduce stress, which is often linked to chronic muscle pain.



How to massage for pain relief: For muscle sprain, oil massage should be done gently after the initial swelling has reduced (usually after 24–48 hours). Warm a small amount of sesame, coconut, castor or mustard oil until it is lukewarm and apply it lightly over the affected area. Massage using slow circular motions and gentle strokes along the muscle without applying too much pressure. Continue for about 10–15 minutes once or twice daily. After massage, applying a warm towel or hot water bag helps improve circulation and healing. Avoid massage if there is severe pain, swelling, bruising or open wounds.



Gentle stretching under proper guidance accelerates recovery and prevents recurrence.

Diet therapy

A balanced naturopathic diet for muscle health includes:

Proteins

Pulses, lentils, chickpeas, sprouts, paneer, curd, nuts and seeds provide essential amino acids for muscle repair.

Calcium and magnesium

Ragi, sesame seeds, leafy greens, bananas and almonds strengthen muscles and bones.

Anti-inflammatory foods

Turmeric, ginger, garlic, tulsi, amla and curry leaves reduce inflammation and pain.

Fruits and vegetables

Papaya, pineapple, oranges, guava, carrots, beetroot and spinach supply antioxidants and vitamins.

Healthy fats

Cold-pressed oils, coconut, groundnuts and flaxseeds support tissue healing.

Hydration

Adequate intake of water, coconut water, buttermilk and herbal teas prevents cramps and fatigue.

Avoiding processed foods, excessive sugar, fried snacks and carbonated drinks is essential, as they promote inflammation and delay recovery.

Fasting and detoxification

Short-term fasting and detox therapies are sometimes recommended in naturopathy to remove metabolic waste. Fruit fasting, vegetable juice fasting or mono-diet therapy helps cleanse the body and improves nutrient absorption. This practice is rooted in ancient Indian traditions of

fasting for physical and spiritual purification.

However, fasting should be done under professional guidance, especially for elderly or weak individuals.

Lifestyle modifications

Naturopathy emphasises disciplined living. Maintaining proper posture, using ergonomic furniture, taking regular breaks during work and ensuring adequate sleep are crucial for muscle health.

Walking barefoot on grass (earthing), sun exposure in the morning and spending time in Nature are encouraged to improve circulation and mental balance.

Stress management through meditation and mindfulness also plays a significant role in reducing muscle tension.

Preventive approach

Prevention is better than cure. Warm-up exercises before physical activity, gradual increase in workload, regular stretching and balanced nutrition prevent muscle injuries.

While naturopathy is highly effective for mild to moderate muscle injuries, severe tears, fractures or nerve damage require medical intervention. An integrated approach combining modern diagnostics with natural therapies ensures safe and comprehensive treatment.

In today's fast-paced world, returning to Nature-based healing not only relieves pain but also promotes long-term wellness, resilience and harmony. **Through conscious living and natural care, individuals can maintain strong muscles, flexible bodies and balanced minds, reflecting the true essence of Indian health philosophy.**



Dr. Sanghamitra Bandyopadhyay

Dr. Sanghamitra started her career in the machine intelligence unit of ISI as a faculty member in 1999 and grew up the ladder to become this prestigious organisation's first woman director in 2015.

The first woman director of Indian Statistical Institute (ISI), Dr. Sanghamitra Bandyopadhyay is a scientist with mastery in machine learning, artificial intelligence as well as biology and bioinformatics. With this kind of multi-disciplinary expertise, she has designed algorithms for studying the role of micro RNAs in cancer, HIV1 pathogenesis and Alzheimer's progression.

Sanghamitra was born in 1968 in Howrah, West Bengal and lived in different small towns and cities, as her father Satyendra Nath Banerjee had a transferable job. This helped her adapt to changes, understand people and appreciate different cultures of our country. She completed her B.Sc. Physics from Presidency College Kolkata, followed by B.Tech in Computer Science with the first rank.

With passion to learn, she later joined IIT Kharagpur and completed her masters as a topper again. Her thirst to research further and achieve mastery drove her to complete Ph.D. in computer science from ISI, Kolkata.

Dr. Sanghamitra started her career in the machine intelligence unit of ISI as a faculty member in 1999 and grew up the ladder to become this prestigious organisation's first woman director in 2015. Though she was not much oriented towards biology during school or college days, she was asked if she could use her prowess in pattern recognition algorithms to identify patterns of interaction and interference of small RNA molecules to combat life threatening diseases.

Ever since, Sanghamitra decided that computational biology, bioinformatics and evolutionary



computation should become her line of inquiry. “Shifting through them and finding what we can only be done computationally not manually”, she started looking out for biomarkers of cancer. In 2014, Prof. Sanghamitra and her peers identified a new genetic biomarker for breast cancer. With practical applications in the field of healthcare, her works have made her one of the leading computational biologists.

A person who entered the portals of ISI as a senior research fellow also demonstrated her strength as a research guide, teacher, scientist and a collaborator. “For a scientific organisation, in particular, the leader should be a reputed academician/scientist who is known for the strength of their science. The other quality which is an absolute must is a very high level of integrity. The actions taken should be very rational and should be backed up by strong logic.

They should always be trying to find a solution, to facilitate things,

but at times when saying no is important, the leader should be able to say no. It is important to have that transparency, to demonstrate that there’s fairness,” says this exemplary leader.

No wonder she is the first person who was reselected in 2020 as the Director of ISI, for the second term of this internationally reputed organisation, after the founder Prof. Mahalanobis. She avers, “Another important part of keeping your team motivated is telling them “I value you” – that you value their contribution, you value what they are doing, you value them for whoever they are, irrespective of successes or failures.” The chambers of ISI echo this value as she continues to be at the helm of affairs.

Dr.Sanghamitra is the recipient of several honours.

- ▶ **2000** - Young Scientist Award from the Indian National Science Academy (INSA).
- ▶ **2002** - Young Engineer Award from Indian National

Academy of Engineers (INAE).

- ▶ **2006** - Swarnajayanti Fellowship from the Department of Science and Technology.
- ▶ **2010** - Shanti Swarup Bhatnagar Prize in Engineering Sciences. She was the second woman scientist to receive it.
- ▶ **2017** - JC Bose Fellowship.
- ▶ **2018** - TWAS prize for Engineering

Other achievements include:

- ▶ IIT Kharagpur distinguished alumni award.
- ▶ Humboldt Fellowship.
- ▶ Senior associateship of ICTP (International Centre for Theoretical Physics) Italy.

Fellow of

- ▶ Indian National Science Academy (INSA).
- ▶ National Academy of Sciences, India (NASI).
- ▶ Indian National Academy of Engineers (INAE).
- ▶ Institute of Electrical and Electronic Engineers (IEEE).
- ▶ The World Academy of Sciences (TWAS).
- ▶ International Association for Pattern Recognition (IAPR).
- ▶ West Bengal Academy of Science and Technology.
- ▶ The Infosys Prize in Engineering and Computer Science was awarded to Prof. Sanghamitra for her scholarly record in algorithmic optimisation.

Modern scientific instruments such as sequencers and information



networks generate prodigious amounts of data that need to be analysed quickly and sometimes at real-time speeds.

Sanghamitra's scholarship concerns design of new computer algorithms that enable us to automatically search for patterns and knowledge in large data sets. Her algorithms save time in finding optimal solutions and have a significant impact on biological data analysis. **Her discoveries include a genetic marker for breast cancer, determination of co-occurrence of HIV with cancers and the role**



of white matter in Alzheimer's disease. The World Academy of Sciences (TWAS) recognised her outstanding contributions in computational biology, multi-objective optimisation and genetic algorithm-based classification and clustering techniques.

Prof. Sanghamitra is internationally acclaimed for her clustering methods using genetic algorithms. She has held the positions of a researcher and faculty member with various foreign academic institutes world-wide including USA, Australia, Germany, France, Italy, China, Slovenia and Mexico and delivered invited lectures in many more countries. She has authored more than 300 research papers, book chapters and conference proceedings in multiple areas of research interest including Bioinformatics and Computational Biology, Computational Intelligence, Pattern Recognition, Data Mining and Multiobjective Optimisation.

From 2018, Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC) has been advising the Prime Minister on various science and technology-related matters for developing a futuristic roadmap. Recognising the zeal for transdisciplinary research, our government made Dr.Sanghamitra a member of this council from the day of its inception. Later in 2022, she was awarded Padma Shri, for her contributions in the fields of machine learning, artificial intelligence, computational biology and bioinformatics.

“By nature, I'm never too happy with successes and never too sad with failures. What has always mattered to me is whether I've given it my best shot or not. And once I have done that, I take the results as they come, whether they are successes or failures. But not giving up is something which has been very important to me. You learn from your failures as well as from your successes”, are her words that reveal a *karmayogi*.



Lourembam Bino Devi

Early life rooted in tradition

Lourembam Bino Devi was born on 1st March 1944 in Singjamei Mathak Thokchom Leikai, Imphal West, Manipur. Growing up in the cultural heartland of the Meitei community, she was surrounded by traditions where art and ritual were closely connected. She studied up to Class IX; though her formal education was limited, her environment nurtured a deep respect for heritage that would later define her life's purpose.

Learning the art of Leeba

At the age of seventeen, soon after her marriage to Lourembam Kunjabihari Singh, Bino Devi began learning Leeba appliqué art from her mother-in-law, Lourembam Ongbi Ibetombi, a National Award-winning artisan. Her training followed the traditional *guru-shishya parampara*. She learnt by observing and practising, without sketches or machines. Every motif was cut freehand using scissors, needle, thread and cloth, guided by memory and cultural knowledge.

Mastery through dedication

Over the next five decades, Lourembam Bino Devi mastered nearly thirty intricate Leeba designs. She created traditional items such as **Monmai pillow covers**, **Ningkhams Samjin waistbands**, **Luhong Phijin and Harao Phijin shawl borders**. Her work strictly followed traditional protocols, as Leeba motifs are considered sacred and closely linked to Meitei rituals, festivals and royal attire.

Each piece took days of careful and patient craftsmanship.

Reviving heritage and sacred motifs

Bino Devi played a crucial role in reviving rare and sacred motifs such as Phantup, associated with the deity Pakhangba and Thamballei Cheplei, inspired by the lotus and Manipur's royal heritage.

She also restored important historical artefacts, including the





flag of Maharaja Chandrakirti and royal velvet shoes of Maharaja Kulachandra Singh, using authentic Leeba techniques.

Educator and guardian of culture

Since 1995, she has conducted workshops at the Manipur

State Museum in collaboration with cultural experts, training students under the *guru-shishya parampara*. She has taught at her home, participated in exhibitions across India and spoken on All India Radio and Doordarshan to spread awareness about Leeba. Despite challenges such as declining

interest among youth and market limitations, she has remained determined to protect the art from extinction.

Notable honours and recognition

1996 - State Award for Master Craftsmen by Commerce and Industries Department, Government of Manipur.

2000 - First prize at the All India Handicrafts Week.

2015 - Silpa Bhushan Award by Manipuri Sahitya Parishad.

2022 - Padma Shri, in recognition of being one of the oldest and most dedicated practitioners of Leeba.



An enduring inspiration

Even in her eighties, Lourebam Bino Devi continues to teach and create. Her life proves that passion, patience and perseverance can preserve an entire cultural legacy. **She stands as an enduring inspiration, reminding us that safeguarding heritage is not just a duty, but a lifelong commitment.**



Defence technology

1. How does radar technology detect fast-moving aerial objects?
2. Why are defence satellites critical for both security and weather monitoring?
3. What is the advantage of a supersonic cruise missile compared to a subsonic one?
4. How does DRDO contribute to student and youth innovation in science and engineering?
5. Why is drone technology considered a major shift in modern defence strategy?
6. How can cyber defence protect a country without physical weapons?
7. Why is indigenous (self-reliant) defence manufacturing strategically important?
8. Which Indian missile is known as the fastest supersonic cruise missile in the world?
9. Why is India's missile named "Agni"—and what does the name tell us about its role?
10. Which Indian defence system is called a "flying fortress in the sky" because it can spot threats hundreds of kilometres away?
11. What does the word "BrahMos" stand for?
12. Why does India follow a "No First Use" nuclear policy, and why is it important globally?
13. How does India protect its borders without firing a single bullet—using technology and satellites?
14. What is cyber warfare and why is it considered the "new battlefield"?
15. Which Indian aircraft carrier is proudly called "Made in India, for India"?
16. Why are submarines harder to detect than warships—and why does that matter?
17. How do fighter jets refuel mid-air? Why is this a game-changer?
18. What is DRDO? How does it turn science students into defence innovators?
19. Can lasers and AI really be used in defence? Where is India already doing this?
20. Why are some Indian missiles named after rivers, fire and warriors?

Answers on page 66



Ved: Hey Vyas, what's up? I heard something about transformers in AI. Can you tell me more?

Vyas: Sure Ved, you can consider transformer to be a smart brain of AI, one that is advanced over the traditional neural networks like CNN and RNNs used for understanding language—like how chatbots, translators and voice assistant's work.

Ved: Oh! So, does it read text like how we read a story?

Vyas: Yes, kind of, but in a much smarter way. Earlier models like RNNs read words one by one, like reading with a finger under each word. Transformers read the whole sentence at once and figure out how all the words are related.

Ved: That sounds great! How does it understand which words are important?

Vyas: Good question. That is where transformers bring the

magic part called **attention** or more specifically, **self-attention**. Imagine we are reading the sentence: “The cat sat on the mat because it was tired.” To understand what “it” means, you pay attention to “cat”. Transformers do the same—they check how much attention each word should give to every other word.

Ved: So, every word looks at all the other words to find relation and importance?

Vyas: Exactly! Each word asks, “Who should I care about?” This helps the transformer understand meaning, grammar and context of the sentence well.

Ved: Cool! But where does the transformer start? Does it understand words directly?

Vyas: First, words are changed into numbers called **embeddings**. Think of embeddings as special coordinates that tell the computer what a word means and how it's related to other words.



CNN vs RNN vs LSTM vs TRANSFORMER

CNN

Convolutional Neural Network



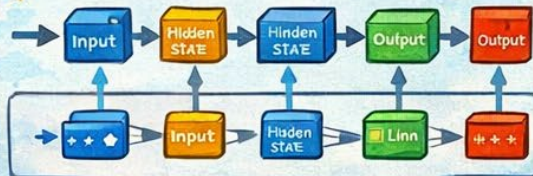
★ for Image Tasks

- ✓ Great at image recognition!
- ✗ Can't handle sequential data

★ Great at image recognition!
✗ Can't handle sequential data

RNN

Recurrent Neural Network



★ for Sequential Data

- → Good for sequential data like text
- → Processes tokens one-by-one

★ Limited Memory!
— Slower compared to others

LSTM

Long Short-Term Memory



- → Solution to short memory!
- → Slower compared to others

★ Solution to short memory!
— Slower compared to others

TRANSFORMER

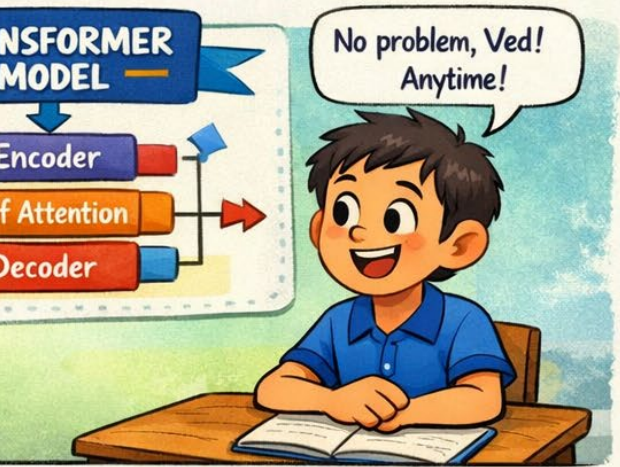
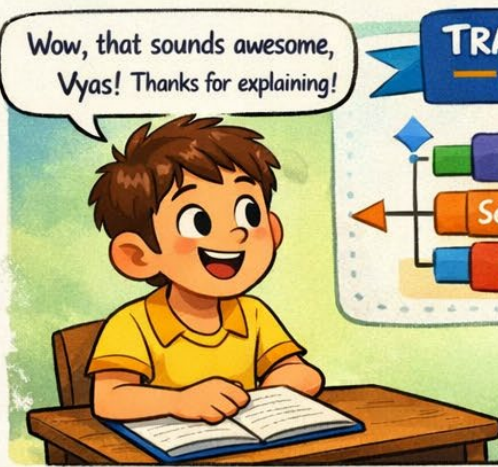
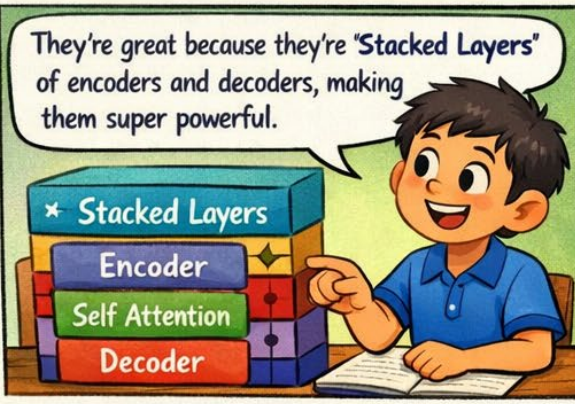
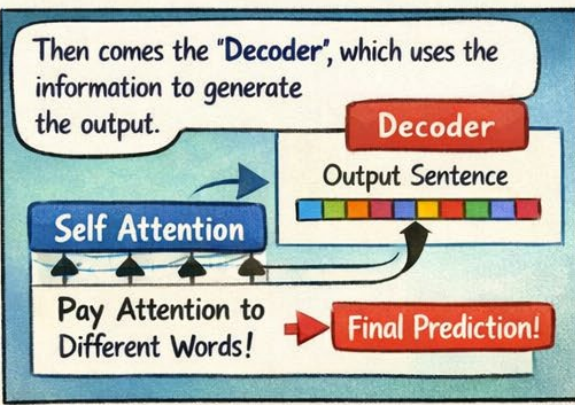
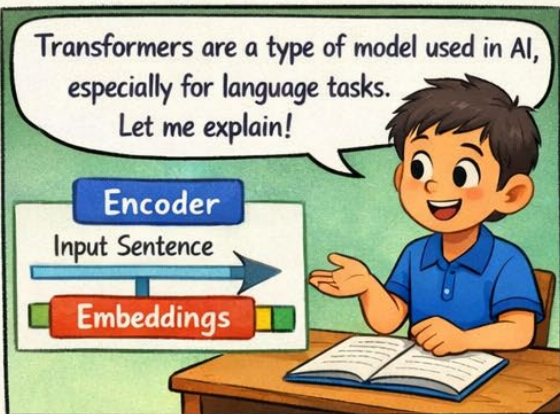


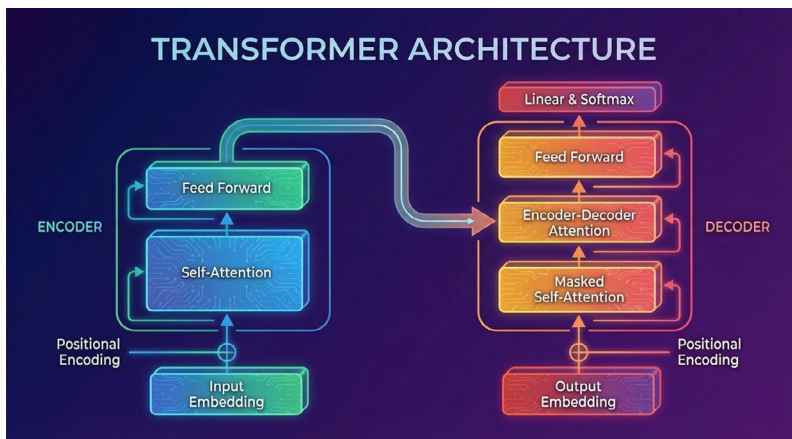
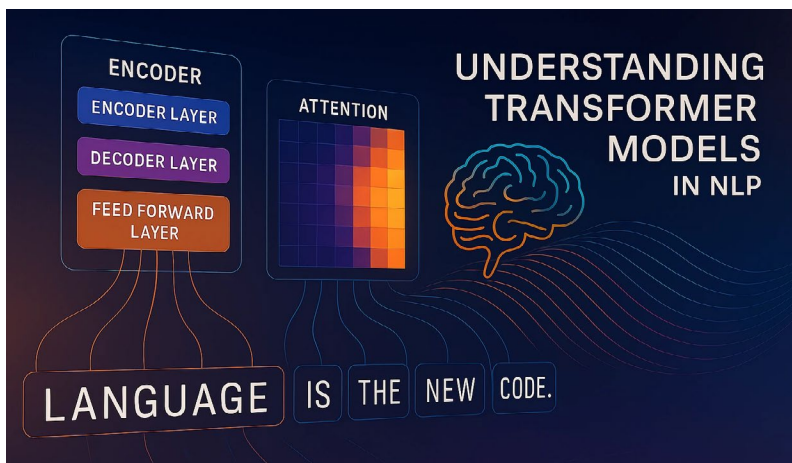
- ★ Understands all words at once using Attention Layers
- ★ Highly parallelized and powerful

★ Needs a lot of data and computation power

CHOOSING THE RIGHT MODEL FOR THE TASK!

Different models have different strengths. For image tasks, CNNs are best. For sequential data, Transformers are powerful, but remember to balance power with need!





Ved: Like how “teacher” and “students” are related?

Vyas: Perfect example! Their embeddings are close to each other. After embeddings, the transformer adds something called **positional encoding**.

Ved: What does that mean? Why?

Vyas: Transformers don’t naturally know word order. Positional encoding tells the model which word comes first, second and so on—like adding page numbers to words.

Ved: Got it. So, what happens next?

Vyas: Then comes the **encoder**. The encoder’s job is to understand the input sentence. It has multiple layers, and each layer has two main parts:

1. **Self-attention** – to see relationships between words.
2. **Feed forward network** – to think deeply about what it learned.

Ved: Multiple layers? Why not just one?

Vyas: More layers mean deeper understanding. The first layer might learn simple things like grammar, while deeper layers understand meaning, emotions or intent.

Ved: That is like school! First, we learn letters, then sentences, then essays!

Vyas: Exactly Now, after the encoder understands everything, the information goes to the **decoder**.

Ved: What does it do?

Vyas: The decoder creates the output. For example, in translation,

it generates the sentence in another language, one word at a time.

Ved: Oh, nice. Does the decoder also use attention?

Vyas: Yes, two types!

- ▶▶ Self-attention to look at the words it already generated.
- ▶▶ **Encoder–decoder attention** to look back at the encoder and decide which input words matter most for the next output word.

Ved: Wow! That’s like checking your notes while writing an answer!

Vyas: Great comparison! That is why transformers are so powerful. They are also parallel, meaning they can process many words at the same time, unlike older models that were slow.

Ved: Is that why models like ChatGPT are fast and smart?

Vyas: Yes! ChatGPT, Google Translate and many AI tools are based on transformers.

Ved: Are there any drawbacks?

Vyas: They need a lot of data and computing power to train. But once trained, they are amazing at understanding language.

Ved: So, in short, transformers use attention to understand everything together, not step by step?

Vyas: Exactly, Ved. That is the fundamental idea. Attention is all you need!

Ved: Haha! Now that makes sense. Thanks, Vyas! I also got to know that transformers handle multi format objects like images, music, audio, video etc.

Vyas: Yes. These can handle multiple format objects/files. We’ll discuss this later. Got to go now. Bye!

Ved: Thanks, Vyas. Bye!



Mukteshwar Temple

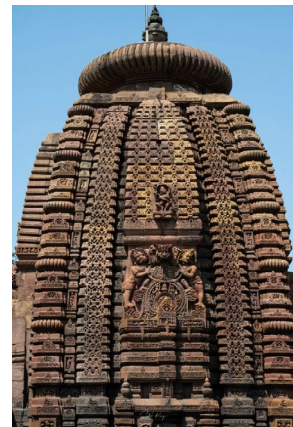


Nestled quietly in Bhubaneswar, the Mukteshwar Temple may be small in size, but it stands tall as one of the finest examples of Odisha's temple architecture. Often called the “gem of Odishan architecture,” this temple captures the grace, imagination and spiritual depth of ancient India.

Built in the 10th century, Mukteshwar Temple marks an important transition in temple design. It beautifully blends earlier simplicity with later decorative richness, making it a turning point in the evolution of Kalinga-style architecture. The moment you walk closer, your eyes are drawn to the

famous arched gateway (*torana*) at the entrance. Unlike anything seen before in Odisha, this curved stone arch is richly decorated with carvings of dancers, floral patterns and mythical figures.

The temple walls are covered with intricate sculptures—graceful women, musicians, ascetics, animals and scenes from daily life. Every carving feels alive, as if the stone itself is telling stories from a thousand years ago. The sanctum tower (*vimana*) rises gently, decorated with detailed motifs, while the small prayer hall (*jagamohana*) adds balance and harmony to the structure.



Best time to visit

The best time to visit is from October to February, when the weather is pleasant. Early mornings and evenings are ideal for a calm and memorable experience.



DO YOU KNOW ?

Mukteshwar Temple is often called the “architectural bridge” between early and mature phases of Odishan temple architecture.



Ashoka Chakra Kirti Chakra Shaurya Chakra

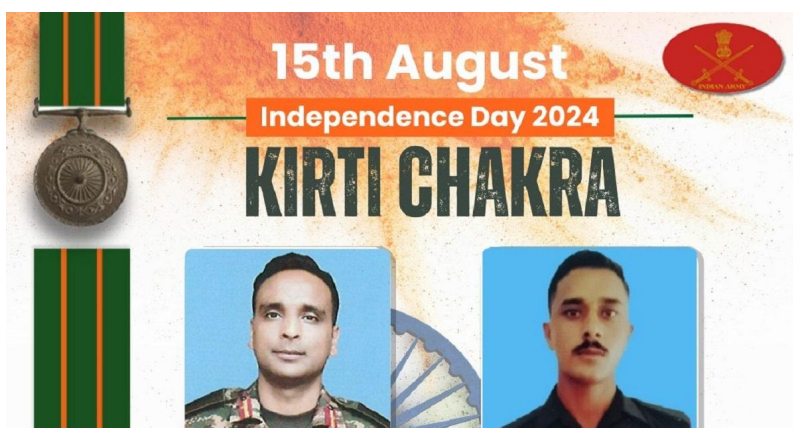
The gallantry awards are announced twice a year—on Republic Day and Independence Day—symbolising the nation’s heartfelt gratitude towards its brave sons and daughters.

Honouring courage beyond the battlefield

India has a proud tradition of recognising extraordinary bravery and sacrifice. After gaining independence, the Government of India established gallantry awards to honour those who displayed exceptional courage in the service of the nation. On 26th January 1950, the Param Vir Chakra, Maha Vir Chakra and Vir Chakra were introduced, but were deemed to have come into effect from 15th August 1947. Later, on 4th January 1952, three additional awards—Ashoka Chakra Class I, II, and III—were instituted, which were renamed in January 1967 as the Ashoka Chakra, Kirti Chakra and Shaurya Chakra, respectively.

Gallantry awards and their significance

These gallantry awards are announced twice a year—on Republic Day and Independence Day—symbolising the nation’s heartfelt gratitude towards its brave sons and daughters. In the order of precedence, the Ashoka Chakra holds a prestigious position, followed by the Kirti Chakra and Shaurya Chakra among other awards. The Ashoka Chakra and Shaurya Chakra stand out as they are awarded for acts of bravery “otherwise than in the face of the enemy,” recognising remarkable courage during peacetime or in internal security situations.



Ashoka Chakra: Supreme bravery in peace

The Ashoka Chakra is awarded for the most conspicuous bravery, daring acts, pre-eminent valour or self-sacrifice. To date, 98 brave individuals have been honoured with this award.

It is open to officers, men and women of all ranks from the Army, Navy and Air Force, including reserve forces and other lawfully constituted forces. Members of the Armed Forces Nursing Services, police personnel, paramilitary forces, the Railway Protection Force and even civilians from all walks of life are eligible.

The award includes a medal, and a monthly stipend of ₹2,800/-.

Kirti Chakra: Supreme bravery in peace

The Kirti Chakra is India's second-highest peacetime

gallantry award, awarded to military personnel and civilians for conspicuous courage and self-sacrifice away from the field of battle.

Ranking below the Ashok Chakra and above the Shaurya Chakra, it is often bestowed for anti-insurgency and rescue operations.

Officers, men and women of all ranks of the Army, the Navy and the Air Force, of any of the Reserve Forces, of the Territorial Army, Militia and of any other lawfully constituted Armed Forces are eligible for this award.

Members of the Nursing Services of the Armed Forces, Civilian citizens in all walks of life and members of Police Forces including Central Para-Military Forces and Railway Protection Force are also eligible.

The decoration may be awarded posthumously. Monetary allowance of ₹1050/- per month.

Shaurya Chakra: Gallantry recognised widely

The Shaurya Chakra, originally instituted as Ashoka Chakra Class III, has been awarded to 2,143 individuals. It honours acts of gallantry not in direct combat with the enemy and may also be awarded posthumously.

Recipients are also entitled to a monetary allowance, acknowledging their sacrifice and service. It carries a monthly stipend of ₹750/- for the recipient.

Following categories of persons are eligible for the Shaurya Chakra:

Officers and men and women of all ranks of the Army, the Navy and the Air Force, of any of the Reserve Forces, of the Territorial Army, Militia and of any other lawfully constituted forces.

Nursing officers of military nursing service.

Civilian citizens in all walks of life and members of Police Forces including Central Para-Military Forces and Railway Protection Force are also eligible.

Legacy of inspiration



We have witnessed the extraordinary stories of Param Vir awardees in earlier editions. We will continue to explore the remarkable journeys of Ashoka Chakra, Kirti Chakra and Shaurya Chakra awardees, who are the true “Desh ke sahas veer”.

Their lives inspire generations to cherish courage, selflessness and unwavering service to the nation.



TEEN TITAN

Kaamyia Karthikeyan

Kaamyia's South Pole success follows her 2024 completion of the Seven Summits, where she scaled the tallest mountain on every continent.

In a breathtaking display of endurance and grit, 18-year-old Kaamyia Karthikeyan has officially etched her name into the annals of polar history. She became the youngest Indian and the second-youngest woman in the world to reach the South Pole on skis, marking the penultimate step in her quest for global exploration dominance.

The 115 km battle

Kaamyia's journey was a gruelling odyssey across the world's most unforgiving terrain. Hauling a heavy supply sled—her life support containing food, fuel and shelter—she navigated a landscape of treacherous sastrugi (wind-sculpted snow ridges) and blinding whiteouts.

To maintain her strength in these sub-zero conditions, Kaamyia had to consume a rich diet of nearly 5,000 calories a day, often eating freeze-dried meals while sheltered in a small tent that served as her only refuge against the Antarctic wilderness. Every litre of water she drank had to be painstakingly melted from snow using a portable stove, a task that added hours of labour to her already exhausting daily routine.

A trail of broken records

While most of her peers are focused on board exams, Kaamyia's "classroom" has been the world's highest peaks. This South Pole success follows her 2024 completion of the Seven Summits, where she scaled the tallest mountain on every continent.



Her record-breaking streak includes:

- ▶▶ **Mount Everest:** Reaching the summit at just 16.
- ▶▶ **Mount Aconcagua:** Becoming the youngest girl to summit the South American giant in 2020.
- ▶▶ **Mount Elbrus:** Completing a rare ski descent from Europe's highest point at age 11.

Training in the heat for the cold

How does a student from tropical Mumbai prepare for the

Antarctic? Kaamya's training was legendary. To simulate pulling a sled on ice, she spent months in the heat of India pulling massive tractor tires across rough terrain. This discipline, fuelled by a passion that began on a trek at age three, has seen her recognised by the Prime Minister and awarded the **Pradhan Mantri Rashtriya Bal Shakti Puraskar**.

One step from the Grand Slam

The South Pole was not the finish line—it was a milestone. Kaamya is now on the brink of

becoming the youngest person in history to complete the **Explorers Grand Slam**. To achieve this, she must reach the North Pole, the final piece of a puzzle that includes all seven major continental summits.

As she stands at the bottom of the world, Kaamya Karthikeyan has sent a clear message to the youth of India: no horizon is too distant and no climate is too cold for a heart-fuelled by fire.



ECONOMICS

The 2025 Nobel Prize for Economics was awarded to **Joel Mokyr, Philippe Aghion** and **Peter Howitt** for their work on innovation-driven economic growth and particularly for developing the concept for creative destruction.

What is creative destruction?

Technological innovation is an unstoppable process that hastened, post industrial revolution. A confluence of factors like education, discovery of electricity and its universal reach across the technology spectrum, adoption of technology etc., paved the way for the march of innovation.

Technology advances bring newer products and replace older ones, resulting in better quality of life. This entire cycle of innovation, newer products, replacing older products older and services is called creative destruction. Creative destruction as a concept was developed by economist Joseph Schumpeter who observed that the essential process in capitalism is

innovation. Newer products and technologies continuously replacing older ones drive economic growth.

The work of Nobel laureates:

Joel Mokyr used historical sources to establish the causes that propelled sustained growth and a new normal was set every time that set the bar for further progress. Prior to the industrial revolution, societies didn't quite capitalise on innovations because there was no clarity as to see how innovation blossomed and how it could be put to use. Joel Mokyr demonstrated that if innovations were to succeed in a sustained way one has to have a scientific explanation as to why they work. He also suggested that people should be open to new ideas. Philippe Aghion and Peter Howitt studied the mechanisms behind sustained economic growth. They developed mathematical models to explain creative destruction. The laureates believe that creative destruction can create conflicts that must be resolved in a constructive manner.

Hurdles that creative destruction overcame: Western Europe was ruled by the nobles who owned most businesses and land. Innovation was viewed with scepticism because the nobles feared loss of power. Innovation and creative destruction always create social upheavals due to job losses, anxiety and adoption bottlenecks. With the pace of innovation and its wider adoption societal disruptions will crop up. This will require continuous upskilling and retraining of labour force. But in hindsight it is obvious that creative destruction has delivered better and more; and improved quality of life for all.

Nobles were the descendants of warlords that were given land by the king in return for service especially military. They were ranked immediately below royalty (kings and queens) in society.

Defence technology

1. Radar Detection uses the Doppler Effect to measure frequency shifts in radio waves, allowing it to distinguish fast-moving objects from stationary background noise.
2. Defence satellites provide secure, encrypted communication for troops and high-resolution atmospheric data for tactical weather forecasting.
3. Their high speed (Mach 1+) minimises an enemy's reaction time, making them significantly harder to intercept than slower subsonic missiles.
4. DRDO fosters innovation through the Dare to Dream contest, internships and funding Centres of Excellence at universities.
5. They allow for persistent surveillance and high-risk strikes without risking the lives of human pilots.
6. Cyber Defence protects a nation's vital soft infrastructure—like power grids, banks and communication networks—from being disabled by hackers.
7. Indigenous importance ensures strategic autonomy, meaning India isn't dependent on foreign nations for parts or software during a war.
8. The BrahMos is currently the fastest supersonic cruise missile in the world.
9. Agni (Fire): Named after the Vedic element of fire, it represents India's nuclear deterrence and the "destructive power" required to maintain peace.
10. The PHALCON AWACS (Airborne Warning and Control System) or the indigenous Netra systems.
11. BrahMos is a combination of the Brahmaputra River in India and the Moskva River in Russia.
12. India promises never to use nuclear weapons first; globally, this establishes India as a responsible nuclear power and prevents accidental escalation.
13. India uses thermal sensors, satellite imaging (RISAT), and "smart fences" (CIBMS) to detect intruders without opening fire.
14. Cyber Warfare involves attacking a nation's digital nervous system; it's the "new battlefield" because it can cripple a country faster and cheaper than a physical army.
15. INS Vikrant is the aircraft carrier designed and built entirely within India.
16. They hide under the ocean's thermoclines (temperature layers) which block SONAR; this makes them the ultimate "invisible" second-strike weapon.
17. Using a "probe-and-drogue" system, jets take fuel from a tanker in flight, drastically extending their range and mission time.
18. The DRDO provides the technical labs and funding to turn student research into military-grade technology.
19. Yes; India is developing the DURGA-II laser system and uses AI for autonomous surveillance and facial recognition at border checkpoints.
20. Missiles are named after elements *Agni* (Fire), *Prithvi* (Earth) and warriors to honour Indian heritage and signify the weapon's purpose and reach.



WORLD BASKETBALL DAY

20th December

**RISE
ABOVE
THE RIM,
DEFY THE
ODDS.**

Good **GOVERNANCE DAY**

25th December

