समाचार पत्रों से चयनित अंश
Newspapers Clippings

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

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Press Information Bureau
Government of India

Ministry of Defence

Mon, 30 Dec 2024

MoD inks Rs 1,990 crore contract with MDL for construction of Air Independent Propulsion Plug for DRDO-AIP system & its integration to enhance endurance of conventional submarines

Rs 877 crore contract signed with Naval Group, France for integration of Electronic Heavy Weight Torpedo to augment fire power capabilities of Kalvari-Class submarines

Ministry of Defence has signed two contracts, worth approx. Rs 2,867 crore, for the construction of Air Independent Propulsion (AIP) Plug for DRDO-AIP system & its integration onboard Indian Submarines, and the integration of Electronic Heavy Weight Torpedo (EHWT) onboard the Kalvari-Class submarines. Both the contracts were signed in the presence of Defence Secretary Shri Rajesh Kumar Singh in New Delhi on December 30, 2024.

The contract for construction of AIP Plug and its integration was inked with Mazagon Dock Shipbuilders Limited, Mumbai worth around Rs 1,990 crore, while the contract for integration of EHWT, being developed by DRDO, was signed with Naval Group, France at an approx. cost of Rs 877 crore.

The AIP technology is being indigenously developed by DRDO. The project pertaining to construction of AIP-Plug and its integration will enhance the endurance of conventional submarines and significantly contribute towards the 'Aatmanirbhar Bharat' initiative. It would generate employment of nearly three lakh man days. The integration of EHWT will be a collaborative effort by Indian Navy, DRDO and Naval Group, France. It would greatly augment the firepower capabilities of Kalvari Class submarines of the Indian Navy.

https://pib.gov.in/PressReleasePage.aspx?PRID=2088874

Press Information Bureau
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Ministry of Defence

Mon, 30 Dec 2024

Mastering frontier technologies is need of the hour; Military training centres readying our soldiers to deal with future challenges: Raksha Mantri at Army War College, Mhow

"Through integration & jointness, Armed Forces will be able to face challenges together in a more efficient way"

"Mastering frontier technologies in today's constantly-evolving times is the need of the hour, and the military training centres are playing a crucial role in equipping & readying our soldiers to deal with future challenges," said Raksha Mantri Shri Rajnath Singh while addressing the officers at the Army War College (AWC) in Mhow, Madhya Pradesh on December 30, 2024.

Highlighting the radical changes being witnessed in the ways of warfare, he stated that unconventional methods like information warfare, Artificial Intelligence (AI)-based warfare, proxy warfare, electro-magnetic warfare, space warfare and cyber attacks are posing a big challenge in today's times.

Raksha Mantri stressed on the need for the military to remain well-trained and equipped to deal with such challenges, lauding the training centres in Mhow for their valuable contribution in these efforts. He commended the centres for constantly improving their training curriculum, in sync with the changing times, and striving to make the personnel fighting fit for every kind of challenge.

Shri Rajnath Singh highlighted Prime Minister Shri Narendra Modi-led Government's vision of making the country *Viksit Bharat* by 2047, describing the current phase as a transition period.

"India is constantly moving on the path of development and is rapidly emerging as a manufacturing hub. From a military point of view, we are getting equipped with modern weapons. We are also exporting Made-in-India equipment to other countries. Our defence exports, which were around Rs 2,000 crores a decade ago, have crossed the record figure of Rs 21,000 crore today. We have set an export target of Rs 50,000 crore by 2029," he added.

Raksha Mantri reasserted the Government's resolve to strengthen integration and jointness among the three services, exuding confidence that, in the times to come, the Armed Forces will be able to face challenges together in a better and more efficient way. He appreciated the fact that high-level training is provided to officers of all wings in Mhow Cantonment.

He urged the officers to explore the possibility of promoting integration through training in areas such as weapons training in Infantry School; AI & Communication Technology in Military College of Telecommunication Engineering (MCTE); and Leadership - Junior and Senior Command in AWC.

Shri Rajnath Singh added that some officers will work as defence attaches in the future, and they should strive to secure national interests at the global level. "When you take up this post of Defence Attaches, you should imbibe the Government's vision of 'Aatmanirbhar Bharat'. Only through self-reliance can India strengthen its defence capabilities and gain more respect on the world stage," he added.

Raksha Mantri voiced the Government's unwavering commitment to make India one of the strongest economic and military powers in the world. "Economic prosperity is possible only when full attention is paid to security. Similarly, the security system will be robust only when the economy is strong. Both complement each other. By 2047, we will not only become a developed nation, but our Armed Forces will also be one of the most modern and strongest militaries in the world," he said.

Shri Rajnath Singh also urged the officers to internalise Dr BR Ambedkar's values of dedication and spirit. He described Baba Saheb as not just the architect of the Indian constitution, but also a visionary guide, reiterating the Government's commitment to introduce his values and ideals to the people, especially the youth.

Commending the Armed Forces for securing the borders & being the first responders during natural disasters, Raksha Mantri said: "This dedication to protect the nation and this spirit to keep ourselves updated in a constantly-changing world can take us ahead of others."

At AWC, Shri Rajnath Singh was briefed by Commandant Lt Gen HS Sahi on the role and significance of the institute towards training and empowering military leaders for warfighting across the entire spectrum of conflict. He was briefed upon the significant steps in training methodology through jointness in multi-domain operations, infusion of technology in training curriculum and exchange programmes being undertaken with academia, universities and industries alongwith training of CAPF officers.

He was also briefed on the global footprints of the institute achieved through training the officers from friendly countries and contributing immensely towards military diplomacy. Chief of the Army Staff General Upendra Dwivedi and other senior officials of the Indian Army were present on the occasion.

Earlier, Raksha Mantri laid a wreath and paid homage to the bravehearts at the Infantry Memorial. On December 29, 2024, Raksha Mantri visited AWC, MCTE, Infantry School and the Army Marksmanship Unit in Mhow. He stated that all these establishments together create a confluence of the country's golden past and a strong, prosperous & bright future. He described the Quantum

Technology Lab and AI lab operating in MCTE as a positive step towards achieving the objective of Adaptive Warfare.

THE ECONOMIC TIMES

Mon, 30 Dec 2024

Deal for jet engine technology transfer with US runs into rough weather

The deal for fighter jet engine technology transfer with the US has run into rough weather, with likely increase in cost following deep technical discussions with the selected Indian partner, Hindustan Aeronautics Limited (HAL).

Sources said negotiations are on and the deal will result in over 80% technology transfer of GE414 INS6 engines, including coating for the hot end of the engine as well as crystal blades and laser drilling technology, but the initial estimated price is likely to exceed. The revision is likely to require internal approvals from the defence ministry to adjust for the additional costs.

Officials had earlier said that the deal is valued at around $1 billion and will involve technology transfer and the setting up of a production line in India which will initially get an order for 99 engines. US manufacturer GE Aviation did not comment on queries sent by ET.

The overrun of the initially estimated price is the latest in a series of similar problems with major defence deals involving technology transfer. Before the Rafale fighter jet deal was signed in 2016, it languished for years as discussions with HAL hit a roadblock given the high cost of domestic manufacturing.

Similarly, the Scorpene submarine deal suffered from major cost and time overruns.

Discussions on a major project to develop a new fighter jet engine for fifth generation combat aircraft have languished for over eight years after discussions with France got stalled on pricing issues.

The deal with the US is important as the 99 engines will be manufactured in India and will power the Mk2 variant of the light combat aircraft. The Air Force has projected a demand for 120-130 of Tejas Mk2 fighters, which if accepted is likely to increase the size of the order beyond 99 engines.

India is also developing twin-engine deck-based fighters for the Navy that are likely to be powered by F414. The first two squadrons of the futuristic advanced multirole combat aircraft will also be powered by the same engine. HAL has already identified land in Bengaluru for the new facility and the plan is to have it up and running within two years of the signing of the contract.

THE ECONOMIC TIMES

Army chief reviews operational preparedness, interacts with troops in Dehradun: Sources

Army Chief Gen Upendra Dwivedi on Monday visited Dehradun during which he reviewed operational preparedness, interacted with troops and received "comprehensive briefings" from some of the top officers on the ongoing security initiatives and infrastructure development in the region, sources said. He also underscored the critical importance of "maintaining peak operational efficiency and adaptability" in an increasingly complex and "evolving security environment" in the Uttarakhand capital, they said.

The visit underscores the "proactive approach" taken by the Chief of the Army Staff to ensure mission readiness while boosting the morale of the troops deployed in varied and challenging terrains. He was accompanied by Lt Gen Anindya Sengupta, General Officer Commanding-in-Chief, Central Command. The Army chief "visited Dehradun where he reviewed operational preparedness and interacted with troops stationed in the region today," a defence source said.

During his visit, Gen Dwivedi "received comprehensive briefings" from Lt Gen D G Misra, General Officer Commanding, Uttar Bharat Area, and Maj Gen Naveen Mahajan, General Officer Commanding, Golden Key Division, he added.

The briefings covered the region's operational capabilities, ongoing security initiatives and infrastructure development, the source said.In addition to these briefings, Gen Dwivedi interacted with the troops and praised their professionalism, dedication and unwavering commitment to the nation.

The Army chief also highlighted the force's ongoing efforts to modernise equipment, improve training standards and foster innovation to effectively address future challenges, the sources said.He reaffirmed the leadership's "unwavering commitment" to the welfare of soldiers and their families, acknowledging their sacrifices in the service of the nation.

In a special address, Gen Dwivedi extended his heartiest wishes to all personnel ahead of the New Year.Prior to reaching Dehradun, the Army chief had accompanied Defence Minister Rajnath Singh to the premier training establishments of the Indian Army at Mhow Military Station on December 29-30.

At Mhow, the Union minister was briefed by Lt Gen H S Sahi, Commandant, Army War College on the role and significance of the institute towards training and empowering military leaders for warfighting across the entire spectrum of conflict. The minister had also addressed all the officers of Mhow Garrison and commended the selfless service and dedication of all ranks, they said.

https://economictimes.indiatimes.com/news/defence/army-chief-reviews-operational-preparedness-interacts-with-troops-in-dehradun-sources/articleshow/116804192.cms

India's defence exports crossed record Rs 21,000 crore over decade: Rajnath Singh

Defence Minister Rajnath Singh said on Monday that India's defence exports have crossed a record Rs 21,000 crore from Rs 2,000 crore a decade ago. Addressing officers at the Army War College (AWC) in more than two-centuries-old Mhow Cantonment, Singh said a target has been set to achieve defence exports of Rs 50,000 crore by 2029.

He said mastering frontier technologies is the need of the hour in the constantly evolving times, noting that military training centres are playing a crucial role in equipping and readying soldiers to deal with future challenges.

"Our defence exports, which were around Rs 2,000 crore a decade ago, have crossed the record figure of Rs 21,000 crore today. We have set an export target of Rs 50,000 crore by 2029," Singh said.

He said Made-in-India equipment is being exported to other countries.Singh mentioned radical changes in warfare in his speech, saying that unconventional methods like information warfare, Artificial Intelligence (AI)-based warfare, proxy warfare, electromagnetic warfare, space warfare, and cyber-attacks are posing a big challenge.

He stressed the need for the military to be well-trained and equipped to fight off such attacks and lauded training centres in Mhow for their valuable contributions.

Singh commended the training centres for constantly improving their training curriculum as per changing times, and striving to make the personnel fighting fit for every kind of challenge.

The defence minister said the Modi government is committed to strengthening integration and jointness among the three services.

"In the times to come, the armed forces will be able to face challenges together in a better and more efficient way," he added.

Singh said high-level training is provided to officers of all wings in the Mhow Cantonment.He appealed to officers to explore the possibility of promoting integration through training in areas such as weapons training in Infantry School; AI and communication technology in Military College of Telecommunication Engineering (MCTE), and leadership - junior and senior command in AWC.

Singh said that some officers will work as defence attaches in the future, and they should strive to secure national interests at the global level.

"When you take up this post of defence attaches, you should imbibe the government's vision of 'aatmanirbhar Bharat'. Only through self-reliance can India strengthen its defence capabilities and gain more respect on the world stage," he added.

The defence minister is on a two-day visit to MP since Sunday.He said the government is committed to making India one of the strongest economic and military powers in the world.

"Economic prosperity is possible only when full attention is paid to security. Similarly, the security system will be robust only when the economy is strong. Both complement each other," he added.

Singh hailed the role of armed forces in securing the borders and being the first responders during natural disasters.

"This dedication to protect the nation and this spirit to keep ourselves updated in a constantly changing world can take us ahead of others," he added.

At AWC, Singh was briefed by commandant Lt Gen HS Sahi on the role and significance of the institute towards training and empowering military leaders for war-fighting across the spectrum of conflict.

The defence minister was also briefed upon the significant steps in training methodology through jointness in multi-domain operations, infusion of technology in training curriculum and exchange programmes being undertaken with academia, universities and industries along with training of CAPF officers, a release stated.

He was also apprised about the global footprints of the institute achieved through training the officers from friendly countries and contributing immensely towards military diplomacy.

Chief of the Army Staff General Upendra Dwivedi and other senior officials of the Army were present on the occasion.

The defence minister laid a wreath and paid homage to brave-hearts at the Infantry Memorial.Earlier in the day, Singh and General Dwivedi offered prayers at the famous Mahakaleshwar temple in Ujjain city.

https://economictimes.indiatimes.com/news/defence/indias-defence-exports-crossed-record-rs-21000-crore-over-decade-rajnath-singh/articleshow/116801211.cms

#SWARAJYA

Mon, 30 Dec 2024

Rajnath Singh Sets Defence Export Target Of Rs 50,000 Crore By 2029, Emphasises Readiness For Non-Traditional Warfare

On Monday (30 December), Defence Minister Rajnath Singh announced that India's defence exports have experienced a significant increase, reaching a record sum of Rs 21,000 crore, a substantial leap from Rs 2,000 crore a decade prior.

Speaking to officers at the Army War College (AWC) within the over two-hundred-year-old Mhow Cantonment, Singh revealed that a goal has been established to reach defence exports worth Rs 50,000 crore by the year 2029.

He emphasised the importance of mastering cutting-edge technologies in these rapidly changing times. He further noted the vital role that military training centres are fulfilling, by preparing soldiers to face future challenges effectively.

In his address, Singh pointed out the dramatic shift in warfare tactics, highlighting that non-traditional approaches such as information warfare, warfare based on Artificial Intelligence (AI), proxy warfare, electromagnetic warfare, space warfare, and cyber-attacks are presenting significant challenges.

He emphasised the importance of having a well-prepared and well-equipped military to fend off potential attacks, praising the training centers in Mhow for their significant contributions. He also stated that equipment manufactured in India is now being shipped to various other countries.

The Defence Minister stated that the Modi administration is dedicated to enhancing unity and collaboration among the three military branches. "In the times to come, the armed forces will be able to face challenges together in a better and more efficient way," he added.

He urged officials to consider the potential of fostering unity by providing training in various areas. These include weapons training at the Infantry School, AI and communication technology at the Military College of Telecommunication Engineering (MCTE), and leadership at both junior and senior command levels in AWC.

https://swarajyamag.com/news-brief/rajnath-singh-sets-defence-export-target-of-rs-50000-crore-by-2029-emphasises-readiness-for-non-traditional-warfare

THE ECONOMIC TIMES

Mon, 30 Dec 2024

INS Tushil Commanding Officer meets Moroccan military leadership to discuss bilateral cooperation

The Commanding Officer of the Indian Navy warship INS Tushil, Captain Peter Varghese, met Brigadier General Ahmed Kartouf, Commander of Weapons of the Casablanca Area, and senior Moroccan military leadership to discuss issues of mutual interest between India and Morocco during INS Tushil's port call at Casablanca, Morocco.

The Indian Navy's spokesperson shared details of the meeting in a post on X: "#INSTushil in Casablanca Capt Peter Varghese, the Commanding Officer, called on Brigadier General Ahmed Kartouf, Commander of Weapons of Casablanca Area & senior Moroccan Military leadership & other key appointments of #RoyalMoroccanNavy.

"The post also noted that issues of mutual interest and avenues for further enhancing operational cooperation between the two navies were discussed. Additionally, the ship's crew participated in yoga and held a friendly volleyball match with the host navy.

The Indian warship INS Tushil, on its maiden operational deployment, made a port call at Casablanca, Morocco, on December 27.

The visit marked an important step in strengthening maritime and diplomatic ties between India and Morocco, the Ministry of Defence stated.

According to the MoD, the visit aims to explore further avenues for collaboration between the two navies. Over the past 12 months, three Indian Navy ships--Tabar, Tarkash, and Sumedha--have visited Casablanca, significantly enhancing mutual trust and interoperability.

INS Tushil was commissioned on December 9, 2024, in Russia and is commanded by Captain Peter Varghese, supported by a dedicated team of 250 personnel. As the frigate continues its journey to its home port in Karwar, it will participate in collaborative exercises with friendly foreign navies, further promoting India's maritime diplomacy in the region, the Ministry noted.

The visit by INS Tushil underlines efforts to further strengthen India-Morocco ties. Morocco, a maritime nation, holds a unique geographical position with coastlines along both the Mediterranean Sea and the Atlantic Ocean, similar to India's strategic maritime positioning.

https://economictimes.indiatimes.com/news/defence/ins-tushil-commanding-officer-meets-moroccan-military-leadership-to-discuss-bilateral-cooperation/articleshow/116788190.cms

THE ECONOMIC TIMES

Mon, 30 Dec 2024

India to add two frontline warships and a submarine to blue-water fleet in 2025

In a significant boost to its maritime defence capabilities, the Indian Navy will commission three major platforms next month: the guided-missile destroyer INS Surat, the stealth frigate INS Nilgiri, and the diesel-electric submarine INS Vagsheer, as reported by TOI. This marks a strategic move to counterbalance China's increasing naval presence in the Indian Ocean Region (IOR), a vital area for India's economic and security interests.

The additions are part of a larger modernisation push, with 60 warships currently under construction in Indian shipyards. These include indigenous projects and international collaborations, reflecting India's focus on bolstering domestic defence production while addressing immediate operational requirements.

INS Surat: AI-Enabled and Combat-Ready

The INS Surat, built under Project 15B by Mazagon Dock Shipbuilders Ltd (MDL), is a 7,400-tonne guided-missile destroyer designed to deliver a formidable punch. Armed with BrahMos supersonic cruise missiles, Barak-8 surface-to-air missiles, and advanced anti-submarine weapons like torpedoes and rocket launchers, INS Surat is the Navy's first AI-enabled warship.

"Surat is also the Navy's first AI-enabled warship to enhance its operational efficiency manifold times," an officer told TOI. With a range of 4,000 nautical miles and an indigenous content of 72%, the destroyer exemplifies India's commitment to building technologically advanced and self-reliant defence systems.

INS Nilgiri: Stealth at the Forefront

INS Nilgiri, the first ship of the Project 17A class of stealth frigates, showcases advanced design elements like radar-transparent fittings and hull shaping to evade enemy detection. Constructed at MDL, this 6,670-tonne vessel is equipped with cutting-edge weapons and sensors to address threats from enemy submarines, ships, and aircraft. The frigate, designed to operate independently or as part of a naval task force, reflects India's growing emphasis on flexibility and survivability in maritime operations. "INS Nilgiri is mounted with guns for close-in defence capability and effective naval gunfire," MDL stated as reported by TOI.

INS Vagsheer: Closing Underwater Combat Gaps

INS Vagsheer is the final Kalvari-class submarine under Project-75, built in collaboration with French naval defence companies. With advanced stealth capabilities, the 1,600-tonne diesel-electric submarine can operate in all theatres of warfare. The addition of INS Vagsheer will help address a pressing gap in India's underwater combat capabilities, as the submarine fleet has reduced from 21 in the 1980s to 16 today. Designed to function in diverse roles, it represents a critical step in boosting the Navy's overall strength beneath the surface.

Broader Naval Strategy and Challenges

India's modernisation efforts include building 60 ships across Indian shipyards, with future plans to induct 31 more warships, including next-generation frigates, corvettes, and stealth submarines. Among the vessels under construction is INS Tushil, a Russian-built frigate expected to arrive in India after traversing multiple seas. Another Russian frigate, Tamal, is slated for delivery next year.

Despite these developments, challenges remain. The Indian Navy, with its current strength of over 130 ships, aims to reach a fleet size of 155-160 vessels by 2030. However, this growth is hindered by the slow pace of domestic shipbuilding and the progressive decommissioning of ageing ships.

China's Expanding Naval Presence

India's efforts come against the backdrop of China's rapidly growing naval capabilities. With the world's largest navy comprising over 370 ships and submarines, China has increased its forays into the IOR and is actively seeking overseas bases. This expansion poses a strategic challenge to India, which relies on the IOR for its maritime and economic security.

https://economictimes.indiatimes.com/news/defence/india-to-add-two-frontline-warships-and-a-submarine-to-blue-water-fleet-in-2025/articleshow/116788932.cms

लेख:नए साल में भारत के लिए रक्षा सुधार क्यों है जरूरी?

भारत के सुरक्षा तकाजों के लिहाज से देखा जाए तो यह साल उथल-पुथल भरा रहा। चीन के साथ रिश्तों में तनाव कम हुआ, जम्मू-कश्मीर में हिंसक घटनाएं बढ़ीं और यूक्रेन-रूस व इस्राइल-हमास-हिजबुल्लाह युद्धों के कुछ ऐसे नए पहलू उभरे, जो भारत के लिए खास अहमियत रखते हैं।

LAC पर तनाव घटा

सीमा विवाद पर भारत और चीन के बीच सहमति बनने के बाद दोनों पक्षों में समझौते हुए। खासकर अक्टूबर 2024 में हुआ समझौता सबसे महत्वपूर्ण है, जिसमें डेमचोक और देपसांग में आपसी गश्त और पशुओं के चरने के अधिकारों की बहाली शामिल रही। दोनों देशों के विशेष प्रतिनिधियों (SR) के बीच मुलाकात हुई, जो पिछले पांच साल में हुई पहली मुलाकात है। हालांकि इस बैठक के बाद जारी किए गए रीडआउट एक-दूसरे से अलग हैं, जो इस बात का सबूत हैं कि दोनों मुल्कों के बीच खाई अभी पूरी तरह पाटी नहीं जा सकी है।

नजरिये का फर्क

चीन के अपने स्टैंड से पीछे हटने के बावजूद ढांचागत समस्याएं संबंधों को सामान्य बनाने में आड़े आ रही हैं। इनमें हिंद प्रशांत क्षेत्र पर दोनों देशों के नजरिये का फर्क भी शामिल है। पेइचिंग इस क्षेत्र को अपने वर्चस्व के नजरिये से देखता है, जबकि नई दिल्ली का झुकाव यहां बहुध्रुवीयता बनाए रखने की ओर है। यदि भारत चाहता है कि इस क्षेत्र में चीन का मौजूदा अपेक्षाकृत लचीला रुख कायम रहे, तो उसे चीन पर दबाव बनाए रखना होगा।

कश्मीर में हिंसा

दूसरी ओर, जम्मू और कश्मीर में आतंकवादी हिंसा में वृद्धि देखी गई। वह भी ठीक उसी समय जब भारत और चीन के बीच तनाव कम हो रहा था। यह कोई संयोग नहीं है। साफ है कि चीन और पाकिस्तान अपने साझा दुश्मन – भारत के खिलाफ आपसी तालमेल बनाकर चल रहे हैं। आतंकवादी कार्रवाइयों में पाकिस्तानी सेना द्वारा प्रशिक्षित विशेष अभियान बलों के हमले भी शामिल हैं, जो भारतीय सेना की गश्ती इकाइयों को निशाना बनाकर अंजाम दिए गए थे। कुछ हमलों का टारगेट जम्मू में इन्फ्रास्ट्रक्चर प्रॉजेक्ट पर काम कर रहे गैर-कश्मीरी नागरिक थे।

राहत के आसार नहीं

रत के लिए मुश्किल यह है कि उसे इन दोनों ही मोर्चों पर कोई बड़ी राहत मिलने के आसार लंबे समय तक नहीं दिख रहे। यदि एक मोर्चे पर तनाव किसी वजह से कम होता है तो लगभग तय माना जा सकता है कि दूसरे मोर्चे पर अस्थिरता और तनाव में बढ़ोतरी हो जाएगी। यह स्थिति भारत को सतर्कता बनाए रखने को मजबूर करती है और बताती है कि उसे दो सक्रिय सैन्य मोर्चों पर लगातार डटे रहना है भले ही वहां तनाव समय-समय पर कम-ज्यादा होता हे।

सही मौके का इंतजार

इनसे अलग एक बड़ा सवाल यह है कि क्या भारत के लिए इस्राइल और ईरान व उसके प्रॉक्सी के बीच चल रहे युद्ध में भी कोई बड़ा सबक है? ईरान के सबसे दमदार क्षेत्रीय प्रॉक्सी हिजबुल्लाह के नेतृत्व का सफाया करके और बड़ी संख्या में उसके लड़ाकों को जख्मी करके इस्राइल ने दिखा दिया है कि उसे क्यों अजेय शक्ति माना जाता है।

उसकी इस कामयाबी के पीछे साम, दाम, दंड, भेद– हर तरह के तरीके इस्तेमाल करके दुश्मन को ठिकाने लगाने की उसकी क्षमता है। उसकी तैयारी किस हद तक होती है, इसका अंदाजा इस बात से लगता है कि उसकी खुफिया एजेंसी ने मौजूदा युद्ध में एक दशक पहले मिले उस मौके का इस्तेमाल किया जब सीरियाई गृहयुद्ध के दौरान बशर अल–असद के शासन की रक्षा करने के लिए लड़ाके भेजते हुए हिजबुल्लाह ने अपने कमांड, कंट्रोल और कम्युनिकेशन (C3) को उजागर होने दिया था। जाहिर है, मामला सिर्फ छल छद्मों के चालाकी भरे इस्तेमाल का नहीं, धैर्यपूर्वक सही मौके का इंतजार करने का भी है।

जमा लिया सिक्का

इन सबका मिला–जुला नतीजा है कि इस्राइल मजबूत होकर उभरा और हिजबुल्लाह पर अपनी श्रेष्ठता स्थापित करते हुए इस क्षेत्र में ईरान का दबदबा कमजोर करने में सफल रहा है। हालांकि इसके बावजूद अभी तक इस युद्ध में उसकी जीत नहीं हुई है, लेकिन फिर भी उसने अपना सिक्का जरूर जमा लिया है जो कुछ महीने पहले तक सोचना भी मुश्किल था।

संसाधनों के बेहतरीन इस्तेमाल

रूस–यूक्रेन युद्ध में भी यह देखने लायक है कि कैसे दोनों ही पक्ष अपने हालात और संसाधनों का अपने पक्ष में बेहतरीन इस्तेमाल कर रहे हैं। रूसियों ने अपने C3 की गोपनीयता बनाए रखना और रसद भंडार तथा आपूर्ति को एक जगह इकट्ठा करने से बचते हुए इन्हें निगाहों में आने से रोकना सीखा है तो यूक्रेन ने कम क्षमता के बावजूद यह दिखा दिया है कि छोटी–छोटी यूनिट एक्शन के जरिए भी वह युद्ध में प्रभावी साबित हो सकता है। यह अलग बात है कि इन सबके बावजूद संसाधन और क्षमता में अंतर की बदौलत रूस भारी पड़ रहा है।

रक्षा सुधारों पर हो जोर

कुल मिलाकर स्थिति यह है कि 2025 में प्रवेश करते हुए रूस और इस्राइल पहले के मुकाबले ज्यादा मजबूत दिख रहे हैं। भारत के लिए इसमें सबक है कि अंतरराष्ट्रीय राजनीति में अपना दखल रखने की अनिवार्य शर्त है सैन्य क्षमता। और इसलिए, महत्वपूर्ण रक्षा सुधारों को ज्यादा जोश के साथ आगे बढ़ाना होगा। इसका कोई विकल्प नहीं है।

2024 में क्या हुआ?

– डॉनल्ड ट्रंप की जीत से बदले समीकरण

– इस्राइल और रूस का बढ़ गया मनोबल

– असद के पतन से ईरान पड़ा कमजोर

– भारत और चीन के बीच कम हुए मतभेद

– बांग्लादेश–पाक की बढ़ती करीबी से चिंता

2025 में क्या हैं चुनौतियां?

– बांग्लादेश सीमा पर बढ़ानी होगी सतर्कता

– कश्मीर में तेज हो सकती हैं आतंकी हिंसा

– चीन के बदलते पैंतरों पर रखनी होगी नजर

– अमेरिका शुरू कर सकता है टैरिफ वॉर

– कहां ले जाती है रूस, इस्राइल की 'जीत'

The Tribune

Mon, 30 Dec 2024

Three projects to integrate armed forces' surveillance

The Ministry of Defence is working on three separate projects to integrate inputs from dedicated surveillance radars and sensors to provide specific real-time inputs for offensive and defensive operations by the Indian Air Force (IAF), Army and the Navy. In case of the IAF, all the national air surveillance radars would be integrated to achieve a 'composite picture' of the air space, said the MoD in a statement on Thursday. This will be done at the Integrated Air Command and Control System (IACCS), operated by the IAF.

The IACCS is a platform for collation of inputs and is designed as an automated command and control system for air operations and disseminates real time information to pilots in the air and commanders on ground. A secure optic fibre of the Air Force Network (AFNet) connects multiple country-wide nodes of the IACCS.

In case of the Indian Army, the integration of sensors and radars for air defence is planned through project 'Akashteer', said the Ministry of Defence. Air-defence weapons include missiles of short and medium range and sophisticated missiles that can hit multiple targets. These can bring down enemy's fired missiles, jets as well as unmanned aerial vehicles (UAV)/drones.

Project Akashteer aims to automate air defence command and firing processes. Developed by Bharat Electronics Limited (BEL), it will improve operational efficiency and integrate the Army's air defence mechanisms for situational awareness for the commander on ground.

Sources said the Akashteer will also provide feed to IACCS under pre-designated protocols to ensure a seamless master network. For maritime security, all sensors based on Indian Naval warships will be connected under the project named 'Trigun'. The first such integration is under progress. Also all naval sensors located on mainland and island territories are being integrated directly to enhance surveillance in island territories.

Last year, the IAF's IACCS achieved integration of all operational radars – its own, Army's and civilian — to bring about a system that entails automated firing response to shoot down incoming enemy missiles, jets and UAVs.

From Nuclear Submarines To Tejas Jet: Top Indian Defence Milestones In 2024

In 2024, India witnessed some of the most path-breaking achievements, ranging from border disengagement with China along the Line of Actual Control to the first test flight of the new variant Light Combat Aircraft (LCA) Tejas Mk1A to the testing of a hypersonic missile. The country's defence and security apparatus evolved in the land, sea, air, and space sectors.

Here are the top milestones in India's defence and security apparatus

Border Disengagement With China

In October, the Centre announced that India and China had agreed upon the "last phase of disengagement" regarding patrolling arrangements in the Depsang and Demchok regions. The former is in northern Ladakh, while the latter is in the east. The areas, along with others like the Pangong Tso, Galwan Valley, and Gogra Hotsprings have been points of contention over varying perceptions of the boundary line.

In 2020, the troops of the nuclear-armed countries clashed in the Galwan Valley in which 20 Indian soldiers and an officer were killed in action. The troops disengaged from most of the regions but Depsang and Demchok remained contentious.

External Affairs Minister S Jaishankar confirmed the big announcement of disengagement at the NDTV World Summit that day and said "We reached an agreement on patrolling, and we have gone back to the 2020 position. With that, we can say the disengagement with China has been completed... There are areas which, for various reasons after 2020, they blocked us, we blocked

them. We have now reached an understanding which will allow patrolling as we had been doing till 2020."

A month later in November, the Indian Army today "successfully completed" patrolling to one of the patrol points in the Depsang region of Ladakh following the consensus.

Mission Divyastra

In March, India successfully conducted the first flight test of Multiple Independently Targetable Re-entry Vehicles (MIRV) with the Agni-5 Intercontinental Ballistic Missile. The Defence Research and Development Organisation (DRDO) conducted a successful test of the MIRV technology which was in development for several years, putting India on an elite list of nations that have the capability.
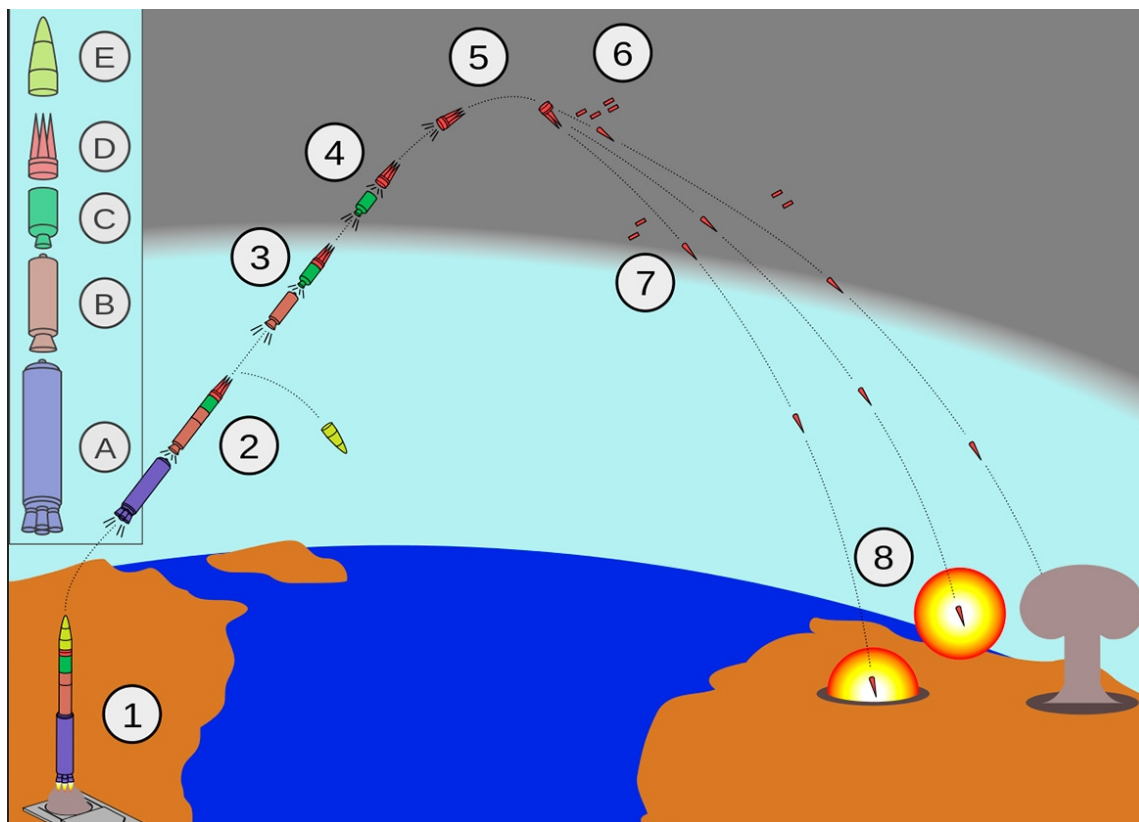
Scientists at DRDO have been working on Multiple Independently Targetable Re-entry Vehicles (MIRV) technologies for many years. The technology allows a single missile like the Agni-5 to carry multiple warheads and independently target locations. The system developed by DRDO is equipped with indigenous Avionics systems and high-accuracy sensor packages, which ensure that the re-entry vehicles reach the target points within the desired accuracy.

Agni-5 is an Intercontinental Ballistic Missile (ICBM) that goes into space before re-entering the atmosphere.

'Project Zorawar' - India's Response To China In Ladakh

In July, the Defence Research and Development Organisation (DRDO) and Larsen & Toubro (L&T) developed a light tank in a record two years, catering to the Army's need for a high-altitude light tank to counter China's ZQ-15 in Ladakh.

The tank was put to an advanced stage of trials and will be inducted soon. The light tank Zorawar weighs 25 tonnes. It is the first time, a fresh tank has been designed and made ready for trials in such a short time.

Around 59 of these tanks will be provided to the Army initially and it will be a front runner for the major programme of 295 more of these armoured vehicles.

Tejas MK1A Was Airborne

On March 28, Group Captain K K Venugopal (retired), a Chief Test Pilot with Hindustan Aeronautics Limited, took the first aircraft of the Tejas MK1A series, to the skies, staying airborne

for 18 minutes. It was a huge milestone in India's LCA project which seeks to replace the existing fleet of MiGs and other old aircraft in the Indian Air Force.

"The Tejas Mk1A will have an advanced electronic RADAR, warfare and communication systems, additional combat capability and improved maintenance features," the HAL said.

The Indian Air Force has ordered 83 Tejas Mk1A variants in a Rs 36,468 crore deal with Hindustan Aeronautics Limited. In November last year, the Defence Acquisition Council cleared the project to acquire 97 more Tejas jets for the Indian Air Force.

Commissioning of INS Arighaat

On August 29, India commissioned INS Arighaat, the second of the Arihant-class nuclear-powered ballistic missile submarine, into service.

The submarine will strengthen India's nuclear triad, enhance nuclear deterrence, help in establishing strategic balance and peace in the region, and play a decisive role in the security of the country.

The country's nuclear submarine has the distinction of having indigenous systems and equipment which were conceptualised, designed, manufactured and integrated by Indian scientists, industry and naval personnel, the defence ministry said.

Nuclear Missile Test Firing

A few months later after the commissioning of INS Arighaat, India test-fired a nuclear submarine-launched ballistic missile with a range of 3,500 km. The K-4 missile was launched in November and will provide India with a second-strike capability.

It underpinned India's nuclear triad capability, putting it in a small group of countries that can fire a nuclear missile from land, air and undersea.

According to reports, it was the first test of the submarine-launched ballistic missile (SLBM) from a submarine.

Hypersonic Missile Test

In November, India successfully test-fired a long-range hypersonic missile from the APJ Abdul Kalam Island off the coast of Odisha.

Defence Minister Rajnath Singh described the test-firing of the missile as a historic moment as it put India in the group of select nations having the capabilities to develop such critical technologies.

He congratulated the Defence Research and Development Organisation (DRDO), the armed forces and the industry for what he described as a "stupendous" achievement.

Commissioning Of Navy's New Choppers

In March, a squadron of MH-60 Romeo helicopters was commissioned at INS Garuda, a naval air station and also the "cradle of naval aviation" in Kochi. The Indian Naval Air Squadron (INAS)

334 is the latest air squadron of the Navy and home for MH-60R, the submarine hunters. Captain M Abhisheik Ram will be the commanding officer of the INAS 334 squadron.

MH-60R, manufactured by Lockheed Martin and Sikorsky, is the naval variant of the US Blackhawk helicopter, is one of the most potent anti-submarine choppers currently operational in the world and is considered a game changer due to its anti-submarine/surface capabilities and command, and control capabilities.

India ordered 24 MH-60Rs in a $905 million government-to-government deal with the US. Two choppers were formally handed over to the Indian Navy by its US counterpart in 2021.

C295 Aircraft Manufacturing Facility

Prime Minister Modi and his Spanish President Pedro Sanchez jointly inaugurated the TATA Aircraft Complex for manufacturing C-295 transport aircraft at TATA Advanced Systems Limited Campus in Gujarat's Vadodara in October 2024.

The C-295 is a transport aircraft of 5-10 tonne capacity with contemporary technology that will replace the Indian Air Force's ageing Avro-748 planes.

In September 2021, India signed a Rs 21,935-crore contract with Airbus Defence and Space SA, Spain for the supply of 56 aircraft - 16 to be brought in fly-away condition from Spain and 40 to be built in India by TASL. Of the 16 aircraft, six have already been inducted into IAF at 11 Sqn based at Vadodara.

The last would be delivered by August 2025. The first Made-in-India C-295 is expected to be rolled out of the Final Assembly Line facility at Vadodara by September 2026 and the remaining by August 2031.

Test Firing Of Rudram-II

In May, India successfully test-fired an air-surface anti-radiation missile from a Su-30MKI fighter jet. The Rudram-II anti-radiation supersonic missile is developed by the Defence Research and Development Organisation (DRDO).

The Rudram-II is the latest version after the mark-1 version was tested four years ago by Su-30MKI, the backbone of India's fighter fleet.

The flight test met all the trial objectives, validating the propulsion system and control & guidance algorithm. Rudram missile is the first indigenously developed anti-radiation missile designed to target enemy ground radars (surveillance, tracking) and communication stations in Suppression of Enemy Air Defence (SEAD) missions.

Rudram-II is one of the finest and is meant to neutralise many types of enemy assets. India currently operates the Russian Kh-31, an anti-radiation missile. The Rudram missiles will replace the Kh-31s.

https://www.ndtv.com/india-news/defence-year-ender-2024-from-nuclear-submarines-to-tejas-jet-top-indian-defence-milestones-in-2024-7366676

FINANCIAL EXPRESS
Read to Lead

Tue, 31 Dec 2024

Drone hijacking threats and India's national security: The case for indigenous technology

As global conflicts, such as the Russia-Ukraine war, the Israeli-Hamas conflict, and Houthi attacks, become increasingly electronic-centric, drones have emerged as a key tool in modern warfare. These conflicts have shown how adversaries gain tactical advantages by disrupting or accessing control systems of drones, exploiting vulnerabilities in their software and communication protocols. This trend has raised significant concerns about the security of drones in India,

especially as many military and civilian drones rely on components from Chinese manufacturers, making them susceptible to hijacking.

In conversation with FinancialExpress.com, Sai Pattabiram, Founder & MD of Zuppa Geo Navigations Pvt Ltd, stresses the growing national security risks posed by the widespread use of Chinese-made drone components. "All recent conflicts, be it Russia-Ukraine or Israeli-Hamas or the Houthi's, have turned out to be Electronic Centric wars, where the focus has been to gain a strategic advantage both tactically by interfering or accessing the control and communication systems of the adversaries' equipment by exploiting vulnerabilities in the software/code layers of the equipment's Cyber Physical Stack (CPS)."

The Cyber Physical System: Understanding Drones as Critical Infrastructure

Drones are categorized as Cyber Physical Systems (CPS), which use electronic computational power to monitor and control physical devices. The core of a drone's operation relies on a continuous feedback loop, driven by real-time sensory inputs. This makes them vulnerable to external interference, especially when using off-the-shelf (COTS) components. The growing reliance on commercial drones, which often use Chinese autopilots and software, has raised alarms over the security of these systems.

"The primary reason for the hijacking of Indian-assembled drones that have been supplied for performing national security-critical roles has been because of the use of Chinese autopilots employing the open-source CPS as shown above. Its survivability is very poor, as all its code elements are easily available and can be downloaded from GitHub by any hacker," Pattabiram explains.
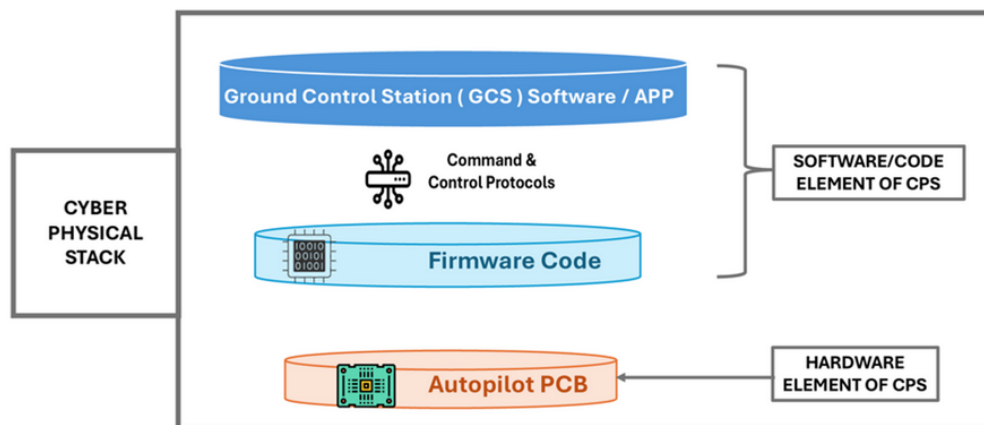
This vulnerability can be exploited by malware residing in the firmware or through other layers such as the command control protocols. In fact, the critical software layer of the Cyber Physical Stack (CPS) is the most vulnerable component, as it governs the drone's operations—replacing the human pilot's brain, in the case of manned aircraft. The security of this software, therefore, is paramount.

Given the rise in drone hijacking incidents, there is an urgent need for a shift towards indigenous, non-Chinese drone components. India must take steps to replace these foreign-made elements with more secure, homegrown alternatives to protect national security.

Open Source Cyber Physical Stack — Open Elements of Ardu Pilot/Firmware + MavLink + Q GCS

Layers Of Penetration
- Code Layer 1: Ground Control Station (GCS)
- CODE Layer 2: Command & Control Protocol
- CODE Layer 3: Firmware

Proprietary Cyber Physical Stack — 3 Proprietary Code Elements
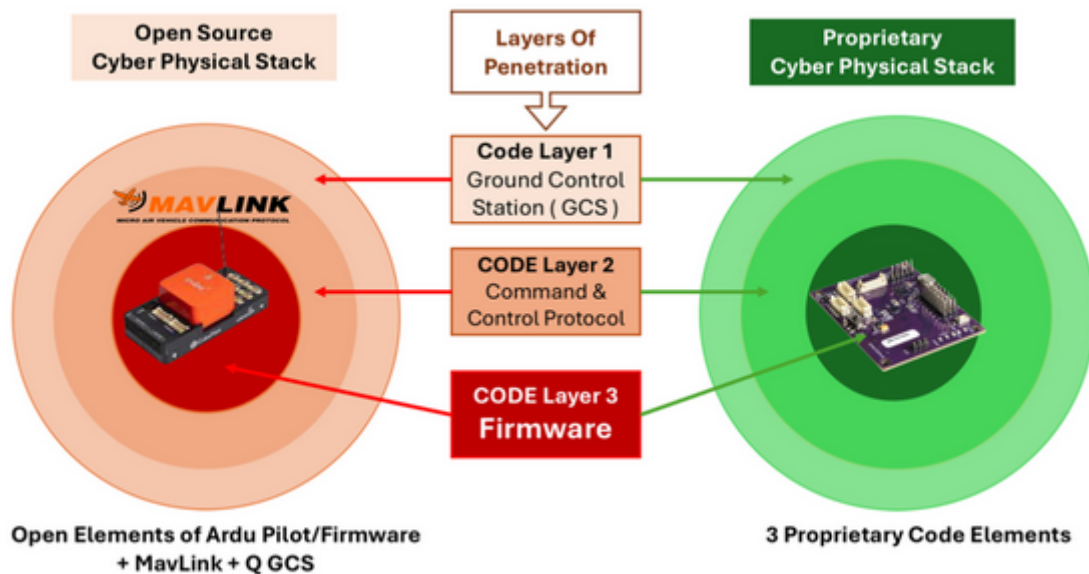
The Need for Indigenous Drone Technology

The widespread use of Chinese components in both civilian and defence drones has been a major concern. Pattabiram highlights the need for a shift toward non-Chinese and indigenous drone components. "The rampant use of COTS civilian drones in the recent wars also necessitates that both civilian and defence drones require to have similar levels of cyber security certification being a dual-use technology that can be used for Civilian, Defence as well as by non-state actors," he says.

This shift to indigenous technology is not only critical for enhancing security but also necessary to ensure the development of a self-reliant drone manufacturing ecosystem in India.

Zuppa's Position in the Global Drone Market

When comparing Zuppa drones to those of Israeli and Turkish manufacturers, Pattabiram notes that while Zuppa is competitive from a technological perspective, policy barriers hinder India's ability to scale and compete internationally.

"In terms of technology, Zuppa is contemporary to global players while additionally enjoying the benefit of being competitive on price terms with the Chinese. Zuppa is the only Indian company manufacturing micro drones similar to the popular DJI drones," he explains.

"Zuppa is the only Indian company developing and manufacturing proprietary autopilots among other global players like Micropilot (Canada), UAV Navigation and Embition (Spain), Microkopter (Germany), DJI and JIYI (China)," Pattabiram adds, stressing that from a technological standpoint, India has the capability to develop drones on par with global leaders.

Policy Challenges and the Road Ahead

However, despite these technological advancements, policy challenges remain a significant barrier. Pattabiram points out that India's drone industry is hindered by outdated policies and ineffective

regulation. For instance, the implementation of the Civilian Drone Rules of 2021 by the Directorate General of Civil Aviation (DGCA) has been slow and inefficient.

"The implementation of the Civilian Drone rules of July 2021 by DGCA is practically non-existent on the ground. In fact, DGCA's costly, time-consuming, ineffective, and un-implemented Type Certification (TC) process favours the import of Chinese components in favour of Indian alternatives," he laments. The Type Certification process for drones can take 12 to 18 months and costs anywhere between Rs 15-35 lakhs, with any component changes requiring a complete redo of the certification. This lengthy process often forces manufacturers to continue using Chinese components, especially in large government initiatives designed to boost India's drone industry, such as the "Namo Drone Didi" and "Svamitva" schemes.

India's Path to Becoming a Global Drone Hub

Despite these policy shortcomings, Pattabiram remains optimistic about India's potential to become a global drone hub by 2030. He believes that India's reputation as a trusted technology partner and the global trust deficit concerning China offer a unique opportunity for India to lead the drone industry.

"For India to evolve into a global drone hub, it must create a strategic framework that maps key essentials such as technology, human resources, manufacturing infrastructure, quality certification, cybersecurity, and domestic consumption. The government needs to identify and support companies with complementary capabilities to create a cluster or ecosystem that can scale globally," Pattabiram asserts.

https://www.financialexpress.com/business/defence-drone-hijacking-threats-and-indias-national-security-the-case-for-indigenous-technology-3703956/

FINANCIAL EXPRESS
Read to Lead

Mon, 30 Dec 2024

How the Indian Army is using AI to boost national security and defence capabilities

Artificial intelligence (AI) is increasingly recognized as a critical force in enhancing national security. It equips defence forces, intelligence agencies, and law enforcement with advanced tools to address evolving and complex threats. By harnessing technologies such as Generative AI, Open-Source Intelligence (OSINT), and Big Data, AI provides real-time insights and predictive capabilities that significantly improve decision-making, threat detection, and response times.

"Artificial Intelligence is revolutionizing national security by empowering defence forces, intelligence agencies, and law enforcement with cutting-edge tools and systems. By harnessing Generative AI, OSINT, and Big Data, these agencies can address complex threats with precision, agility, and efficiency. AI delivers 360° situational awareness, predicts threats, automates

surveillance, and defends against evolving cyberattacks. It accelerates decision-making, enhances counter-terrorism efforts, and strengthens border security while reducing human error and response times. For India, AI is not just a technological advancement but a strategic pathway to global leadership, ensuring resilience and dominance in an era of dynamic global challenges," explains Tarun Wig, Co-founder & CEO of Innefu Labs, to FinancialExpress.com in an exclusive interaction.

By enabling precise intelligence gathering, improving cyber defence, and automating surveillance, AI ensures that national security efforts are more agile and effective, allowing agencies to stay ahead of emerging threats.

Leveraging AI for Integrated Theatre Commands: Revolutionizing Military Strategy

AI is transforming India's Integrated Theatre Commands (ITCs) into powerful, data-driven hubs that bridge operational silos across land, air, and maritime domains. This integration enhances the coordination, decision-making, and real-time responsiveness of military commanders, equipping them with advanced predictive analytics and situational awareness tools.

"Artificial Intelligence is transforming India's Integrated Theatre Commands (ITCs) into agile, data-driven hubs of military strategy. By bridging operational silos across land, air and maritime domains, AI enables seamless coordination and real-time decision-making. With advanced predictive analytics, threat forecasting, and situational awareness, commanders can anticipate risks, optimize resources, and respond proactively to evolving threats. AI automates the analysis of diverse data formats, from drone feeds to text and videos, delivering actionable intelligence and reducing response times. This integration of AI not only enhances operational efficiency but also establishes India's strategic superiority, ensuring resilience and dominance in the complex landscape of modern multi-domain warfare," according to Wig. explains.

"AI is not just a tool but a force multiplier, enabling Integrated Theatre Commands to operate as a cohesive, agile unit. The future of defence lies in leveraging AI to redefine strategy and ensure precision in action," he adds.

AI as a Force Multiplier: Maximizing Military Efficiency and Effectiveness

In his view AI serves as a "force multiplier" for military operations, optimizing resource use, enhancing decision-making, and boosting efficiency.

"Artificial Intelligence is the ultimate force multiplier, enabling our armed forces to achieve more with fewer resources while enhancing operational efficiency and soldier safety. By automating routine tasks and offloading low-value work, AI allows military personnel to concentrate on critical priorities, reducing workload and increasing effectiveness. Its ability to analyze vast data sets and deliver actionable insights in real-time empowers commanders to make faster, more accurate decisions. From improving combat lethality to optimizing resource allocation, AI is revolutionizing military efficiency, ensuring our forces are always a step ahead in safeguarding national security."

By facilitating more informed, real-time decisions and improving combat readiness, AI strengthens the military's capacity to act swiftly and with greater accuracy.

Harnessing AI to Resolve India's Judicial Challenges: A Technological Solution

"Artificial Intelligence is poised to transform India's judicial system by addressing inefficiencies and accelerating justice delivery. With secure, on-premise AI solutions, courts can process and analyze vast volumes of data with precision, enabling streamlined workflows and faster case resolutions. Advanced tools like speech-to-text, multilingual OCR, and sophisticated text and image processing simplify legal research, summarize case files, and accurately translate complex legal documents. By automating routine tasks and delivering actionable insights, AI allows legal professionals to dedicate more time to critical judgments and decisions. This technological leap not only enhances efficiency and transparency but also moves India closer to achieving a more accessible, inclusive, and equitable justice system," he adds.

India's Leadership in AI Adoption: A Vision for the Future

"India's remarkable leadership in AI adoption, as highlighted by the recent BCG report, reflects the nation's strong commitment to leveraging technology for transformation. With 30% adoption, surpassing the global average of 26%, India is uniquely positioned thanks to its skilled workforce, robust government initiatives like 'National Strategy for AI' and 'AI for All,' and a dynamic startup ecosystem. The widespread integration of generative AI—used weekly by 83% of Indian employees—underscores how innovation is becoming deeply rooted in our professional culture. This confluence of support, talent, and vision not only enhances India's AI capabilities but also reinforces its role as a global hub for technological advancement," Wig observes.

India's commitment to AI adoption, along with its strategic focus on creating an innovation-driven ecosystem, ensures that the nation remains at the forefront of technological development and global AI leadership.

https://www.financialexpress.com/business/defence-ais-role-in-national-security-enhancing-defence-and-intelligence-capabilities-3703077/

Mon, 30 Dec 2024

After Ukraine, Russia's "Next Target" Is Full Control Of Baltic Sea; May Target NATO's Easter Flank, Report Claims

In the wake of Russia's full-scale invasion of Ukraine, Helsinki is reportedly worried that Moscow may target NATO's eastern flank, particularly Finland and its neighboring countries. Finnish newspaper Iltalehti, citing an alleged government defense report, revealed that unnamed NATO sources have warned of Moscow's intentions to launch attacks on Finland, the Baltic states, and potentially other nearby nations. However, no specific timeline for such an action has been outlined.

The report referenced past military exercises, such as Russia's 2017 Zapad exercise, during which Moscow simulated attacks on Norway, Finland, and the Baltic nations. Iltalehti suggested that Russia had not abandoned its invasion plans and might pursue them once the conflict in Ukraine concludes.

The newspaper also mentioned NATO sources suggesting that Russia could plan a coordinated attack on various parts of the alliance's eastern flank. This could include Russia's 14th Army Corps advancing from Murmansk toward the Norwegian coast by sea, land, and air.

Additionally, Russia might deploy troops to Lapland (the northernmost region of Finland) to capture Ivalo Airport, with missile forces stationed on the Kola Peninsula potentially targeting Finland. The Finnish report also detailed a potential Russian strategy to establish a buffer zone in Northern Lapland and Norway's Finnmark.

It was further indicated that Russian missile forces could target Finland's southern and southeastern coastlines. At the same time, Moscow's 6th Army might attempt to break through Estonia and Latvia by assaulting their capitals. Lithuania could also be at risk, as Russia may attempt to use Belarus as a route to establish a land corridor linking the Russian exclave of Kaliningrad to Belarus, potentially seizing the Suwalki Corridor, a region critical to NATO's defense strategy.

The report also pointed to Russia's military presence in Kaliningrad and its Baltic Fleet, which could target Sweden's Gotland island in an effort to disrupt NATO's operations in the Baltics. According to the Finnish government report, Russia's security strategy is driven by a desire to create a "buffer zone" spanning from the Arctic to the Mediterranean, encompassing the Baltic Sea and the Black Sea.

Micael Bydén, the former head of Sweden's armed forces, remarked that Russia's long-term goal may be to exert control over the Baltic Sea. In response to the report, Finland's Defense Forces (FDF) said rehearsals are a normal part of any military's operations.

A statement from the FDF said, "There is no immediate military threat to Finland," adding that the country would continue to monitor developments closely without commenting on media speculation regarding other nations' military activities.

NATO Faces Growing Concerns?

Russian President Vladimir Putin has long articulated his vision of reclaiming historical territories, with the 17th-century Russian Empire serving as a model for his aspirations. As the war in Ukraine continues, Western experts and officials have warned that Russia's ambitions will not stop with Ukraine. Putin is seen as likely to exploit security vulnerabilities across Europe, even eyeing regions as far south as Georgia, which shares a border with Turkey.

This has raised alarm about the possibility of future Russian attacks on NATO countries, which could trigger a collective military response under NATO's Article 5. The article stipulates that an attack on one member would be considered an attack on all, obligating all members to respond. In June, German Defense Minister Boris Pistorius said that Putin "might even attack a NATO country" and stressed the need for Europe to be ready for potential conflict by 2029.

With this in mind, the Baltic states and Finland—countries with direct borders to Russia—are particularly vulnerable to Moscow's ambitions. In recent months, these nations, among NATO's top contributors to defense spending relative to GDP, have bolstered their security measures.

Moreover, NATO has ramped up military preparedness. In March, NATO led the Nordic Response 2024 exercise, involving 20,000 soldiers transferred to Northern Norway and Finnish Lapland, under the leadership of US Vice Admiral Douglas Perry.

In another concerning development, Finland recently seized an oil tanker suspected of belonging to Russia's "shadow fleet." The vessel was linked to the damage of submarine cables off the coast of Finland on Christmas Day.

Speaking to Sky News, NATO's deputy assistant secretary general for hybrid and cyber threats warned that these attacks could escalate significantly, stating that there is a "real prospect" that one of these hybrid assaults could cause substantial casualties or massive economic damage.

https://www.eurasiantimes.com/after-ukraine-russias-next-target-is-full-control/

Science & Technology News

Press Information Bureau
Government of India

Ministry of Science & Technology

Mon, 30 Dec 2024

Fabrication of lysozyme bilayers in presence of ions can mimic biological protein absortion on inserted implants

A research group stabilized bilayers of lysozyme protein molecules on hydrophilic and hydrophobic silicon surface from solution at room temperature to imitate the actual protein adsorption in living organisms. This will help in mimicking the real biological processes of ion-mediated protein adsorptions on inserted implants and biomaterials.

Lysozyme is a model protein that has four disulfide bonds and is found in human tears, sweat, milk, and saliva. On the other hand, ions are an integral part of the living body and are involved in multiple biological processes such as regulation of electrochemical potential, fluid-electrolyte equilibrium, extra-cellular acid-base equilibrium, muscle contraction and so on. In this context, the introduction of implants inside a living body would undoubtedly lead to ion-mediated protein-surface interactions.

A group of scientists from Institute of Advanced Study in Science and Technology (IASST), Guwahati, an autonomous institute of North-East India under the Department of Science and

Technology (DST), carried out fabrication of lysozyme bilayers in the presence of ions. It has led to ion-mediated lysozyme adsorption that can mimic the biological adsorption of proteins in a real living body.

The lysozyme bilayer was stabilised in the presence of mono-(Na+), di-(Ca2+) and trivalent (Y3+) ions consisting of a bottom layer embedded with lysozyme molecules favouring side-on orientation and an additional upper layer of molecules favouring the side-on or tilted orientation. The reserachers have explained the mechanism of stabilization of bilayers of lysozyme on Si surface controlled via different ions interactions.

According to the group led by Dr. Sarathi Kundu, Associate Professor, along with Mr. Sanu Sarkar, a Senior Research Fellow, and Dr. Aditi Saikia, a post-doctorate fellow, the entire immobilization process of lysozyme bilayer on Si surfaces from the dissolved ions interacting with lysozyme molecules was realized primarily via modified hydrogen bonding, hydrophobic and electrostatic interactions in an ionic atmosphere.

The lysozyme-lysozyme interaction competing with the lysozyme-surface interaction in the ionic atmosphere leads to protein adsorption in its native globular form on the hydrophilic surface and with a little elongated structure on the hydrophobic surface. Bilayer film populated with more lysozyme molecules gives rise to a higher contact angle. The stabilization of lysozyme bilayers by ions at room temperature will turn out to be helpful in mimicking the real biological processes of ion-mediated protein adsorptions on inserted implants and biomaterials. This research work was published in the New Journal of Chemistry under the reputed Royal Society of Chemistry.
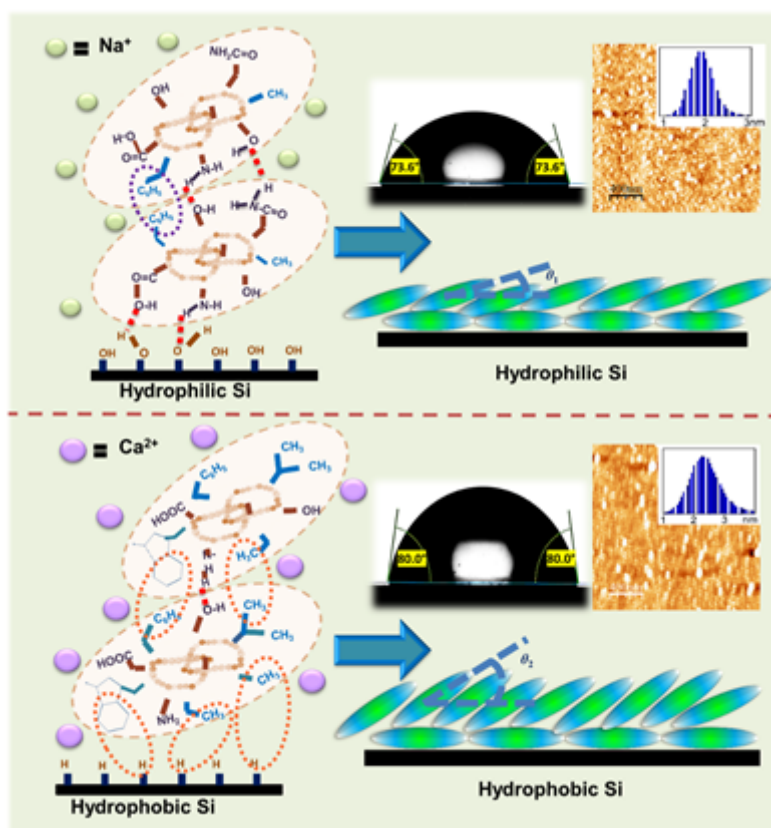
https://pib.gov.in/PressReleasePage.aspx?PRID=2088886

India becomes 4th nation to achieve space docking with indigenously developed 'Bharatiya docking system': Jitendra Singh

Following the successful launch of the SpaDeX mission, Union Minister of state Jitendra Singh stated that India has become the fourth country to join the select league of nations to achieve space docking through its own indigenously developed "Bharatiya Docking System."

Privileged to be associated with the Department of Space at a time when Team #ISRO mesmerises the world with global wonders, one after the other.

India becomes the fourth to join the select league of nations to seek Space docking, through its own indigenously developed "Bharatiya... pic.twitter.com/N9o7qID8z4

- Dr Jitendra Singh (@DrJitendraSingh) December 30, 2024

Taking to X, Singh said, "India has become the fourth country to join the select league of nations to achieve space docking, through its own indigenously developed 'Bharatiya Docking System.'"

"Privileged to be associated with the Department of Space at a time when Team #ISRO mesmerizes the world with global wonders, one after the other." the Minister added.

Hailing Prime Minister Narendra Modi for laying the road to "Viksit Bharat," Singh said, "A humble tribute to PM @narendramodi's mantra of 'Atmanirbhar Bharat' heading towards 'Viksit Bharat,' which will pave the way for a journey beyond the skies for 'Gaganyaan' and 'Bharatiya Antriksha Station.'

"Meanwhile, the Indian Space Research Organisation (ISRO) is preparing for the launch of the NVS-02 satellite in January 2025, aboard the Geosynchronous Satellite Launch Vehicle (GSLV), said ISRO Chairman S. Somanath. Speaking about the upcoming mission, Somanath added that this mission is just one of many planned for the upcoming year.

"In 2025, we have many missions. To start with, we have the mission of GSLV launching the NVS-02 in the month of January," Somanath said.

Earlier, on May 29, 2023, the GSLV-F12 rocket successfully launched the NVS-01 satellite, weighing 2,232 kg, into Geosynchronous Transfer Orbit (GTO). According to an ISRO statement, the NVS-01 satellite featured an indigenous atomic clock and was designed to enhance the capabilities of NavIC, including L1 band signals for broader service coverage. The NVS-02 mission is likely to continue this progress, further strengthening the NavIC system with advanced features.

The announcement was made by Somanath after the successful launch of PSLV-C60, which carried the SpaDeX and other payloads. Following the launch, Somanath highlighted the importance of

docking for the Chandrayaan-4 mission, confirming that the final docking is expected to occur around January 7, 2025.

"Chandrayaan-4 has multiple modules, five in total, which will be launched at different times and integrated into two separate modules. These modules need to reach orbit and then dock both in Earth orbit and Moon orbit. Docking is essential for Chandrayaan-4. This mission aims to go to the Moon, land there, return to Earth, and complete the journey successfully," Somanath explained.

He further added, "This is one of the proving grounds for Chandrayaan-4. Docking will begin tomorrow, and many processes will take place, but the final docking will likely happen by January 7."Somanath also celebrated ISRO's 99th launch, saying, "For us, this is the 99th launch of any launch vehicle from the Satish Dhawan Space Centre. It's a very significant milestone. We're preparing for the 100th launch at the start of next year. In this 99th launch, PSLV-C60 successfully placed two SpaDeX satellites, weighing 220 kilograms, into a circular orbit of 475 kilometers."

He further explained that SpaDeX would undergo various operations starting tomorrow, working towards its docking condition, with the final docking expected by January 7, 2025. "This is not the first SpaDeX; there will be more varieties, including demonstrations of bigger and more complex versions of docking systems in the coming days," he added.

The SpaDeX mission, ISRO's year-end project, is historic as it aims to achieve the rare feat of docking or merging two satellites in space. The project is a cost-effective technology demonstration mission for in-space docking using two small spacecraft launched by PSLV.

The primary objective of the SpaDeX mission is to develop and demonstrate the technology required for the rendezvous, docking, and undocking of two small spacecraft (SDX01, the Chaser, and SDX02, the Target) in low-Earth circular orbit. Docking technology is crucial for long-term missions like Chandrayaan-4, the planned Indian space station, and the eventual manned Gaganyaan mission.

https://economictimes.indiatimes.com/news/science/india-becomes-4th-nation-to-achieve-space-docking-with-indigenously-developed-bharatiya-docking-system-jitendra-singh/articleshow/116812799.cms

THE**WEEK**

Mon, 30 Dec 2024

Explained: Why is ISRO's SpaDeX mission crucial for India's ambitious space station programme

The Indian Space Research Organisation (ISRO) has undertaken an exciting mission called the Space Docking Experiment (SpaDeX). This mission is designed to test and showcase India's ability to dock and undock two small satellites in space.

Docking is a complex process where two spacecraft connect while orbiting the Earth. This achievement is a huge milestone for India, placing it among a select group of nations capable of

performing in-space docking. The mission involves two small satellites, each weighing about 220 kilograms, which will be launched on a PSLV-C60 rocket from the Satish Dhawan Space Centre in Sriharikota on December 30 at 9.58pm.

One of the key goals of this mission is to demonstrate the transfer of electric power between the docked satellites, a critical feature for future space operations like robotic missions and building India's planned space station, the Bharatiya Antariksh Station (BAS). When comparing SpaDeX to similar missions by other space agencies, there are several similarities and differences as many space technology experts point out.

"NASA, the space agency of the United States, has been a leader in docking technology. Its Gemini programme in the 1960s was the first to successfully dock two spacecraft in orbit, paving the way for future missions to the Moon, such as the Apollo programme. NASA continues to use docking technology today with the International Space Station (ISS), where spacecraft regularly dock to deliver astronauts and supplies," says space expert Girish Linganna.

"Russia, through its space agency ROSCOSMOS, also has a long history of expertise in docking. Its Soyuz spacecraft has been a reliable transport vehicle for astronauts to the ISS for decades. A notable achievement was the Apollo-Soyuz test project in 1975, the first international space mission, where a Soyuz spacecraft docked with an American Apollo spacecraft, showcasing advanced docking technology and international collaboration," added Linganna.

He further explains that China has also made significant progress in docking technology. Through its Tiangong programme, China launched space laboratories like Tiangong-1 and Tiangong-2 to test docking systems. In 2011, the Shenzhou VIII spacecraft successfully docked with Tiangong-1, marking a major step forward for China's space programme. The operational Tiangong space station now features multiple docking ports for various spacecraft, both crewed and uncrewed.

"Europe, through the European Space Agency (ESA), has contributed to docking advancements with its Automated Transfer Vehicle (ATV). The ATV was an uncrewed spacecraft that docked with the ISS to deliver supplies and even helped adjust the station's orbit. These missions demonstrated Europe's ability to perform autonomous docking, which is important for future deep space missions," added Linganna.

Although the ESA's ATV missions were successful, their main purpose was delivering cargo and helping maintain the space station. They were not designed for missions involving astronauts. As a result, ESA is usually not considered among the countries with the ability to independently dock crewed spacecraft.

ISRO's SpaDeX mission, while similar in objective, stands out for being a cost-effective technology demonstration. By developing its own docking systems and technology, ISRO is positioning itself as a major player in global space exploration. The success of SpaDeX will not only enhance India's capabilities but also pave the way for ambitious future missions, such as returning samples from the Moon and building a space station. This mission is a bold step forward for India in establishing itself as a leader in space technology, showcasing the nation's growing expertise and ambition in space exploration.

SpaDex introduces two advanced satellites, SDX01 (Chaser) and SDX02 (Target), weighing 300kg and 350kg, respectively. These satellites, deployed into a 470km orbit, carry entirely homegrown docking systems designed by ISRO. Beyond demonstrating basic docking, the mission includes autonomous manoeuvres like rendezvous, undocking, and post-docking operations, signalling India's readiness for more sophisticated space endeavours.

"India's docking system employs a compact, streamlined design with a 450mm interface. Incorporating features like advanced LiDAR for precise measurements, indigenous sensors for navigation, and a soft-capture mechanism, the system reflects a hybrid approach. This unique configuration blends simplicity with cutting-edge technology, optimizing reliability while adhering to international compatibility standards. At the same time, this mission exemplifies ISRO's hallmark efficiency, completing this ambitious project on a remarkably economical budget of Rs 375 crore. Strategic decisions, including indigenous development, innovative designs, and efficient resource allocation, have kept costs significantly lower than international counterparts. This achievement underscores India's ability to deliver high-quality results without excessive expenditure," remarked Srimathy Kesan, founder and CEO of Space Kidz India.

It is expected that this mission is poised to propel India's space programme toward transformative goals. Autonomous docking technology is pivotal for initiatives like the Gaganyaan human spaceflight programme, facilitating crew transfers, modular construction, and emergency rescues. Additionally, it is integral to the planned Bharatiya Antariksh Station, supporting assembly and resupply operations. Beyond human spaceflight, SpaDEX opens avenues for orbital servicing, enabling maintenance, repairs, refuelling, and debris management.

https://www.theweek.in/news/sci-tech/2024/12/30/explained-why-is-isros-spadex-mission-crucial-for-indias-ambitious-space-station-programme.html

THE ECONOMIC TIMES

Tue, 31 Dec 2024

ISRO set to launch NVS-02 satellite in Jan 2025, with more missions planned for upcoming year: ISRO Chief

The Indian Space Research Organisation (ISRO) is preparing for the launch of the NVS-02 satellite in January 2025, aboard the Geosynchronous Satellite Launch Vehicle (GSLV), said ISRO Chairman S Somanath. The ISRO chief on Monday further added that this mission is just one of many planned for the upcoming year.Speaking about the upcoming mission, Somanath said, "In 2025 we have many missions, to start with, we have the mission of GSLV launching the NVS-02 in the month of January..."

On May 29, 2023, the GSLV-F12 rocket successfully launched the NVS-01 satellite, weighing 2,232 kg, into Geosynchronous Transfer Orbit (GTO).According to an ISRO statement, the NVS-

01 satellite featured an indigenous atomic clock and was designed to enhance the capabilities of NavIC, including L1 band signals for broader service coverage.

The NVS-02 mission is likely to continue this progress, further strengthening the NavIC system with advanced features.The announcement was made by Somanath after the successful launch of PSLV-C60, which carried the SpaDeX and other payloads.Following the launch, Somanath highlighted the importance of docking for the Chandrayaan-4 mission, confirming that the final docking is expected to occur around January 7, next year.

He said, "Chandrayaan-4 has multiple modules, five in total, which will be launched at different times and integrated into two separate modules. These modules need to reach orbit and then dock both in Earth orbit and Moon orbit. Docking is essential for Chandrayaan-4. This mission aims to go to the Moon, land there, return to Earth, and complete the journey successfully."He further added, "This is one of the proving grounds for Chandrayaan-4. Docking will begin tomorrow, and many processes will take place, but the final docking will likely happen by January 7."

Somanath also celebrated ISRO's 99th launch, saying, "For us, this is the 99th launch of any launch vehicle from the Satish Dhawan Space Centre. It's a very significant milestone. We're preparing for the 100th launch at the start of next year. In this 99th launch, PSLV-C60 successfully placed two SpaDeX satellites weighing 220 kilograms into a circular orbit of 475 kilometres."

He further explained that SpaDeX would undergo various operations starting tomorrow, working towards its docking condition, with the final docking expected by January 7, 2025. "This is not the first SpaDeX; there will be more varieties, including demonstrations of bigger and more complex versions of docking systems in the coming days," he added. Meanwhile, Dr Jitendra Singh, Minister of State for Science and Technology, also celebrated the success of the mission on social media. He wrote, "Privileged to be associated with the Department of Space at a time when Team #ISRO mesmerizes the world with global wonders, one after the other." Singh highlighted ISRO's growing global recognition and its achievements in space exploration.

Singh also noted, "India becomes the fourth country to join the select league of nations pursuing space docking, with its indigenously developed 'Bharatiya Docking System.' This is a humble tribute to PM Narendra Modi's mantra of 'Atmanirbhar Bharat,' heading towards a 'Viksit Bharat.' This achievement will pave the way for future projects like 'Gaganyaan' and the 'Bharatiya Antariksha Station.'"

The SpaDeX mission, ISRO's year-end project, is historic as it aims to achieve the rare feat of docking or merging two satellites in space. The project is a cost-effective technology demonstration mission for in-space docking using two small spacecraft launched by PSLV.

The primary objective of the SpaDeX mission is to develop and demonstrate the technology required for the rendezvous, docking, and undocking of two small spacecraft (SDX01, the Chaser, and SDX02, the Target) in low-Earth circular orbit. Docking technology is crucial for long-term missions like Chandrayaan-4, the planned Indian space station, and the eventual manned Gaganyaan mission.

https://economictimes.indiatimes.com/news/science/isro-set-to-launch-nvs-02-satellite-in-jan-2025-with-more-missions-planned-for-upcoming-year-isro-chief/articleshow/116813811.cms

From SpaDeX launch to Aditya-L1: India's top space missions in 2024

In 2024, India reaffirmed its position as a leading space-faring nation, with ISRO achieving several significant milestones. The agency's successes included satellite launches, advancements in reusable technologies, and progress towards human space exploration. As a part of its ambitious vision, ISRO laid the groundwork for missions that aim to extend India's presence in outer space and interplanetary research.

Key Satellite Launches and Missions

XPoSat: Pioneering X-ray Polarimetry

On 1 January 2024, ISRO launched the X-ray Polarimeter Satellite (XPoSat) aboard PSLV-C58 from Sriharikota. The mission marked India's entry as the second nation globally, after NASA, to study space-based polarisation of X-ray emissions. The satellite aims to observe celestial phenomena such as black holes and neutron stars, enhancing India's capacity for advanced astronomical research.

Aditya-L1: India's First Solar Mission

India's maiden solar mission, Aditya-L1, reached its halo orbit at the Lagrange point (L1) on 6 January. Launched on 2 September 2023, this spacecraft will study the Sun's atmosphere, including its photosphere, chromosphere, and corona. Its uninterrupted view of the Sun enables unprecedented observations, providing valuable data on solar activity and its impact on space weather.

INSAT-3DS: Strengthening Weather Monitoring

The successful launch of the INSAT-3DS weather satellite aboard GSLV-MkII on 17 February marked another milestone. Designed for a 10-year operational life, the satellite enhances India's capabilities in weather forecasting, disaster management, and environmental monitoring.

Proba-3 Satellites for ESA

On 5 December, ISRO launched ESA's Proba-3 satellites, which aim to simulate a total solar eclipse using precision formation flying. This mission underscores ISRO's reliability in international collaborations and advanced satellite technology.

Technological Milestones in Reusability and Space Docking

Reusable Launch Vehicle (RLV) Achievements

ISRO achieved breakthroughs in reusable technology with two successful landing experiments (RLV-LEX-02 and RLV-LEX-03) in 2024. Conducted in March and June, these tests demonstrated autonomous landing capabilities from complex flight conditions. Pushpak, the winged vehicle used

in these missions, was released from a Chinook helicopter at a height of 4.5 km. ISRO validated critical technologies like navigation, control systems, and high-speed landing essential for reusable vehicles.

Space Docking Success: SpaDeX Mission

India became the fourth country to achieve space docking through its indigenously developed Bharatiya Docking System. "The rocket has placed the spacecraft in the right orbit, and the SpaDeX satellites have moved one behind the other," said ISRO Chairman S. Somanath. The docking process is expected to conclude in early January 2025. Union Minister Jitendra Singh praised the achievement, stating, "India has become the fourth country to join the select league of nations to achieve space docking, through its own indigenously developed Bharatiya Docking System."

Human Spaceflight and Future Exploration

Gaganyaan Preparations

The Gaganyaan mission, India's first crewed spaceflight, saw substantial progress in 2024. The assembly of the Human Rated Launch Vehicle Mark-3 began in December, with the uncrewed test flight scheduled for early 2025. Gaganyaan aims to send a three-member crew to a 400-km orbit for three days, marking a significant leap in India's human spaceflight capabilities.

Interplanetary Missions

The Union Cabinet approved the Venus Orbit Mission and Chandrayaan-4 in September 2024. The Venus mission, with a budget of ₹1,236 crore, focuses on studying the planet's surface, atmosphere, and solar interactions. Chandrayaan-4, allocated ₹2,104 crore, will collect lunar soil samples for research.

Bharatiya Antariksh Station (BAS-1)

As part of its long-term vision, ISRO received approval for India's first space station. The project aims to extend the Gaganyaan programme, with the development of the first module, BAS-1, focusing on building and operating a sustainable space habitat.

India's space achievements in 2024 are part of a larger trajectory of progress. ISRO's PSLV continues to be a trusted workhorse for satellite launches, while missions like Chandrayaan and Mangalyaan have established India's expertise in interplanetary exploration. These successes, along with newer innovations in reusable technologies and space docking, position India for an exciting future in space exploration.

ISRO is set to commence 2025 with the launch of the NVS-02 satellite aboard GSLV in January. Chairman S. Somanath remarked, "In 2025, we have many missions. To start with, we have the mission of GSLV launching the NVS-02 in the month of January." With ambitious goals, including the Gaganyaan mission and continued development of interplanetary missions, ISRO's vision aligns with India's aspiration to lead in the global space arena.

ISRO's accomplishments in 2024 have set the stage for a transformative decade in India's space exploration journey. With advancements in technology, international collaborations, and ambitious

goals, the nation continues to make strides toward becoming a self-reliant and globally competitive space power.

THE ECONOMIC TIMES

Mon, 30 Dec 2024

IISc researchers develop new ML model to find semiconductor properties

Researchers at the Indian Institute of Science (IISc), in collaboration with University College London, have developed machine learning-based methods to predict material properties with limited data. The research shows that this approach can aid in the discovery of semiconductors. It can also predict how quickly ions can move within electrodes in a battery, helping to build better energy storage devices.

The research team, led by Sai Gautam Gopalakrishnan, Assistant Professor at the Department of Materials Engineering, developed a model based on Graph Neural Networks (GNNs) for the study.

IISc, in a release, explained that the lack of data on material properties—which is needed to train models that can predict which types of materials possess specific properties, such as electronic band gaps, formation energies, and mechanical properties—is a hindrance. This is due to expensive and time-consuming methods currently in use.

In transfer learning, researchers use a large model first pre-trained on a large dataset and then fine-tuned to adapt to a smaller target dataset. "In this method, the model first learns to do a simple task like classifying images into, say, cats and non-cats, and is then trained for a specific task, like classifying images of tissues into those containing tumors and those not containing tumors for cancer diagnosis," Gopalakrishnan explained.

"The architecture of the GNN, such as the number of layers and how they are connected, determines how well the model can learn and recognize complex features in the data," IISc scientists noted.

The IISc team found that their transfer learning-based model, which was first pre-trained and then fine-tuned, performed much better than models trained from scratch. The team also used a framework called Multi-property Pre-Training (MPT), in which they simultaneously pre-trained their model on seven different bulk 3D material properties. "This model was also able to predict the band gap value for 2D materials that it was not trained on," the institute added.

"The team first determined the training data size required for predicting material properties. They also pre-trained the model by tuning only some layers while 'freezing' the others," Reshma Devi, first author and PhD student at the Department of Materials Engineering, said. She added that the

researchers provided data on material properties such as dielectric constant and formation energy of the material as the input, enabling the model to predict values for specific material properties, like the piezoelectric coefficient.

Gopalakrishnan believes that the GNN model can be used to make better semiconductors by predicting their tendency to form point defects, contributing to India's push towards semiconductor manufacturing.

https://economictimes.indiatimes.com/tech/technology/iisc-researchers-develop-new-ml-model-to-find-semiconductor-properties/articleshow/116803986.cms

Google's Willow quantum processor — how it works, why it matters

Google recently unveiled its latest quantum processor, named 'Willow'. The research team that built it also tested it and the results were published in Nature.

They created a great level of buzz about the realisability of quantum computers that could tackle many practical problems.

The results also kicked up intriguing debates about explaining the power of quantum information processing and how they could solve problems that even the most powerful classical computers struggle with.

Computers process information stored in an array of 0s and 1s. In classical computers, some physical system with two possible states is used to represent these 0s and 1s. These physical systems are called bits. A common example is an electric circuit that allows two levels of voltage, one called 0 and the other called 1. A classical computer is a collection of bits together, and the information flowing in and out of bits is controlled and manipulated by physical operations called gate operations. For example, an AND gate accepts two inputs, each either 0 or 1, and outputs 1 if both inputs are 1 and 0 for any other combination of inputs.

A quantum bit, or qubit, has two distinct states representing 0 and 1. More importantly, a qubit can be in states that are also combinations of 0 and 1. This feature is called quantum superposition. Classical bits can't do this. Because of this ability, each qubit needs two distinct numbers to represent the contributions of 0 and 1 respectively in the qubit's state. If we have two bits, we need two numbers, one for each bit, to represent the state of the collection. With two quantum bits, we need four numbers to represent the state. For 10 bits, we need 10 numbers to represent the state of the collection. For ten qubits, we need 210 (1,024) numbers.

This exponential growth in the information required to represent qubits' states and the superposition of states are the major reasons why quantum computers could be more efficient and

powerful than classical computers. Like a classical computer, a quantum computer is also a collection of qubits and a host of physical operations called quantum gates that change the states of qubits to perform calculations.

Difficult to isolateSome of the major impediments to realising quantum computers are the fragile nature of quantum states. Specifically, while classical bits are robust and long-lasting, qubits are fragile and collapse quickly at the slightest disturbance. This in turn limits the amount of time for which qubits can hold information, how errors-free the quantum computer can keep its calculations, and how well a quantum computer can be scaled.

It is difficult to isolate a physical gadget to avoid perturbations due to external noise. Therefore, computations are prone to errors. For example, when a bit is expected to represent 0, there is a small chance it may be in the state representing 1. This is called the bit flip error. Methods to identify and fix these errors are called error-correction protocols.

A single 0 is represented by three bits in the state 000 (corresponding to each bit in the state 0). If there is a bit-flip error, the resulting state could be 100, 010 or 001 (depending on whether the first, second or third bit is flipped). Similarly, 1 is represented as 111. If we need to encode 01 as the basic information, its true representation is 000111. Looking at the concatenated sequence in groups of three bits, the occurrence of 100, 010, 001, 011,101 or 110 will mean an error has crept in. When three physical bits represent one logical digit, it is easy to figure out which bit has flipped and correct it suitably before the next step in the computation.

Similarly, one way to mitigate the effect of errors in a quantum computer is to correct them using additional qubits that keep track of errors creeping in during computations. This is a logical answer to the error problem, it is however unsuitable for qubits in superposed states. Creating exact copies of unknown superposed states is prohibited by the no-cloning theorem of quantum physics. On the other hand, error correction often requires redundancy, i.e. providing more qubits than what is needed to encode information. This makes it clear more than one physical qubit is needed to represent a single logical qubit. (Qubits also have another type of error called phase flip error, which presents similar challenges to error correction.)

How quantum computing can make large language models even better

One effective method to detect and correct errors in a quantum computer without also violating the no-cloning theorem is called surface code. Here, engineers arrange an array of qubits on a grid. The qubits are grouped into two categories, namely data qubits and measurement qubits. While the error in data qubits is what we wish to identify and correct, any attempt to measure them will force them out of superposition and whatever information they encode will be lost.

To avoid this, the surface code method provides the set of measurement qubits. These qubits are entangled with data qubits through suitable gate operations. (If two qubits are entangled, any measurement of one particle will instantaneously cause the other particle to lose its superposition state.) In this setup, the presence of errors in the data qubits is inferred by making suitable measurements of the measurement qubits, while using the gates to prevent the data qubits from being affected, and thus correcting inconsistencies in the data qubits.

The error rateAccording to Google, its new quantum processor Willow has significantly better error correction and is thus significantly faster than other quantum computers, not to mention classical computers as well. The researchers who developed it tested it by using it to solve a computationally hard problem.

Willow houses 105 physical qubits and operates at temperatures close to the theoretically possible lowest temperature (0 K, -273.15° C). Nearly half of these are data qubits and the remaining are measurement qubits. The superconducting qubits are not strictly two-state systems. When performing gate operations, the physical system can get excited or 'leak' to states other than 0 and 1. These excited states can subsequently interfere with the computations and introduce errors. So a few qubits — i.e. the measurement qubits — are reserved to correct such leakage errors.Coherence time is the duration over which an intended state (typically, superpositions) of a qubit can survive without being changed due to interactions with the environment or with other parts of the computer.

The coherence time of data qubits on Willow is about 100 microseconds, which is more than the coherence time of the physical qubits. This is a consequence of the error correction protocols used. This in itself is an interesting result because it means the information-holding time can be improved by external manoeuvring.

The next milestone for researchers to achieve is to lower the error rate — calculated as the ratio of the number of qubit errors to the number of gate operations — as they build ever-larger quantum computers with more physical qubits and more error correction operations. Google alone has progressed from 3-by-3 to 5-by-5 to 7-by-7 arrays of data qubits, and the error rate has decreased by more than half in each step.

What one expects for a collection of qubits on a circuit is that the error rate either remains the same or increases as the number of qubits is increased. That the error rate becomes smaller as more qubits are added is the below-the-threshold capability of Willow's architecture and operation. This is vital to achieve quantum processors with enough qubits that perform almost error-free computations of problems of practical relevance — the ultimate goal.

Team at Kolkata institute engineers bacteria to solve maths problemsNo dead-endsThe particular computationally difficult task with which Google tested Willow is called random circuit sampling (RCS). In the RCS task, Willow has to calculate the probability of occurrence of possible strings of 0s and 1s in the output when the quantum gates that act on the qubits are chosen randomly. If there is no noise, RCS is a computationally hard task, meaning that the number of calculations required to make the prediction increases exponentially with the input size.

Willow completed the RCS task for random gate operations realisable on Willow in a few minutes. The researchers estimated that the same task on the most powerful classical computer available today would take 10 septillion years (i.e. 1 followed by 24 zeroes). To compare, the universe's age in years is approximately 1 followed by 10 zeroes. It is plausible that classical computers running better algorithms may eventually match Willow's feat, although researchers are not aware of such improvements today.

Researchers are still a long way away from realising quantum processors of reasonable size to be useful in practical contexts. This said, it's only natural that Willow created the sort of buzz that it did: it has shown that the major issues in realising a reliable quantum computer can be addressed and surmounted, that they are not dead-ends. The work of the Google team provides hope that quantum computers may soon help us unravel nature's mysteries and also solve computationally difficult problems in drug design, materials science, climate

modelling, and optimisation, among others — all with deep societal impact.S. Srinivasan is a professor of physics at Krea University.

NASA probe makes closest ever pass by the sun

NASA's pioneering Parker Solar Probe made history on December 24 when it flew closer to the sun than any other spacecraft, with its heat shield exposed to scorching temperatures topping 930 degrees Celsius.Launched in August 2018, the spaceship is on a seven-year mission to deepen scientific understanding of our star and help forecast space-weather events that can affect life on the earth.

Tuesday's historic flyby should have occurred at precisely 5:23 am IST (1153 GMT), although mission scientists will have to wait for confirmation until December 28 as they lose contact with the craft for several days due to its proximity to the sun.

"Right now, the Parker Solar Probe is flying closer to a star than anything has ever been before," at 6.1 million kilometers away, NASA official Nicky Fox said in a video on social media on December 24 morning. "It is just a total 'yay, we did it' moment."

If the distance between the earth and the sun is the equivalent to the length of an American football field, the spacecraft should have been about four metres from the end zone at the moment of closest approach, a point that scientists call perihelion.

"This is one example of NASA's bold missions, doing something that no one else has ever done before to answer long-standing questions about our universe," Parker Solar Probe program scientist Arik Posner said in a statement on December 30. "We can't wait to receive that first status update from the spacecraft and start receiving the science data in the coming weeks."

So effective is the heat shield that the probe's internal instruments remain near room temperature -- around 29 degrees Celsius -- as it explores the sun's outer atmosphere, called the corona.The Parker Solar Probe will also be moving at a blistering pace of around 690,000 km/hr, fast enough to fly from New Delhi Chennai in around 10 seconds.

"Parker will truly be returning data from uncharted territory," said Nick Pinkine, mission operations manager at the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland. "We're excited to hear back from the spacecraft when it swings back around the sun."

By venturing into these extreme conditions, the Parker probe has been helping scientists tackle some of the sun's biggest mysteries: how solar wind originates, why the corona is hotter than the surface below, and how coronal mass ejections -- massive clouds of plasma that hurl through space -- are formed.

The Christmas Eve flyby was the first of three record-setting close passes. The next two are set to occur on March 22 and June 19, 2025, and both are expected to bring the probe back to a similarly close distance from the sun.

After its launch in 2018, the probe has been gradually circling closer towards the sun, using flybys of Venus to gravitationally pull it into a tighter orbit.

https://www.thehindu.com/sci-tech/science/nasa-probe-makes-closest-ever-pass-by-the-sun/article69042696.ece

Vikram Sarabhai's death anniversary: How one man's vision transformed India's future

Known as the father of India's space program, Vikram Sarabhai is credited as one of the most influential personalities in the science and technology forums in the country. Sarabhai died on December 30, 1971, but even today his words act like a beacon of light for the young generation. In order to honour his work, Sarabhai received the Padma Bhushan in 1966 and the Padma Vibhushan after his death in 1972. His efforts were not confined to the field of space; he also worked for the establishment of important scientific organisations and facilities that assisted India in attaining a better place in the scientific map of the world.

Sarabhai was born into an illustrious business family in Ahmedabad, and thus his initial education endeavoured him for the accomplishments ahead. Completing his schooling in India, he further went to St. John's College, Cambridge University, and while studying, developed an interest in science and technology. His marriage to classical dancer Mrinalini Swaminathan in 1942 was indeed the most important episode in his life, but the Quit India movement dampened his life with disturbances. There have been no parallels for Sarabhai's leadership and vision in the scientific context and the institutional legacy that he set up for the nation that remains relevant to this day in providing support to technologically progressive India.

The Birth of India's Space Programme

The foundation for the Indian space program was set by Sarabhai when he founded the Physical Research Laboratory (PRL) in Ahmedabad in 1947. In 1962 he set up the Indian National Space Research Committee (INCOSPAR), which was later developed into the Indian Space Research Organisation (ISRO). As the first chairman of ISRO, Sarabhai set out the nation on its mission to space, to harness space technology for nation building, for communication, for weather and meteorological purposes, for agriculture, and more.

Contribution to Science and Technology

Besides space research, the versatile Sarabhai founded many other important organisations that have benefitted the Indian research system in more ways than one. These are the Indian Institute of Management (IIM) Ahmedabad, the Space Applications Centre of the Indian Space Research Organisation, and the Vikram Sarabhai Space Centre. He also helped in the setting up of essential projects like the Faster Breeder Test Reactor and the Variable Energy Cyclotron Project. The knowledge in nuclear technology and space research done by Sarabhai also guides India today. His consistent pursuit of scientific study and the exemplary leadership he offered turned India into a world-class, technologically and space-revolutionised nation.

https://www.news9live.com/science/isros-spadex-satellites-successfully-deploy-solar-panels-docking-around-7-jan-2785667