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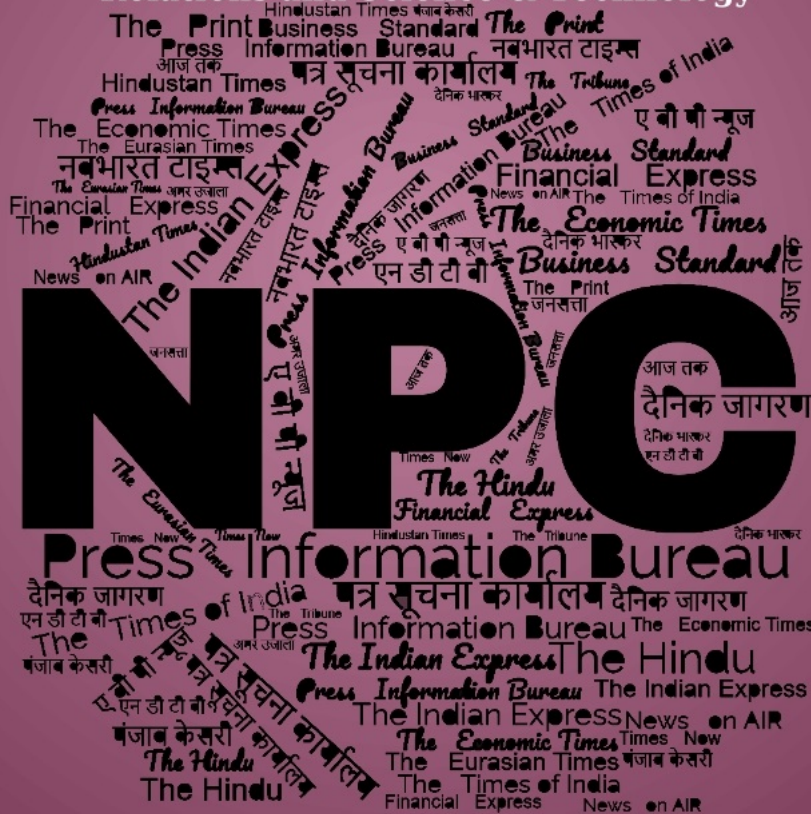
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Tue, 08 Oct 2024

Sukhoi Fighter Aircraft: DRDO Developed Fighter Jets With Indigenous Technology

The frontline fighter jet Sukhoi-30 MKI is being upgraded with indigenous technology. Specifically, the Defence Research and Development Organisation (DRDO) has developed an indigenous Uttam Radar, which will equip Sukhoi-30 with the capability of a 4.5-generation fighter jet. The Uttam Radar was showcased at the Jodhpur Defence Expo last month.

Different Generation

Currently, there are 259 Sukhoi-30 fighter jets in the country, which are Generation-4 jets. The Indian Air Force has two squadrons of Sukhoi-30 at Jodhpur airbase, with around 36 aircraft. After the technology transfer from Russia, Hindustan Aeronautics Limited (HAL) has been producing Sukhoi. Generation-5 fighter jets are now being developed. The Rafale is a Generation-4.5 fighter jet. Therefore, Sukhoi's capability is being upgraded.

Multi-mode Solid State

The Uttam Radar was developed for the indigenous fighter jet Tejas MK-A, but it is a multi-mode solid-state active phased array fire control radar with a scalable architecture, which can be fitted on various types of fighter jets.

Uttam Radar

The Uttam Radar uses the SLC channel to jam enemy radar signals, making it difficult for them to detect the fighter jet's signal. This makes the fighter jet's role more effective in air-to-air combat. The Uttam Radar provides stealth technology-like capabilities to the fighter jet. The radar is fully electronically scanned and has a wideband RF front end and an ultra-low sidelobe antenna, which provides better detection in an electromagnetic environment.

<https://www.patrika.com/en/special-news/sukhoi-fighter-aircraft-will-be-upgraded-with-indigenous-technology-19048729>

Defence News

Defence Strategic: National/International



Press Information Bureau
Government of India

Ministry of Defence

Tue, 08 Oct 2024

Delivery Of Yard 3026 (Nirdeshak)

Nirdeshak (Yard 3026), second of four Survey Vessel (Large) ships, steered by the Indian Navy's Warship Design Bureau and being built at Garden Reach Shipbuilders & Engineers (GRSE), Kolkata was delivered to the Indian Navy on 08 Oct 24. The first ship of the class, INS Sandhayak, was commissioned on 03 Feb 24. The contract for four Survey Vessels (SVL) was signed on 30 Oct 18.

The SVL ships are designed and built as per classification rules of Indian Register of Shipping by M/s Garden Reach Shipbuilders & Engineers (GRSE), Kolkata. The ship aims at full scale coastal and deep-water hydrographic survey of port/ harbour approaches and determination of navigational channels/ routes. The ship will also collect oceanographic and geophysical data for defence and civil applications. With a displacement of about 3400 tons and overall length of 110 meters, Nirdeshak is fitted with state-of-the art hydrographic equipment such as data acquisition and processing system, autonomous underwater vehicle, remotely operated vehicle, DGPS long range positioning systems, digital side scan sonar, etc. Powered by two diesel engines, the ship can achieve speeds in excess of 18 knots.

The keel of the ship was laid on 01 Dec 20 and the ship was launched on 26 May 22. The ship has undergone a comprehensive schedule of trials in harbour and at sea prior to its delivery.

Nirdeshak has an indigenous content of over 80% by cost. The delivery of Nirdeshak is a reassurance on impetus of the Government of India and the Indian Navy towards 'Aatmanirbhar Bharat'. The delivery of Nirdeshak is a tribute to the collaborative efforts of a large number of stakeholders, MSMEs and the Indian industry in enhancing the maritime prowess of the nation in the Indian Ocean Region.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2063279>



**Press Information Bureau
Government of India**

Ministry of Defence

Tue, 08 Oct 2024

Special Campaign 4.0 of Department of Defence Production is in full Swing

Department of Defence Production (DDP) has been conducting the Special Campaign 4.0 on Swacchata within the Department and across its Defence Public Sector Undertakings (DPSUs) and Attached offices located in various parts of the country aggressively with saturation approach.

It started with a preparatory phase from 15th September 2024 to 30th September, 2024 to identify targets to be taken up for cleaning during the campaign period.

The main campaign started from 2nd October, 2024 and will last upto 31st October, 2024. In the preparatory phase of the Special Campaign, DDP along with its DPSUs and Attached Offices identified 800 (approx.) cleanliness sites across the country and so far, 605 sites have been accomplished.

The meeting was convened by Secretary (DP) along with CMDs of DPSUs and DG Level officers of Attached Offices to implement the Special Campaign 4.0 in a befitting manner. The daily progress is being monitored at Joint Secretary level officer and a dedicated team of officials upload the achievements on SCDPM portal hosted by Department of Administrative Reforms & Public Grievances (DARPG). All the DPSUs and Attached Offices are enthusiastically participating in the campaign.

Significant progress has been reported in the successful identification of the targets so far and work is in full swing in all the DPSUs and attached offices to achieve these targets. This year remarkable 8 Lakh Sq. Feet space is anticipated to be freed after disposal of scrap and other redundant material and so far, space of 109,903 Sq. Ft. has been freed after disposal of scrap & other waste material.

So far, 6769 physical files have been identified for review/disposal. More than 30000 MT unserviceable stores/scrap have been disposed of under the campaign, thereby extracting revenue to the tune of 3.6 Crores.

More than 147 tweets have been posted on X (Formerly known as Twitter) by the DPSUs and DDP tagging to #SpecialCampaign 4.0 to create awareness of the campaign. 8,602 persons have participated so far in Swacchata Activities from the DPSUs in DDP. The campaign is in full swing to achieve the target set by DDP.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2063197>



**Press Information Bureau
Government of India**

Ministry of Defence

Tue, 08 Oct 2024

Indian Air Force's display of air power & 'Aatmanirbharta' resolve marks its 92nd anniversary celebrations at Air Force Station, Tambaram in Chennai

An immaculate ceremonial parade, a breath-taking demonstration of air power and a spectacular static display of state-of-the-art equipment marked the celebrations of the 92nd anniversary of the Indian Air Force (IAF) at the Air Force Station, Tambaram in Chennai, Tamil Nadu on October 08, 2024. Chief of Defence Staff General Anil Chauhan graced the celebrations, while the ceremonial parade was reviewed by Chief of Air Staff Air Chief Marshal AP Singh.

In his address, the Chief of Air Staff underscored the need for IAF to remain prepared to meet any contingency that challenges the national interests. He stated that the current global security environment is in a state of constant flux and ongoing conflicts have demonstrated an inescapable need to have a strong and capable Air Force. Adopting the latest technology along with innovative and out-of-the-box thinking will play a decisive role in today's multi-domain environment, he added.

Air Chief Marshal AP Singh emphasised that the theme of Air Force Day 2024, 'Bhartiya Vayu Sena: Saksham, Sashakt, Aatmanirbhar' perfectly describes the aspirations of IAF. "Over the years, we have become more empowered with better technology and achieved new levels of exploitation of systems & weapons.

Aatmanirbharta in the field of defence R&D and manufacturing is our priority. Concrete steps have been taken to support Make in India initiatives by engaging MSMEs, start-ups, individual innovators, professionals, R&D institutes and academia," he added.

The Chief of Air Staff described the Air Force Day as an occasion for the air warriors to rededicate themselves in the service of the nation, introspect on the previous year, celebrate the achievements, recognise the areas of improvement and realign to the present & future requirements. On the previous year's achievements, he said that IAF has proved its mettle on various fronts. "One of our primary objective is to deliver weapons, on target, on time, every time and this capability was aptly showcased during the firepower demonstration exercise 'Vayu Shakti' at Pokhran Range in February 2024," he said.

Air Chief Marshal AP Singh added that the IAF, this year, expanded its participation in bilateral and multilateral exercises with friendly countries. He stated that the successful conduct of the largest multi-national exercise on Indian soil 'Tarang Shakti' was a testimony to the competence and professionalism of India's air warriors.

The Chief of Air Staff asserted that IAF has always been the first responders in calls of humanitarian assistance and disaster relief both within the country & abroad, highlighting the various ops conducted in the last one year. He reaffirmed IAF's full commitment towards providing a conducive and working environment to the air warriors, terming the welfare and well-being of the personnel & their families as of utmost importance.

Parade

The parade commenced with the marching-in of the President's Colours, symbolising pride, unity, strength and esprit-de-corps. The atmosphere became even more melodious through the performance of a Tri-Services Band, which filled the air with patriotic fervor. The Air Warrior Drill Team captivated the audience with their sharp and synchronised movements, leaving a lasting impression on all present.

Airshow

The parade was followed by an aerial display, with various jets including Tejas Light Combat Aircraft, Sukhoi-30 MKI and Pilatus performing daring low-level aerobatic manoeuvres. The skies over Chennai were painted in the colours of the national flag as the Suryakiran Aerobatics Team and Sarang Helicopter Team mesmerised the crowd with thrilling performances.

Static display

The static display featured state-of-the-art such as ALH Mk-4, C-295 Transport aircraft, Akash Missile Defence System, HTT-40, and Rohini radar.

The event was a fitting tribute to IAF's nearly a century of unwavering dedication and unparalleled service to the nation, embodying the theme of 'Bhartiya Vayu Sena: Saksham, Sashakt, Aatmanirbhar'.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2063089>



Press Information Bureau
Government of India

Ministry of Defence

Tue, 08 Oct 2024

Raksha Mantri & his German counterpart discuss ways to further strengthen defence industrial collaboration & supply chain resilience during telephonic conversation

Raksha Mantri Shri Rajnath Singh held a telephonic conversation with the German Federal Minister of Defence Mr Boris Pistorius on October 08, 2024. They briefly reviewed the ongoing defence cooperation activities including exercises in the air and maritime domains.

The Ministers discussed ways to further strengthen the defence industrial collaboration and enhance supply chain resilience. They planned to meet in the near future to give concrete shape to the defence engagements and joint projects with an aim to transform defence as a key pillar of the India-Germany bilateral relationship.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2063119>

QUAD navies kick off 11-day Malabar drills at Visakhapatnam

The navies of India, the United States, Australia and Japan on Tuesday kicked off the Malabar naval drills at Visakhapatnam at a time when China is seeking to expand its footprint in the vast Indo-Pacific region, officials aware of the matter said.

The 11-day drills are being conducted in two stages — the harbour phase, followed by the sea phase. The first edition of the Malabar drills took place in 1992 when it was a bilateral exercise between India and the US.

It has since evolved into a multilateral event aimed at enhancing interoperability, fostering mutual understanding, and addressing shared maritime challenges in the Indian Ocean and Indo-Pacific region.

The exercise will feature various Indian naval platforms, including guided missile destroyers, multi-purpose frigates, submarines, fighter aircraft and helicopters. While Australia will deploy the HMAS Stuart, an Anzac-class frigate with its MH-60R helicopter, and a P-8 maritime patrol aircraft, the US Navy will field the USS Dewey, an Arleigh Burke-class destroyer with its integral helicopter, and a P-8 maritime patrol aircraft. Japan is taking part with JS Ariake, a Murasame-class destroyer.

Complex maritime operations such as anti-submarine warfare, surface warfare, and air defense exercises will be conducted at sea during the Malabar drills, with an emphasis on improving situational awareness in the maritime domain, the Indian Navy had earlier said.

As far as the Indo-Pacific region is concerned, China is seeking to expand its footprint by setting up military bases, bullying countries to advance its unlawful maritime claims and ensnaring vulnerable states in unsustainable debts to force strategic concessions, as previously reported.

Speaking at an event last week, Union defence minister Rajnath Singh reiterated India's unwavering resolve to a rules-based international order, respect for international law, and adherence to the principles enshrined in the UN Convention on the Law of the Sea.

<https://www.hindustantimes.com/india-news/quad-navies-kick-off-11-day-malabar-drills-at-visakhapatnam-101728391940833.html>

THE TIMES OF INDIA

US okays sale of torpedoes worth \$175m to India

The United States govt has approved a proposed sale of 53 MK-54 lightweight torpedoes worth \$175 million to India for the multi-mission MH-60R Seahawk helicopters being inducted by the Indian Navy.

The Biden administration's notification to the US Congress on Monday said the sale will support Washington's foreign policy and national security objectives by helping to strengthen the bilateral

strategic relationship and improving the security of major defence partner India, which "continues to be an important force for political stability, peace, and economic progress in the Indo-Pacific and South Asia regions".

"The proposed sale will improve India's capability to meet current and future threats by increasing the size of its anti-submarine weapons stockpile for its MH-60R helicopters," it said.

The Navy in March had commissioned its first squadron of six submarine-hunting MH-60R Seahawk helicopters, armed with Hellfire missiles, MK-54 torpedoes, and precision-kill rockets, at INS Garuda in Kochi, as was then reported by TOI.

By next year, India is slated to induct all the 24 heavy-duty Seahawks, which are also equipped with multi-mode radars and night-vision devices, under the Rs 15,157 crore (\$2.13 billion) contract inked with the US in Feb 2020.

<https://timesofindia.indiatimes.com/india/us-okays-sale-of-torpedoes-worth-175m-to-india/articleshow/114058153.cms>

THE TIMES OF INDIA

Tue, 08 Oct 2024

Telangana's Simpliforge Creations & IIT-H set up Army's largest 3D printed barracks in MP

Telangana-based Simpliforge Creations and the Indian Institute of Technology, Hyderabad, teamed up with the Military Engineer Services (MES) to set up the 's largest and Madhya Pradesh's first 3D printed building at Morar Cantonment in Gwalior, Madhya Pradesh.

The building, which will house barracks with the capacity to accommodate 14 jawans, was built to demonstrate efficient housing solutions for troops in remote and challenging terrain.

Simpliforge Creations Co-Founder & CEO Dhruv Gandhi said while the foundation work for the 11- 11.5 ft tall structure, spread over around 2,500 sq ft, was done using conventional construction techniques, the 10-ft tall portion above the ground, excluding the beam, was all 3D printed in just a month's time.

"The foundation work took about two weeks, including one week for construction and one week for curing. The slab and finishing work took a little over two weeks. The 3D printing work was done within a month," Gandhi said, pointing out that the structure cost about 20% more than conventional construction.

While the IIT-H team conducted the design analysis and vetted the structure, Simpliforge Creations prepared the design and did the construction for the project. The barrack was inaugurated by Major General KTG Krishnan, General Officer Commanding, Shahbaaz Division.

<https://timesofindia.indiatimes.com/city/hyderabad/indian-army-unveils-largest-3d-printed-barracks-in-madhya-pradesh/articleshow/114057538.cms>

Sri Lankan minister defends govt's decision to allow Chinese military training ship

Sri Lanka's newly-appointed Foreign Minister Vijitha Herath on Tuesday defended the government's move to allow a Chinese military training ship to arrive in Colombo, saying the decision falls within the framework of the country's diplomatic engagements and such visits "pose no threat".

He was responding to a question on the Chinese People's Liberation Army (PLA) Navy training warship "Po Lang" which arrived at the port of Colombo on Tuesday "as part of an ocean-going voyage aimed at enhancing the professional capabilities of midshipmen and conducting naval exchanges with other countries," said a statement.

Herath, also the Cabinet Spokesman, said Sri Lanka maintains balanced diplomatic relations with all countries. He said the government's decision to allow the Chinese military training vessel to visit Sri Lanka falls within the framework of the country's diplomatic engagements.

"We are happy to allow military training ships. They pose no threat," Herath said. "We have seen military ships arriving from Germany and the US". The previous government had placed a moratorium on allowing foreign scientific research survey vessels in the Exclusive Economic Zone (EEZ) of Sri Lanka.

Herath's predecessor Ali Sabry in July said that Sri Lanka was to review the moratorium to decide if to continue with it or lift it. India had repeatedly raised concerns over several Chinese research vessels in the Sri Lankan waters.

Herath said Sri Lanka would continue to allow visits by military training ships to maintain international cooperation while safeguarding national interests.

The visiting ship -- an 86-meter-long Sail Training Vessel crewed by 130 personnel including 35 Officer Cadets -- was welcomed by the Sri Lanka Navy in compliance with naval traditions. To strengthen the camaraderie between the two navies, crew members of the ship are set to participate in a series of programmes organized by the Sri Lanka Navy, according to an official statement.

In addition, crew members of the ship will explore some of the tourist attractions of the country, during their stay in Colombo.

Additionally, Sri Lanka Navy personnel will have the opportunity to participate in briefings on the operational functions of the ships as well, the statement added. The vessel's journey includes visits to multiple countries such as Vietnam, Indonesia, Sri Lanka, and Singapore, as well as a technical stop in Hong Kong.

<https://economictimes.indiatimes.com/news/defence/sri-lankan-minister-defends-govts-decision-to-allow-chinese-military-training-ship/articleshow/114046844.cms>

Army commanders to hold top security conference along China border in Sikkim

All senior commanders of the Indian Army will be convening in Sikkim for a crucial conference. This meeting, scheduled for October 10-11, marks the first time top Army officials will gather at a location near the Line of Actual Control (LAC) with China.

The conference will be addressed by key figures, including Defence Minister Rajnath Singh, sources told India Today. The discussions will focus on pressing security concerns, particularly the ongoing situation along the LAC, with special attention to the sensitive regions of Ladakh and Arunachal Pradesh, where frequent stand-offs and face-offs between Indian and Chinese forces have occurred.

This meeting also serves as the inaugural conference for General Upendra Dwivedi, who assumed the role of Chief of Army Staff on June 30, 2024. Recently, General Dwivedi described the border situation with China as "stable but not normal," reflecting the complexities of the ongoing tensions, which have persisted for four years, entering their fifth winter.

The second phase of the conference is expected to take place in New Delhi on October 28-29. Commanders will also analyze lessons from recent global conflicts to better equip the Indian forces, considering the challenges faced by different arms of the Army.

As the Army leadership comes together to address these critical issues, the focus remains on ensuring the security and stability of India's borders amid evolving geopolitical dynamics.

<https://www.indiatoday.in/india/story/army-jawans-meet-sikkim-top-security-conference-along-china-border-2613746-2024-10-09>

Business Standard

China is building world's largest amphibious assault ship. Details here

China's first large-deck amphibious assault ship of its new class is rapidly taking shape, and recent images analysed by The War Zone defence portal show that the enormous ships' twin-island configuration design is likely to make a wider range of air operations easier and strongly suggest that these ships are being designed to carry enhanced air wings, including larger drones.

Recent photographs of the first of the Type 076 landing helicopter dock (LHD) ships, known in the West as the Yulan class, reportedly show that two separate island superstructures have recently been installed on the deck.

The construction of the first Yulan-class landing helicopter assault ship is taking place at the Changxing Island Shipbuilding Base, outside Shanghai.

What does the twin-island configuration mean?

The Type 076 will not be the first aviation-optimised warship to feature twin islands, points out the report. For example, this design has previously been used on much larger vessels, such as the British Queen Elizabeth class aircraft carriers, along with the Italian Trieste, another LHD, which is a closer comparison in terms of size.

In fact, it has been speculated that India's prospective future aircraft carrier, the INS Vishal, could also adopt this design.

The twin-island layout simplifies flight operations and allows for one to be dedicated to navigation and ship-related duties, while the other can then be used exclusively for controlling flight operations, explains the report.

The design choice reinforces previous indications that China's Type 076 ships will be heavily focused on deploying airpower, including heavier fixed-wing drones. According to the report, the additional requirement of managing drones on the deck could also have contributed to this design choice.

What else do we know about China's new Type 076 ships?

Once completed, the Type 076 will be the largest amphibious assault ship in the world, according to Center for Strategic and International Studies (CSIS), an American think tank based in Washington, DC.

Based on satellite imagery, CSIS estimates that the under construction ship's flight deck measures approximately 260 by 52 metres, providing an area of over 13,500 square metres. This is significantly larger than the US' America-class amphibious assault ships and Japan's Izumo-class helicopter carriers.

Considering its size, the Type 076 is shaping up to be much more than a traditional amphibious assault ship. In fact, it falls between China's existing largest amphibious warship, the Type 075, and its newest and largest aircraft carrier, the Type 003 Fujian.

According to The War Zone report, the Type 076 boasts other features that also indicate the primacy of air operations in its role.

For example, it has a large open flight deck, which is significantly wider than other amphibious assault ships.

There are strong indications also that a catapult system has been installed on the ship's bow, and this is likely to be paired with arresting gear. This will allow the ship to launch and recover stealthy uncrewed combat air vehicles (UCAVs) and other larger fixed-wing drones.

The ship's focus on air operations is also apparent because of the provision for an aircraft elevator on the port side at the stern. This would be in addition to another large elevator located centrally at the stern.

The War Zone report says that there is a possibility that the ship's catapult mechanism could be an electromagnetic aircraft launch system (EMALS), which would be sufficient to launch fixed-wing aircraft at heavier operational weights.

EMALS is an advanced technology, and only the US and China have successfully implemented it. China's third and latest aircraft carrier, the Fujian, is already equipped with three EMALS-style catapults.

What role will the Type 076 play?

While the Type 076 is still expected to primarily operate rotary-winged aircraft, like other traditional amphibious assault ships, the report adds that all indications suggest that drones will also play a significant role in its air wing.

According to CSIS, the Type 076 will be capable of carrying dozens of aircraft and drones, amphibious landing craft, and a complement of over 1,000 marines. However, its larger size, compared to other ships in a similar role, will allow it to carry more aircraft in its internal hangar and offer more space for aircraft launches on its expansive flight deck.

The inclusion of a catapult system for launching fixed-wing aircraft will make it unique among amphibious assault ships, with only aircraft carriers traditionally having been fitted with catapults. Till date, amphibious assault ships have usually been limited to helicopters and vertical/short takeoff and landing aircraft like the F-35B.

These vessels, once operational, will represent a significant step forward in the People's Liberation Army Navy's (PLAN's) ability to project power further from China's shores, according to CSIS.

When will China's monstrous new amphibious warfare ship be completed?

Based on the construction timelines of the Fujian carrier and the Type 075s, the Type 076 could be launched by the first half of 2025, according to CSIS.

However, it will likely take several more months or even years before the ship is officially commissioned into the PLAN.

https://www.business-standard.com/external-affairs-defence-security/news/china-is-building-world-s-largest-amphibious-assault-ship-details-here-124100800474_1.html



Tue, 08 Oct 2024

Asian NATO: Why India Does Not Back Japan's Idea Despite Tensions With China & Alliance With Tokyo?

On September 27, Shigeru Ishiba emerged victorious in a runoff against top female candidate Sanae Takaichi to become the head of the ruling Liberal Democratic Party (LDP) in Japan.

As a result, on October 01, Ishiba took over as prime minister of Japan from Fumio Kishida following his official election by the Japanese parliament. Ishiba stands for an attempt to change the LDP. If you vote for him, it indicates that the LDP is committed to fostering a reform-oriented image. If a non-conformist, non-faction leader is elected, the LDP should be stronger for the elections that take place next month.

Known for his defense expertise, Ishiba is likely to continue many of the policies of his predecessor, Prime Minister Fumio Kishida. However, it is also widely anticipated that he will seek methods to strengthen Japan's independence while appreciating the importance of the American alliance.

Some of these strategies include renegotiating the Status of Forces Agreement and exploring collective security agreements with like-minded allies in Asia.

The inauguration of Shigeru Ishiba as prime minister ushers in a new era for the nation's military tactics and foreign policy. In an article he wrote for the Hudson Institute in Washington, Ishiba advocated for a conversation on the potential for American nuclear weapons to be stationed in the Asia-Pacific region (APR) and the establishment of an Asian counterpart to NATO.

This project not only changes the course of Japanese policy but also questions the country's remilitarization and what it means for the rest of the region.

Japan followed a pacifist posture outlined in its Constitution for many years. But shifting political dynamics worldwide and escalating hostilities in the area—particularly in light of China's expanding military might and North Korea's nuclear aspirations—are pressuring Japan to reevaluate its defense policies.

Shigeru Ishiba, a well-known supporter of bolstering Japan's defense capabilities, has drawn attention to the absence of an Asia-Pacific collective defense framework that is NATO-equivalent and capable of successfully thwarting threats from nations such as China, Russia, and North Korea.

Ishiba explicitly suggested in his statement that an alliance be formed in Asia to coordinate operations with the United States and maybe employ nuclear weapons as a deterrent. This action represents a significant shift from Japan's "nuclear-free" posture adopted after the war. Tokyo has long refrained from making official commitments to nuclear weapons, even in spite of its close defense ties to the United States.

However, Japan's objectives have changed as a result of North Korea's nuclear ambitions and China's growing military activities, notably near the disputed Senkaku Islands.

China has been acting more aggressively in the South China Sea and surrounding the Senkaku Islands, which Japan claims as its own. The increased level of tension makes Japan more dependent on security assurances and ways to stave off possible attacks.

In the meantime, China and Russia maintain their military cooperation by deepening their strategic partnership and holding cooperative drills. In this situation, Ishiba suggested an Asian alliance modeled after NATO.

The countries in the region will have no choice but to look for measures to safeguard their interests if China and Russia maintain their tight coordination. It is believed that Ishiba's idea is a reaction to these altering global dynamics. Recently, for the first time, Chinese warships sailed into Japanese waters while Chinese aircraft flew over Japanese airspace. In response, Japan sent its own warships—for the first time—into the Taiwan Straits.

Apart from maintaining nuclear deterrence, Japan is proactively improving its military capabilities and fortifying its alliance with the United States armed forces. One of the biggest military exercises, with 45,000 soldiers, is called "Keen Sword-25," and it is slated for the fall of 2024. These drills show Japan's preparedness to incorporate military activities into its civilian domain by utilizing civilian infrastructure like ports and airports.

Tokyo is trying to move away from its long-standing pacifist position, which restricted the use of its military forces to self-defense, as these moves indicate. Although Japan adheres to a Constitution that outlaws war as a way of resolving international conflicts, its current activities demonstrate increased confidence in the need for active deterrence.

Positioning India

PM Ishiba's proposal to form an Asian NATO includes India as well. Additionally, he recommended that the region either build its own nuclear weapons or that the US station nuclear weapons there. This proposal results from the growing Chinese threat, especially regarding

Taiwan, and doubts about the US extended deterrent's dependability. As tensions rise, India will need to strike a balance between its strategic autonomy and the security interests of its close partners without getting embroiled in a formal mutual defense pact.

Ishiba hasn't traveled to India on business. For most of this century, when India-Japan relations grew under Shinzo Abe, he was not part of the mainstream LDP. At the G20 and East Asia summits, Ishiba would meet the leaders of ASEAN and the Quad, which included Australia and India.

Naturally, Japan's top focus continues to be its deepening and intensifying alliance with the US. Unlike its more junior partner status in the past, Japan is today a global partner with a growing defense role.

Under the US nuclear umbrella, Japan had placed sanctions on India for its 1998 nuclear tests; today, it is considering a future in which it may require nuclear weapons. With a developing fleet of ship-based submersible ballistic nuclear submarines (SSBNs) and intercontinental ballistic missiles (ICBMs), India is a nuclear weapons state.

India's security is not dependent on the US nuclear umbrella. This is the exact reason India should not join an Asian NATO, especially if it is motivated by concerns over Taiwan. A mutual defense commitment will be going too far, even if India has strategic alliances, reciprocal logistics agreements, joint military exercises, and enhanced interoperability with the Quad countries.

India's external affairs minister, S. Jaishankar, recently said that India didn't share the vision for an 'Asian NATO' proposed by Japanese Prime Minister Shigeru Ishiba. Jaishankar was speaking at the Carnegie Endowment for International Peace in Washington when he said that, unlike Japan, India had never been a treaty ally of another country. When asked about Japan's call for a NATO-like grouping of Asian countries, Jaishankar said, "We don't have that kind of strategic architecture in mind." India, Japan, Australia, and the US are part of the Quad, deemed a counterbalance to China.

The idea put up by Ishiba to station nuclear weapons in the Asia-Pacific area will undoubtedly spark fresh hostilities. China and Russia will probably interpret this action as a threat to their security and take appropriate action diplomatically or militarily.

It's unlikely that North Korea will overlook any discussion of increased American nuclear deterrent in the area. India and Japan have been strong allies for many years. They share the goal of an open and free Indo-Pacific, have growing economic and defense ties, and are dedicated to regional stability.

Although China's assertiveness and Japan's growing security worries are legitimate, India must proceed cautiously with the suggested solution—an Asian NATO.

Remilitarization, the creation of an Asian NATO, and nuclear weapons may be considered necessary responses to escalating threats. However, there are still unanswered concerns about how these choices will affect Japanese society and the stability of the Asia-Pacific area in the long run. If an Asian NATO is established, India will need to collaborate closely but will not join it.

India's involvement in the Indo-Pacific is already important, and its participation in organizations like the Quad provides a framework for coordination on regional security without the rigidity of a formal military alliance.

<https://www.eurasiantimes.com/asian-nato-why-india-does-not-back-japans/>

India Air Force shouldn't see China as rival? Right, it's becoming more of a threat

The Global Times, a Chinese state-affiliated media outlet, cited experts on Tuesday who advised that the Indian Air Force (IAF) should not view China as a rival. This statement was a response to remarks made by Air Chief Marshal (ACM) AP Singh, who, in an interview with the Times of India on Monday, candidly acknowledged that India is “lagging behind” China in military technology and is “way behind” in defence production.

While ACM Singh’s assessment reflects a sober recognition of China’s advancements in technology, defence production, and infrastructure, the perspective presented by The Global Times raises critical questions. It is essential to recognise that China’s role extends beyond that of a mere rival; it poses a significant threat to India’s national security. If China were to be removed from India’s defence considerations, the landscape of security threats would change drastically, potentially allowing even Pakistan to align more closely with India.

Erosion of air combat advantage

Moreover, the assertion that China is “steadily eroding” India’s air combat advantage cannot be overlooked. This erosion is compounded by significant delays experienced by Hindustan Aeronautics Limited in delivering indigenously manufactured Tejas fighters, further exacerbating India’s challenges in maintaining a competitive edge in aerial combat capabilities.

India’s growing anxiety over its air security, particularly concerning China, stems from the latter’s substantial enhancement of air force infrastructure along the Line of Actual Control (LAC). This is especially pronounced in the Tibet and Xinjiang regions, where tensions between the two nations continue to simmer. A critical development is the recent deployment of J-20 stealth fighters at the Shigatse dual-use airbase, located just 150 kilometres from Sikkim. Satellite imagery reveals that six J-20 stealth fighters were stationed at Shigatse in 2024, highlighting its increasing strategic significance. This forward positioning of advanced fifth-generation aircraft is rare, as they usually remain stationed deeper within Chinese territory. Reports indicate that these J-20s arrived on May 27, 2024, alongside a Y-20 transport aircraft, pointing to a significant operational surge intended to bolster China’s military presence along the border.

Strategic upgrades and expansion

Another key facility, the Hotan Air Base in Xinjiang, has undergone substantial upgrades, including a second runway, expanded hangar space, and enhanced surface-to-air missile defences. These improvements significantly increase the base’s capability for both offensive and defensive operations, allowing for rapid deployment along the LAC.

Moreover, China is modernising several critical airbases in Tibet, including Ngari Gunsa, Lhasa Gonggar, and Hotan. Upgrades involve extending runways and enhancing logistical and radar capabilities, which facilitate a wider range of military operations.

Since 2017, China has developed or upgraded 37 heliports and airports in Tibet and Xinjiang. These projects are designed to improve surveillance and provide crucial connectivity in the challenging Himalayan terrain, enabling the People’s Liberation Army (PLA) to conduct reconnaissance, swiftly deploy troops, and launch potential strikes along the LAC.

As reported by Air and Space Forces Magazine, China currently produces over 100 J-20s annually for domestic use, further amplifying concerns regarding the balance of air power in the region.

In September of this year, reports emerged regarding China's construction of a new heliport situated 20 kilometres east of the LAC in the strategically sensitive 'Fishtails' region of Arunachal Pradesh. This area, which includes Fishtail 1 in the Dibang Valley and Fishtail 2 in the Anjaw district, is particularly contentious due to the differing interpretations of the LAC by India and China.

According to reports, the heliport is located on the banks of the Gongrigabu Qu river in the Nyingchi Prefecture of the Tibet Autonomous Region, firmly within what China considers its undisputed territory. Satellite imagery from EOS Data Analytics revealed that, on December 1, 2023, no construction activity was apparent at the site. However, by December 31, land clearance had commenced, and recent high-resolution images from Maxar, dated September 16, 2024, indicated that the heliport is nearing completion.

This facility features a 600-metre runway specifically designed for rolling helicopter take-offs, which is crucial for operations at high altitudes. Although the heliport is situated at a relatively lower elevation compared to much of the Tibetan plateau—enhancing helicopter payload capacity—it remains a significant strategic asset for China in this region.

In addition to the runway, the heliport features hangars, a large apron area for helicopters, and essential air traffic control infrastructure. Its construction is indicative of China's broader strategy to strengthen its border with India, which includes the establishment of 'Xiaokang' villages—dual-use settlements intended for both civilian and military purposes.

Realities of military expansion

In this context, it is bewildering for The Global Times to cite a military expert who accuses the IAF of "sensationalizing China's reasonable and legitimate national defense development." The reality is starkly different. During a Congressional testimony in March, Admiral John Aquilino, the former head of the US Indo-Pacific Command, cautioned that China could soon possess the world's largest air force due to its aggressive modernisation efforts. Should India not be genuinely concerned? Currently, it operates a fleet of 31 fighter jet squadrons—nine short of the minimum requirement of 42. While India strives to address these deficiencies, China is expanding its air force at an unprecedented rate.

Recent reports indicate that an IAF Rafale demonstrated its capability to "shoot down Chinese spy balloon-type objects," a move aimed at countering Chinese surveillance activities, which has further alarmed Beijing. Wasn't it China that initiated this spy balloon business that even spooked the United States? If China is indeed conducting military operations that undermine India's national security, then India must take serious steps to counteract this threat. If China has the right to expand its military, so too does India.

A treacherous landscape

The relationship between India and China received a harsh reality check during the violent clash in the Galwan Valley in June 2020, which led to the tragic deaths of 20 Indian soldiers and four Chinese troops. Trust has eroded, giving way to an atmosphere of treachery. As both nations navigate this treacherous landscape, India must reassess its military strategies and capabilities in light of the ongoing challenges posed by China. A proactive approach to strengthening its defence posture will be crucial in safeguarding national security and maintaining stability in the region.

<https://www.firstpost.com/world/india-air-force-shouldnt-see-china-as-rival-right-its-becoming-more-of-a-threat-13823049.html>

Science & Technology News



Press Information Bureau
Government of India

Ministry of Atomic Energy

Tue, 08 Oct 2024

DAE Inaugurates MACE, Asia's Largest and World's Highest Imaging Cherenkov Observatory, at Hanle, Ladakh

The Major Atmospheric Cherenkov Experiment (MACE) Observatory has been inaugurated by Dr. Ajit Kumar Mohanty, Secretary DAE & Chairman of the Atomic Energy Commission, at Hanle, Ladakh, on 4th October 2024. MACE is the largest imaging Cherenkov telescope in Asia. Located at an altitude of ~4,300 m, it is also the highest of its kind in the world. The telescope is indigenously built by BARC with support from ECIL and other Indian industry partners. The inaugural of MACE Observatory was a part of the Platinum Jubilee year celebrations of the DAE. The event commenced with the unveiling of commemorative plaques by Dr. Mohanty at the MACE site at Hanle, Ladakh, thereby officially inaugurating the MACE Observatory.

In his inaugural address, DAE Secretary Dr. Mohanty applauded the collective effort that brought the MACE telescope to fruition. He stated that the MACE Observatory is a monumental achievement for India, and it places our nation at the forefront of cosmic-ray research globally. He further added that this telescope will allow us to study high-energy gamma rays, paving the way for deeper understanding of the universe's most energetic events. Dr. Mohanty emphasised the significant role that MACE project plays not only in advancing scientific research but also in supporting the socio-economic development of Ladakh. Students were encouraged to explore careers in astronomy and astrophysics, with Dr. Mohanty expressing hope that the MACE project would inspire future generations of Indian astronomers, scientists, and engineers. Dr. Mohanty also paid tribute to India's pioneering contributions to the field, including the work of Dr. Homi J. Bhabha, whose legacy continues to inspire India's cosmic-ray research.

Shri Ajay Ramesh Sule, Additional Secretary, DAE, stressed the importance of balancing tourism and scientific activities within the Hanle Dark Sky Reserve (HDSR) and encouraged students to pursue careers in science and technology.

Speaking on the occasion, Dr. Annapurni Subramaniam, Director, Indian Institute of Astrophysics (IIA), highlighted the fruitful collaborative efforts between several constituent Units of DAE and the IIA.

Shri Sajjad Hussain Mufti, Chief Conservator of Forests, UT Ladakh, outlined the key features of the Hanle Dark Sky Reserve and the focus on community engagement. He reaffirmed the UT administration's unwavering commitment to supporting DAE's scientific activities.

Dr. S. M. Yusuf, Director, Physics Group, BARC, in his welcome address, emphasized the importance of the MACE telescope in advancing India's space and cosmic-ray research capabilities. The vote of thanks was delivered by Dr. K. K. Yadav, Head of Astrophysical Sciences

Division of BARC, followed by a visit to the state-of-the-art MACE Control Room. The dignitaries present on the occasion interacted with the team of astronomers and technicians.

A pictorial compilation documenting the journey of the MACE project was also released on the occasion. Dr. Mohanty felicitated the representatives of the Nambardars (village leaders), the school headmaster, and the venerable Lama of the Handle Gompa.

A special film on the MACE telescope was screened, showcasing the scientific and technological advancements made during the project. The day concluded with a guided tour of the MACE Observatory, giving attendees an exclusive look at the world-class observatory that establishes India on the global advanced astronomy map.

The inauguration of the MACE telescope marks a significant step forward for Indian astrophysics and cosmic-ray research. Situated at an altitude of $\sim 4,300$ m, the MACE telescope will observe high-energy gamma rays, contributing to global efforts to understand the most energetic phenomena in the universe, such as supernovae, black holes, and gamma-ray bursts. This facility will also complement global observatories, strengthening India's position in the field of multi messenger astronomy.

Looking ahead, the MACE project aims to foster international collaborations, advancing India's contributions to space research and bolstering India's position in the global scientific community. The observatory will also serve as a beacon of inspiration for future generations of Indian scientists, encouraging them to explore new frontiers in astrophysics.



<https://static.pib.gov.in/WriteReadData/userfiles/image/8F2PH.jpg>



Combination nanotherapeutic clotting implant reduces localized tumor recurrence post-surgery

A combination therapeutic implant consisting of metal-based nanomedicine reinforced with patient derived blood clotting components reduces localised tumour recurrence post-surgery.

The technology can be used to fabricate a therapeutic kit that can generate this autologous hybrid implant by using simple equipment such as handheld homogenizer and a centrifuge which might be beneficial to marginalised cancer patients.

Surgery and chemotherapy are inevitable in managing solid tumors. However, local recurrence due to residual tumor and systemic toxicity due to drug non-specificity confer these vital modalities inefficient. Nanotechnological tools show promise in reducing toxicity and improving solubility of chemodrugs, but due to their poor tumor bioavailability (<0.7% of injected dose) and rapid clearance by reticulo endothelial system, their progress is deescalated. A key obstacle is also the adsorption of host serum proteins over the surface of nanoparticles termed as 'protein corona'.

Protein corona has been recently established as a molecular fingerprint of a patient and has been realized to be integrated into the basic design of nanoparticles for a futuristic personalized treatment strategy. Considering serum proteins being the first line of interaction for a drug molecule soon after its systemic administration, scientists are trying to devise ways in positively channelizing corona proteins towards generation of precision nanomedicines and diagnostic tools.

Scientists at Institute of Nano Science and Technology (INST), Mohali, an autonomous institute of Department of Science and Technology in collaboration with researchers from IIT Ropar, AIIMS Bilaspur and PGIMER Chandigarh have developed and tested an indigenous intra-operative combination treatment consisting of drug and metal-based nanomedicine stabilized by patient derived serum protein corona termed as Nano-Micro-Sera (NMS) and reinforced them into autologous fibrin to aid in the post-surgical management of locally recurrent tumors.

The hybrid fibrin implant quickly bonds with damaged tissue in the residual tumor bed. After closure of the surgical site, localized chemo-phototherapy impeded tumor recurrence through immunogenic cell death (ICD) mediated dendritic cell maturation and T-cell activation.

Although fibrin sealants are commercially available, autologously derived fibrin glue is also utilized favourably during mastectomy, maxillofacial and ophthalmological surgery. Due to its wide acceptance for such clinical procedures, strengthening it further with therapeutic functionality by incorporating NMS is highly warranted.

The autologous hybrid fibrin glue developed by the researchers exhibited remarkable synergy and superior outcomes in suppressing recurrent breast tumors. This host-specific approach published in the journal *Nanoscale* was meticulously crafted for bedside fabrication using minimal resources, addressing the limitations of conventional therapies and ensuring accessibility for patients across different economic conditions.

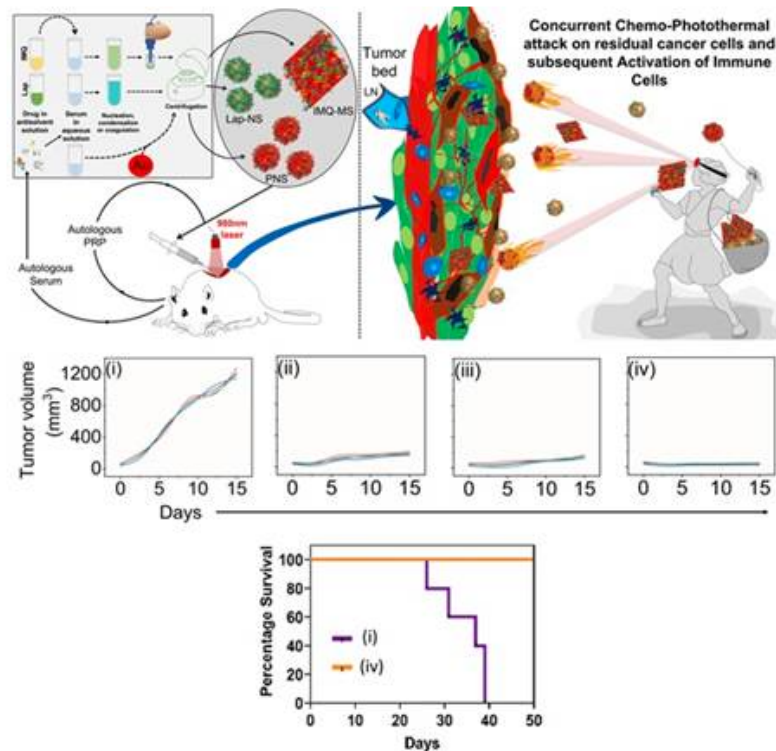


Figure shows work flow for preparation of Nano Micro Sera (NMS) and its application at the tumor bed with hybrid fibrin glue that initiates concurrent chemo-photo thermal attack on residual cancer cells and further activation of immune cells. The combination nanotherapeutic fibrin implant (iv-NMS) effectively decreased post-surgical tumor regrowth in comparison to Control groups (i-autologous implant, ii-combination of chemotherapeutic drug and photothermal agent loaded fibrin implant and iii-immunoadjuvant loaded fibrin implant), thus improving overall survival.

Considering the large number of patients suffering from solid tumors in India, an affordable methodology for localized post-surgical management will have significant impact in controlling recurrence of primary tumor and thereby affecting the probability for local as well as distant metastasis.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2063297>

Pioneers in artificial intelligence win the Nobel Prize in physics

Two pioneers of artificial intelligence — John Hopfield and Geoffrey Hinton — won the Nobel Prize in physics Tuesday for helping create the building blocks of machine learning that is revolutionizing the way we work and live but also creates new threats for humanity.

Hinton, who is known as the godfather of artificial intelligence, is a citizen of Canada and Britain who works at the University of Toronto, and Hopfield is an American working at Princeton.

“These two gentlemen were really the pioneers,” said Nobel physics committee member Mark Pearce.

The artificial neural networks — interconnected computer nodes inspired by neurons in the human brain — the researchers pioneered are used throughout science and medicine and “have also become part of our daily lives,” said Ellen Moons of the Nobel committee at the Royal Swedish Academy of Sciences.

Hopfield, whose 1982 work laid the groundwork for Hinton's, told The Associated Press, “I continue to be amazed by the impact it has had.”

Hinton predicted that AI will end up having a “huge influence” on civilization, bringing improvements in productivity and health care.

“It would be comparable with the Industrial Revolution,” he said in an open call with reporters and officials of the Royal Swedish Academy of Sciences.

“We have no experience of what it’s like to have things smarter than us. And it’s going to be wonderful in many respects,” Hinton said.

“But we also have to worry about a number of possible bad consequences, particularly the threat of these things getting out of control.”

The Nobel committee also mentioned fears about the possible flipside.

Moons said that while it has “enormous benefits, its rapid development has also raised concerns about our future. Collectively, humans carry the responsibility for using this new technology in a safe and ethical way for the greatest benefit of humankind.”

Hinton, who quit a role at Google so he could speak more freely about the dangers of the technology he helped create, shares those concerns.

“I am worried that the overall consequence of this might be systems more intelligent than us that eventually take control,” Hinton said.

For his part, Hopfield, who signed early petitions by researchers calling for strong control of the technology, compared the risks and benefits to work on viruses and nuclear energy, capable of helping and harming society. At a Princeton news conference, he made reference to the concerns, bringing up the dystopia imagined in George Orwell's “1984,” or the fictional apocalypse inadvertently created by a Nobel-winning physicist in Kurt Vonnegut’s “Cat’s Cradle.”

Hopfield, who was staying with his wife at a cottage in Hampshire, England, said that after grabbing coffee and getting his flu shot, he opened his computer to a flurry of activity.

“I’ve never seen that many emails in my life,” he said. A bottle of champagne and bowl of soup were waiting, he added, but he doubted there were any fellow physicists in town to join the celebration.

Hinton said he was shocked at the honor.

“I’m flabbergasted. I had no idea this would happen,” he said when reached by the Nobel committee on the phone. He said he was at a cheap hotel with no internet.

Hinton, 76, helped develop a technique in the 1980s known as backpropagation instrumental in training machines how to “learn” by fine-tuning errors until they disappear. It’s similar to the way a student learns, with an initial solution graded and flaws identified and returned to be fixed and repaired. This process continues until the answer matches the network’s version of reality.

Hinton had an unconventional background as a psychologist who also dabbled in carpentry and was genuinely curious about how the mind works, said protege Nick Frosst, who was Hinton's first hire at Google's AI division in Toronto.

His "playfulness and genuine interest in answering fundamental questions I think is key to his success as a scientist," Frosst said.

Nor did he stop at his pioneering 1980s work.

"He's been consistently trying out crazy things and some of them work very well and some of them don't," Frosst said. "But they all have contributed to the success of the field and galvanized other researchers to try new things as well."

Hinton's team at the University of Toronto wowed peers by using a neural network to win the prestigious ImageNet computer vision competition in 2012. That spawned a flurry of copycats and was "a very, very significant moment in hindsight and in the course of AI history," said Stanford University computer scientist and ImageNet creator Fei-Fei Li.

"Many people consider that the birth of modern AI," she said.

Hinton and fellow AI scientists Yoshua Bengio and Yann LeCun won computer science's top prize, the Turing Award, in 2019.

"For a long time, people thought what the three of us were doing was nonsense," Hinton told the in 2019. "My message to young researchers is, don't be put off if everyone tells you what you are doing is silly."

Many of Hinton's former students and collaborators followed him into the tech industry as it began capitalizing on AI innovations, and some started their own AI companies, including Frosst's Cohere and ChatGPT maker OpenAI. Hinton said he uses machine learning tools in his daily life.

"Whenever I want to know the answer to anything, I just go and ask GPT-4," Hinton said at the Nobel announcement. "I don't totally trust it because it can hallucinate, but on almost everything it's a not-very-good expert. And that's very useful."

Hopfield, 91, created an associative memory that can store and reconstruct images and other types of patterns in data, the Nobel committee said.

Just as Hinton came to the field from psychology, Hopfield stressed how cutting edge science comes from crossing the borders of scientific fields like physics, biology and chemistry instead of researchers staying in their lane. It's why this prize is a physics prize, he said, pointing out that his neural network borrows from condensed matter physics.

With big complex problems in scientific fields, "if you are not motivated by physics, you just don't tackle the class of problems," Hopfield said.

While there's no Nobel for computer science, Li said that awarding a traditional science prize to AI pioneers is significant and shows how boundaries between disciplines have blurred.

Not all of their peers agree with the Nobel laureates about the risks of the technology they helped create.

Frosst has had many "spirited debates" with Hinton about AI's risks and disagrees with some of Hinton's warnings but not his willingness to publicly address them.

"Mostly we disagree on timescale and on the particular technology that he's sounding the alarm on," Frosst said. "I don't think that neural nets and language models as they exist today pose an existential risk."

Bengio, who has long voiced concerns about AI risks, said what really alarms him and Hinton is “loss of human control” and whether AI systems will act morally when they're smarter than humans.

“We don’t know the answer to these questions,” he said. "And we should make sure we do before we build those machines.”

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<https://www.hindustantimes.com/science/the-nobel-prize-in-physics-is-being-awarded-a-day-after-2-americans-won-the-medicine-prize-101728373908158.html>



Tue, 08 Oct 2024

Upper stage of historic PSLV-37 mission re-enters Earth’s atmosphere eight years after launch: ISRO

The Indian Space Research Organisation (ISRO) informed that the upper stage of the Polar Satellite Launch Vehicle C-37 (PSLV C-37 mission) re-entered the Earth’s atmosphere on October 6.

The PSLV-C37 mission was launched on February 15, 2017 with Cartosat-2D as the main payload along with another 103 satellites as co-passengers, namely INS-1A, INS- 1B, Al-Farabi 1, BGUSAT, DIDO-2, Nayif 1, PEASS, 88 Flock-3p satellites, and 8 Lemur-2 satellites. The space agency created history as it was the first mission to launch 104 satellites with a single vehicle.

After injecting the satellites and passivation, the upper stage (PS4) was left at an orbit of approximately 470x494 km.

“It was regularly tracked by US Space Command (USSPACECOM) as an object with NORAD id 42052. Its orbital altitude slowly decayed, primarily due to atmospheric drag effects,” ISRO informed on October 8. Since September 2024, ISRO System for Safe and Sustainable Space Operations Management (IS4OM) regularly monitored the orbital decay as part of its regular activities and predicted re-entry into the atmosphere in the first week of October 2024.

“The orbit had decayed to a size of 134x148 km, as of October 6, 2024 12:45 UTC. As per USSPACECOM prediction published in Space Track, the re-entry took place on October 6 at 15:49

UTC (+/-1 minute of uncertainty) while IS4OM prediction also showed that reentry would occur on October 6 at 15:48:25 UTC. The corresponding impact point is in the North Atlantic Ocean,” ISRO informed.

The atmospheric re-entry of the rocket body within eight years of its launch is fully compliant with the international debris mitigation guidelines, in particular, the guideline of Inter-Agency Space Debris Coordination Committee (IADC) that recommends limiting the post-mission orbital life of a defunct object in Low-Earth orbit (LEO) to 25 years.

According to ISRO, this requirement was met by properly designing a passivation sequence, which lowered the orbit of PS4 after injection of the payloads. At present, special initiatives are undertaken to ensure that the residual orbital lifetime of the PSLV upper stages is reduced to 5 years, or even less, by actively de-orbiting them to lower altitude orbits through engine re-starts, as in PSLV-C38, PSLV-40, PSLV-C43, PSLV-C56, and PSLV-C58 missions.

Controlled re-entry of the upper stage is also envisaged for the disposal of the upper stage in future PSLV missions. “As part of its longstanding commitment to preserve long term sustainability of outer space activities, ISRO will continue to implement proactive measures to meet the objectives of Debris Free Space Mission (DFSM) by the year 2030.

<https://www.thehindu.com/sci-tech/science/upper-stage-of-historic-pslv-37-mission-re-enters-earths-atmosphere-eight-years-after-launch-isro/article68731779.ece>



Tue, 08 Oct 2024

Scientists are working on a way to detect cancer with sound waves

Scientists have developed a new technique to detect cancers. The method uses ultrasound to turn a small part of our body’s tissue into droplets that are released into the blood. These bubbles contain molecules like RNA, DNA, and proteins that allow the scientists to identify particular types of cancer.

Roger Zemp, associate professor of electrical and computer engineering at the University of Alberta, Canada, led a recent study describing such a technique. He presented his team’s findings at the joint meeting of the Acoustical Society of America and the Canadian Acoustical Association at Shaw Centre in Canada on May 13.

A summary of the findings was also published in the Journal of the Acoustical Society of America earlier this year.

Break-off, blood, biomarker

Doctors have been using ultrasound to take pictures of internal organs. The technology converts the sound waves reflected by surfaces inside the body to an image, just the way bats use ultrasound to sense their surroundings. This said, the gold standard to detect many cancers is a biopsy. Doctors extract a small piece of tissue or cells using a large needle from the part of the body where cancer is suspected to be present.

In vitro tests can confirm if the tissue/cells are cancerous and, if so, what kind of cancer it is. Now, Zemp and his colleagues at the university are figuring out a way to use ultrasound to perhaps

someday replace biopsies, which are cumbersome, painful, and potentially injurious. They have found that high-energy ultrasound (at frequencies greater than those used in ultrasound scans) can break off a small piece of cancerous tissue into droplets and release their contents into the bloodstream. The team could then test the blood for biomarkers — certain biomolecules like DNA, RNA or proteins — specific to cancer.

“Ultrasound can enhance the levels of these genetic and vesicle biomarkers in blood samples by over a 100-times,” Zemp said in a press release. This method could allow clinicians to use blood samples to detect specific cancer types and even the mutations they contain, which is currently undetectable in blood. He estimated the technique could help clinicians avoid nearly half of all biopsies.

‘New kind of readout’

In the most advanced use of the technique, Zemp and his colleagues detected the presence of a single cancer cell circulating in the blood. When cancer progresses and spreads, cancer cells move to parts of the body other than their original site via the blood. But scientists and clinicians have struggled to spot these cells in the blood because they’re very small in number.

A few tests are still sensitive enough to detect them but they’re expensive. For example the ‘CellSearch’ test costs \$10,000 (Rs 8.4 lakh).

But Zemp & co. were able to detect a cancer cell in the blood samples of a prostate cancer patient using their technique. The team passed ultrasound waves through blood samples isolated from the cancer patients. The waves shredded the circulating cancer cells and released the biomarkers they contained into the blood.

The team looked for and confirmed the presence of these biomarkers. Zemp estimated this version of the test would cost a hundred-times less, around \$100 (Rs 8,400). The researchers are now trying to expand their findings to other types of cancer, particularly breast cancer and melanoma. “We hope our ultrasound technologies will benefit patients by providing clinicians a new kind of molecular readout of cells and tissues with minimal discomfort,” Zemp said in the same release.

Needed: large cohorts

Himanshu Shekhar, assistant professor of electrical engineering, and Karla MercadoShekhar, assistant professor of biological sciences and engineering, both at IIT Gandhinagar, said the effort was promising and considerably more advanced than previous work in this field.

“The ability to perform ultrasound-aided detection using drawn blood samples is most exciting because of the simplicity of this approach. The main advantage of this approach is its non-invasiveness, which will prevent patient discomfort,” Shekhar said.

Mercado-Shekhar said the approach could be extended to monitoring cancer progression and treatment response. However, she cautioned more studies in a large cohort of patients would be required before doctors start using this tool in the clinic. Clinical trials with large cohorts of patients with different types of cancer and healthy people across different ethnic groups and geographies are important to ensure the technique can produce accurate results for different cancer types and prove that it’s sensitive to their varying biomarker thresholds.

About five years

Brian Tysinger, a research assistant professor of public policy, and Jakub Hlavka, associate professor of population and public health sciences, both at the University of Southern California, underscored this point in an article published by the US National Academies Press in May 2022: “Lack of representative studies on screening for cancer or cardiometabolic disease may lead to

recommendations that fail to consider earlier ages or lower biomarker thresholds to start screening that might be warranted in some populations.”

There has been a push of late for more accessible and affordable cancer screening methods. The U.S. National Cancer Institute recently launched its ‘Cancer Screening Research Network’. In 2025, the network will start a pilot study to evaluate a battery of screening tests to spot cancer early and accurately with a cohort of 24,000 people. The study is expected to be completed in four years. The network may later support similar trials for screening methods developed by individual research groups, potentially including the ultrasound-based one.

“If results of clinical trials are favourable, the researchers will likely pursue regulatory approval in collaboration with industry partners, and subsequently, this technique could be available commercially in about five years,” Mercado-Shekhar said.

<https://www.thehindu.com/sci-tech/science/cancer-biopsies-painful-ultrasound-waves-alternative/article68724135.ece>



Tue, 08 Oct 2024

Genome-editing is helping us understand hereditary cancers better

The International Agency for Research on Cancer’s estimates of the burden of 36 cancers in 185 countries suggest one in five individuals have a lifetime risk of developing cancer. The Agency also estimated that one in nine males and one in 12 females will die of cancer.

In all, the agency counted 20 million new cancer cases and 9.74 million cancer-related deaths in 2022 and which it said could rise to a whopping 32 million new cases and 16 million deaths by 2045. By then Asia alone may account for almost half of all cases worldwide.

All cancers occur due to genetic mutations in the body’s genome and a subset of these cancers are the result of inherited mutations. Researchers have estimated that around 10% of all individuals with any cancer could have inherited a genetic mutation implicated in the cancer; they have also found the prevalence of inherited mutations to be higher among individuals with ovarian cancer (20%).

It is 10% among those with breast, colorectal, lung or prostate cancers, and a lower 6% among those with cervical cancer.

The BRCA genes

Scientists have exhaustively documented hereditary cancers. We know there are more than 50 genetic syndromes (collections of symptoms) that predispose individuals to cancer and are caused by genetic variants that humans are capable of inheriting.

In fact, the discovery of the BRCA1 and the BRCA2 DNA-repair genes in 1994 and 1995, by Mary-Claire King et al. and Mark Skolnick et al. respectively, bolstered our understanding of hereditary cancer syndromes.

Hereditary breast-ovarian cancer syndrome is a relatively common cancer predisposition syndrome caused by mutations in the BRCA1 and the BRCA2 genes (or BRCA). In women, genetic

mutations in BRCA primarily increase the risk of cancers of the breasts, ovaries and the fallopian tube. In men, they make prostate cancer and male breast cancer more likely.

Many studies have also shown variations in the make-up of BRCA genes could increase the risk of pancreatic, colorectal, uterine, and some other cancers. By some estimates, BRCA1 and BRCA2 mutations are present in around one in every 400 individuals, and therefore have an elevated risk of developing cancer. Researchers have also documented a higher than average prevalence in certain populations by virtue of these groups carrying specific variants of these genes.

For example, among the Ashkenazi Jews that emerged in Central Europe and their descendants, around one in 40 individuals carry mutations in the BRCA genes — about 10-times more common than in the general population. This higher prevalence has been attributed to some genetic bottlenecks and founder effects within the community.

A genetic bottleneck is when the genetic diversity in a population drops (due to various factors), leaving their gene pool ill-equipped to fend off diseases and other threats that require adaptation. When a small group of individuals with a genetic bottleneck found a new population, the bottleneck's effects become pronounced in this group — a phenomenon called the founder effect.

Will the therapy take?

Testing for mutations in the BRCA gene is crucial because it helps individuals and clinicians identify higher risk sooner and develop personalised prevention strategies, including increased surveillance, preventive surgery, and/or targeted therapies. In a May 17 paper in the Journal of Clinical Oncology, the American Society of Clinical Oncology recommended 15 genes in all to ascertain an individual's risk of developing breast and ovarian cancers.

There are targeted therapies available today for individuals who develop cancers due to mutations in the BRCA genes or in genes implicated in other DNA-repair pathways. One such involves poly (ADP-ribose) polymerase (PARP) inhibitors, a new class of chemotherapy drugs. Investigators have reported promising results from recent clinical trials of PARP inhibitors, particularly in combination with platinum-based chemotherapy, offering hope for millions of people facing or experiencing hereditary cancers associated with specific mutations.

Our understanding of cancer genes and the mutations that cause cancer have improved significantly of late. One reason is tools like CRISPR screens, which have transformed the way researchers study the BRCA genes by enabling high-throughput functional genetic analysis.

That is, using CRISPR-Cas9 technology, researchers can target the BRCA genes and create specific mutations in them in order to study their effects on DNA repair and cancer development. Researchers have also used such CRISPR-based methods to explore an individual's propensity to resist targeted therapies.

For example, cancers involving mutated BRCA genes are sensitive to PARP inhibitors. But studies have shown many mutations in other genes involved in DNA repair could also influence the response to PARP inhibitors, and there doesn't yet exist a consistent method to predict it in clinical settings. So last year, a study published in the journal Nature Communications used genome-wide CRISPR-Cas9 screens to identify specific mutations that increase the sensitivity to PARP inhibitors.

Risk is a spectrum

In another, more recent paper, researchers at the Wellcome Sanger Institute in the U.K. reported identifying more than 3,000 genetic changes in the RAD51C gene, which is also crucial for DNA repair, that may significantly increase the risk of breast and ovarian cancers.

After they mapped the structure of the protein encoded by this gene, the researchers were able to pinpoint the portions they determined to be critical for repairing DNA. So drugs targeting this portion could pave the way for new therapeutic strategies. The researchers used a technique called saturation genome editing to examine 9,188 variants, revealing that 3,094 could disrupt the gene's function and increase ovarian cancer risk six-fold and aggressive breast cancer risk four-fold.

They also discovered variants that partially impaired RAD51C function, suggesting a broader spectrum of risk for breast and ovarian cancers than previously understood. The findings, published in Cell on September 18, offer novel insights that clinicians can use to clarify the effects of RAD51C mutations.

Importantly, the study confirmed genetic risk lies on a spectrum influenced by the extent to which genetic changes affect protein function while emphasising the value of large-scale variant analysis for better personalised medicine and cancer prevention strategies. The researchers are preparing to apply similar techniques to other genes with plans to eventually cover the entire human genome.

Cancer discovered early

Population prevalence studies play an important role in identifying the spread of certain hereditary cancers in different groups. These studies help uncover genetic risk factors that may be more common in certain populations due to founder events. In tandem, at-risk individuals need to undergo genetic screening at regular intervals.

The result will potentially be a cancer discovered early, which will help the individual make more informed healthcare decisions, alert their family members to risk for them as well, and adopt therapies likely to be more effective, including preventive treatment and lifestyle changes. The ultimate outcome is for cancer morbidity and mortality to drop and, beyond, for everyone to have healthier lives.

<https://www.thehindu.com/sci-tech/science/genome-editing-is-helping-us-understand-hereditary-cancers-better/article68727272.ece>



Tue, 08 Oct 2024

NASA aims for Mars in the 2030s: Crewed mission to uncover red planet secrets

NASA plans to send humans on a scientific round trip to Mars potentially as early as 2035. The trip will take about six to seven months each way and will cover up to 250 million miles (402 million kilometers) each way. The astronauts may spend as many as 500 days on the planet's surface before returning to Earth.

NASA's Artemis program plans to return humans to the Moon this decade to practice and prepare for a Mars mission as early as the 2030s. While NASA has several reasons for pursuing such an ambitious mission, the biggest is scientific exploration and discovery.

I'm an atmospheric scientist and former NASA researcher involved in establishing the scientific questions a Mars mission would investigate. There are lots of mysteries to investigate on the red planet, including why Mars looks the way it does today, and whether it has ever hosted life, past or present.

Mars geology

Mars is an intriguing planet from a geological and atmospheric perspective. It formed with the rest of the solar system about 4.6 billion years ago. Around 3.8 billion years ago, the same time that life formed on Earth, early Mars was very Earth-like. It had abundant liquid water on its surface in the form of oceans, lakes and rivers and possessed a denser atmosphere.

While Mars' surface is totally devoid of liquid water today, scientists have spotted evidence of those past lakes, rivers and even an ocean coastline on its surface. Its north and south poles are covered in frozen water, with a thin veneer of frozen carbon dioxide. At the south pole during the summer, the carbon dioxide veneer disappears, leaving the frozen water exposed.

Today, Mars' atmosphere is very thin and about 95% carbon dioxide. It's filled with atmospheric dust from the surface, which gives the atmosphere of Mars its characteristic reddish color.

Scientists know quite a bit about the planet's surface from sending robotic missions, but there are still many interesting geologic features to investigate more closely. These features could tell researchers more about the solar system's formation.

The northern and southern hemispheres of Mars look very different. About one-third of the surface of Mars – mostly in its northern hemisphere – is 2 to 4 miles (3.2-6.4 kilometers) lower in elevation, called the northern lowlands. The northern lowlands have a few large craters but are relatively smooth. The southern two-thirds of the planet, called the southern highlands, has lots of very old craters.

Mars also has the largest volcanoes that scientists have observed in the solar system. Its surface is peppered with deep craters from asteroid and meteor impacts that occurred during the early history of Mars. Sending astronauts to study these features can help researchers understand how and when major events happened during the early history of Mars.

Asking the right questions

NASA formed a panel called the Human Exploration of Mars Science Analysis Group to plan the future mission. I co-chaired the panel, with NASA scientist James B. Garvin, to develop and assess the key scientific questions about Mars. We wanted to figure out which research questions required a human mission to address, rather than cheaper robotic missions.

The panel came up with recommendations for several important scientific questions for human investigation on Mars. One question asks whether there's life on the planet today. Remember, life on Earth formed about 3.8 billion years ago, when Earth and Mars were similar-looking planets that both had abundant liquid water and Mars had a denser atmosphere.

Another question asks what sort of environmental changes led Mars to lose the widespread, plentiful liquid water on its surface, as well as some of its atmosphere. These questions, alongside other recommendations from the panel, made it into NASA's architectural plan for sending humans to Mars.

How do you get to Mars?

To send people to Mars and return them safely to Earth, NASA has developed a new, very powerful launch vehicle called the Space Launch System and a new human carrier spacecraft called Orion.

To prepare and train astronauts for living on and exploring Mars, NASA established a new program to return humans to the Moon, called the Artemis program. In mythology, Artemis was

Apollo's twin sister. The Artemis astronauts will live and work on the Moon for months at a time to prepare for living and working on Mars.

The Space Launch System and Orion successfully launched on Nov. 16, 2022, as part of the Artemis I mission. It made the Artemis program's first uncrewed flight to the Moon, and once there, Orion orbited the Moon for six days, getting as close as 80 miles (129 kilometers) above the surface.

Artemis I splashed back down to Earth on Dec. 11, 2022, after its 1.4 million-mile (2.2 million-kilometer) maiden journey. Artemis III, the first mission to return humans to the lunar surface, is scheduled for 2026. The Artemis astronauts will land at the Moon's south pole, where scientists believe there may be large deposits of subsurface water in the form of ice that astronauts could mine, melt, purify and drink. The Artemis astronauts will set up habitats on the surface of the Moon and spend several months exploring the lunar surface.

Since the Moon is a mere 240,000 miles (386,000 km) from Earth, it will act as a training ground for the future human exploration of Mars. While a Mars mission is still many years out, the Artemis program will help NASA develop the capabilities it needs to explore the red planet.

<https://indianexpress.com/article/technology/science/nasa-mars-crewed-mission-2030-9608721/>



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TIFR researchers maintain quantum entanglement over 100 metres

In a midnight milestone in quantum communications, scientists in the dark corridors of the Tata Institute of Fundamental Research (TIFR) successfully measured the preservation of entanglement between pairs of photons separated by a distance of 100 metres.

Quantum entanglement is a phenomenon that puzzled even Albert Einstein, who called it 'spooky action at a distance', seemingly allowing for information to travel faster than the speed of light. Quantum entanglement allows for two particles to be connected in such a way, that a change in state of one instantly influences the state of the other, irrespective of the distance between them.

The distance record as such does not have a significance in terms of pure physics, but can potentially improve human communications. The conventional algorithms used to secure digital communications are based on the ability to solve mathematical problems, and cracking these problems would take impractically long on conventional computers.

However, there is the potential for future quantum computers that can solve mathematical problems exponentially faster than conventional computers, making conventional cryptographic methods obsolete. This not only exposes secure and private communications over the internet, but also isolated data stored offline, secured by conventional cryptographic methods. The interception of data by malicious actors can potentially be prevented using quantum mechanics.

The benefits of quantum cryptography

For quantum communications, you need to seed in some kind of interpretation of the data beforehand, and selectively break the entanglement between particles. These quantum states are fragile, and measuring them inherently involves uncertainty. These properties prevent the duplication of quantum states, and prevents eavesdroppers.

Entanglement allows for correlated results of random measurements between pairs of entangled particles or states, irrespective of the distances between them. This feature can be exploited to transmit and receive unhackable messages, as well as messages over great distances. The researchers intend to stretch the record further, and measure the preservation of entanglement over tens and hundreds of kilometres.

<https://www.news9live.com/science/tifr-researchers-maintain-quantum-entanglement-over-100-metres-2717620>

