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Wed, 21 Dec 2022

अग्नि-5 ने चीन को डराया, अब 'प्रलय' की बारी, जानिए कितनी पावरफुल है नई भारतीय मिसाइल

बॉर्डर पर चीन के साथ तनाव के बीच भारतीय सेना में बैलिस्टिक मिसाइल 'प्रलय' को शामिल करने की तैयारी है. भारतीय रक्षा बलों ने इसका प्रस्ताव पेश किया है. इसी हफ्ते होने वाली हाई लेवल की मीटिंग में इस मिसाइल को मंजूरी मिली सकती है. चीन के साथ वर्तमान हालातों को देखते हुए इस मिसाइल की तैनाती की जा सकती है. यह मिसाइल 150 से 500 किलोमीटर के दायरे में लक्ष्य को निशाना बना सकती है. इससे सीधे तौर पर चीन के कब्जे वाले तिब्बत के उस हिस्से को निशाना बनाया जा सकेगा, जहां चीनी सेना की गतिविधि जारी है. हाल में अग्नि-5 के परीक्षण से पहले चीन बौखला गया था. अब प्रलय की तैनाती होती है यह चीनी सेना को रोकने का काम करेगी. बैलिस्टिक मिसाइल प्रलय का पिछले साल DRDO ने परीक्षण किया था. परीक्षण सफल रहा था.

जानिए यह मिसाइल कितनी पावरफुल है और चीन-पाकिस्तान के पास इस कैटेगरी की कौन सी मिसाइल्स हैं...

- **जमीन से जमीन पर मार करने वाली मिसाइल:** इसे DRDO ने भारत के बैलिस्टिक मिसाइल डिफेंस प्रोग्राम के तहत तैयार किया है. 5 टन वाली प्रलय मिसाइल 500 से लेकर 1 हजार किलो तक के वॉरहेड को ले जाने में सक्षम है. यह जमीन से जमीन पर मार करती है. इसे पृथ्वी मिसाइल की तकनीक पर तैयार किया गया है. पृथ्वी मिसाइल को आधार पर समझा जाए तो यह हाई एक्सप्लोसिव, परमाणु और केमिकल वेपन ले जाने में सक्षम है.
- **टारगेट के 33 फीट दायरे में हर चीज होगी तबाह:** बैलिस्टिक मिसाइल प्रलय जिस हिस्से को निशाना बनाती है वहां के 33 फीट दायरे वाले हिस्से को तबाह कर देती है. प्रलय मिसाइल भारत के इंटीग्रेटेड गाइडेड मिसाइल डेवलपमेंट प्रोग्राम का हिस्सा है.
- **चीन के मिलिट्री बेस को करेगी टारगेट:** प्रलय की मदद से तिब्बत के जिस हिस्से में चीनी सेना का कब्जा है और वहां मिलिट्री बेस को टारगेट किया जा सकेगा. पिछले कुछ सालों में चीन ने उस

हिस्से में सड़कें, ब्रिज, एयरपोर्ट और रेलवे लाइन बिछाई है. हालात बिगड़ने पर LAC पर इसे तैनात किया जा सकेगा. यह भारतीय सेना को ताकत देने का काम करेगी.

- **चीन और पाकिस्तान के पास ऐसी कौन सी मिसाइलें हैं:** मीडिया रिपोर्ट के मुताबिक, प्रलय मिसाइल की गति करीब 2 हजार किलोमीटर प्रति घंटा हो सकती है. इस कैटेगरी की बात करें तो चीन और पाकिस्तान के पास भी ऐसी मिसाइलें हैं. चीन के पास डॉंगफेंग-12 और पाकिस्तान के पास गजनवी, एम-11 और शाहीन मिसाइल हैं. गजनवी 320 KM, एम-11 350 KM और शाहीन 750 KM रेंज वाली मिसाइलें हैं.

‘प्रलय’ के लिए 332.88 करोड़ रुपए को मंजूरी

बैलिस्टिक मिसाइल प्रलय को तैयार करने के लिए प्रोजेक्ट को 2015 में मंजूरी मिली थी. इस प्रोजेक्ट के लिए 332.88 करोड़ रुपए का बजट जारी किया गया था. ऐसी मिसाइलों का लक्ष्य दुनिया के एयर डिफेंस साइट और इंफ्रास्ट्रक्चर को पूरी तरह से नष्ट करना है. इसे रक्षा अनुसंधान और विकास संगठन (DRDO) ने विकसित किया है. पहले गलवान और अब अरुणाचल प्रदेश के तवांग में दोनों सेनाओं की झड़प के बाद हालात तनावपूर्ण हैं. ऐसे में अगर प्रलय को तैनात किया जाता है तो चीन के कब्जे वाले तिब्बती हिस्से से भारत को सुरक्षा मिलेगी.

<https://www.tv9hindi.com/knowledge/indian-armed-forces-to-get-pralay-missile-which-will-allow-targeting-of-chinese-infra-in-tibet-feature-of-pralay-missile-au256-1620583.html>

Defence News

Defence Strategic : National/International



Press Information Bureau
Government of India

Ministry of Defence

Wed, 21 Dec 2022

Aatmanirbhar Bharat: iDEX-DIO Signs 150th Contract for Defence Innovation on Expendable Mobile Anti-Submarine Warfare Training Target Capable of Simulating Sound & Movement of a Submarine

Innovations for Defence Excellence (iDEX), the flagship initiative of Department of Defence Production, has reached a milestone with the signing of its 150th contract. The contract relates to an Indian Navy project of the Defence India Start-up Challenge (DISC 7) SPRINT edition. The

challenge was titled 'Expendable Mobile Anti-Submarine Warfare (ASW) Training Target (EMATT) capable of simulating the sound and movement of a submarine' and the winner was Altair Infrasec Pvt Ltd, Pune.

The Challenge envisaged development of a training target capable of being deployed from P8I aircraft, MH60R helicopters, ships doing speed up to 10 knots and other Remotely Piloted Aircraft without undertaking any modification on the platform from which the EMATT is required to be launched.

The contract was signed by Joint Secretary (Defence Industries Production) & Additional CEO/DIO Shri Anurag Bajpai with CEO, Altair Infrasec Pvt Ltd Shri Anil Anand in the presence of Defence Secretary Shri Giridhar Aramane and other senior civil & military officials of Ministry of Defence in New Delhi on December 21, 2022. The iDEX achieved the milestone within five months of the signing of its 100th contract on July 26, 2022.

In his address, the Defence Secretary elaborated on the conducive environment created due to the initiatives taken by the Government, under the leadership of Prime Minister Shri Narendra Modi, wherein new private sector companies are being provided with opportunities to grow and contribute to Nation Building. He expressed hope that more companies would take advantage of this ecosystem and help achieve the vision of 'Aatmanirbhar Bharat'. He congratulated Altair Infrasec Pvt Ltd and assured the support of Ministry of Defence for the completion of the project. The iDEX framework was launched by the Prime Minister in 2018 with the objective to provide a platform of co-creation and co-development in the defence sector, engage start-ups and develop defence and aerospace set up in the country. The iDEX is being implemented by Defence Innovation Organisation (DIO), established under Department of Defence Production.

Within a short span of time iDEX, which has also been awarded the prestigious Prime Minister Award for Public Policy in Innovation Category for the year 2021, has emerged as a game changer in the defence eco-system through its flagship programmes like DISC, Prime and Open Challenges (OC). iDEX has been able to build the required momentum and generate a critical mass of start-ups in the defence sector. Till date, iDEX has received more than 6,500 applications from individual innovators, MSMEs and start-ups under DISC, Prime and OC. It has also been able to generate thousands of jobs and attract India's talent back to the country.

During DefExpo 2022 held in October, the Prime Minister had launched Mission DefSpace, including DISC 8 to develop innovative solutions for the Armed Forces in the space domain through industry and start-ups. The last date to apply is January 02, 2023. The iDEX, in association with Tri-Services, DPSUs, MSMEs & start-ups, is striving to develop cutting-edge technology products to make India 'Aatmanirbhar' and achieve the export target of USD \$5 billion i.e. Rs 40,000 crore with the objective of transforming India into a global defence manufacturing hub in the next 25 years.

The iDEX is working at path-breaking pace to ensure that its agreements with the start-ups and innovators reach logical conclusions timely, eventually opening a myriad of options for the budding soon-to-be-unicorns and at the same time, addressing the requirement of the Services.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1885420>

Rapid Progress Being Made Towards ‘Aatmanirbharta’ in Defence Production: Union Minister

India's defence industry can now produce a wide range of high-end products such as tanks, armoured vehicles, fighter aircraft, warships, submarines, missiles, electronic equipment, special alloys and a variety of ammunition, according to Ajay Bhatt, Minister of State for Defence. According to the Ministry of Defence, rapid progress has been made toward achieving complete ‘Aatmanirbharta’ (self-reliance) in the production of defence equipment for the country’s armed forces. As a result of these initiatives, many state-of-the-art products, including the 155 mm artillery gun system – Dhanush, the light combat aircraft – Tejas, the surface-to-air missile system – Akash, the main battle tank – Arjun, the armoured personnel carrier – BMP-II and IIK, Sukhoi-30 MK1, Cheetah helicopter, INS Khanderi, anti-submarine warfare corvette (ASWC), etc. have been produced in the country during the last few years.

The government has taken several policy initiatives and implemented reforms to encourage indigenous design, development, and manufacturing of defence equipment, promoting self-reliance in defence manufacturing and technology in the country, according to the minister. In April 2018, the Innovations for Defence Excellence (iDEX) ecosystem was launched to foster innovation and technology development in the defence and aerospace sectors by engaging industries such as MSMEs, startups, individual innovators, R&D institutes and academia.

“iDEX provides them with grants and other assistance to carry out innovations that have the potential to be adopted for India's defence and aerospace needs in the future. 233 problems have been opened through iDEX, 310 startups have been engaged and 140 contracts have been signed. In 2022, iDEX launched the ‘iDEX Prime’ framework to support startups with a grant-in-aid of up to Rs 10 crore to enable the development of high-end solutions,” Bhatt stated. He said that 595 industrial licences were issued to 366 companies operating in the defence sector until October 2022. According to him, the government has also established two defence industrial corridors, one in Uttar Pradesh and one in Tamil Nadu, to attract investments in the aerospace and defence sectors. Domestic procurement accounted for 54 per cent of total procurement in 2018-19, increasing to 59 per cent in 2019-20 and 64 per cent in 2020-21. This year, it has been increased to 68 per cent, with 25 per cent of the budget earmarked for procurement from private industry, said the minister.

<https://www.businessworld.in/article/Rapid-Progress-Being-Made-Towards-Aatmanirbharta-In-Defence-Production-Union-Minister/21-12-2022-458900/>



Wed, 21 Dec 2022

अग्नि-5, प्रलय और प्रहार...साल 2022 में भारत ने किया इन मिसाइलों का टेस्ट, 'रॉकेट फोर्स' बनाने की भी तैयारी

भारत ने 15 दिसंबर 2022 को देश की सबसे शक्तिशाली इंटरकॉन्टिनेंटल बैलिस्टिक मिसाइल अग्नि-5 के ट्रायल का सफल परीक्षण किया. इस मिसाइल ने 5500 किलोमीटर की दूरी पर टारगेट को सफलता से तबाह किया. एक तरफ जहां अग्नि-5 का ट्रायल सफल रहा वहीं दूसरी तरफ चीन से तनाव के बीच भारत अब एलओसी पर 'प्रलय' मिसाइल को तैनात करने जा रहा है, जो चीन के किसी भी अटैक को काउंटर कर सकती है. भारत ने इस साल यानी 2022 में धनुष, निर्भय क्रूज मिसाइल जैसे कई ऐसे मिसाइलों का सफल परीक्षण किया है जो कि सुरक्षा के लिहाज से भारत के लिए बड़ी उपलब्धि है.

साल 2022 में भारत ने एक से एक स्वदेशी मिसाइलों का परीक्षण करके ना सिर्फ आसमान में अपनी ताकत दिखाई है. बल्कि एयरोस्पेस में बढ़ती ताकत का एहसास दुनिया को भी कराया है.

साल 2022 में इन स्वदेशी मिसाइलों का किया गया सफल परीक्षण

- **मैन पोर्टेबल एंटी-टैंक गाइडेड मिसाइल** - इस मिसाइल का परीक्षण डीआरडीओ ने जनवरी के महीने में किया था. भारत में विकसित की गई एंटी-टैंक एक कम वजन वाली मिसाइल है. इसे मैन पोर्टेबल लॉन्चर से लॉन्च किया जाता है.
- **हेलिना मिसाइल** - अप्रैल में एंटी-टैंक गाइडेड मिसाइल 'हेलीना' लॉन्च की गई. इस मिसाइल का अलग-अलग उच्च-ऊंचाई वाले क्षेत्रों में हेलीकॉप्टर की मदद से दो बार सफलतापूर्वक परीक्षण किया गया. यह उड़ान परीक्षण डीआरडीओ, भारतीय सेना और भारतीय वायु सेना ने संयुक्त रूप से आयोजित किए थे.
- **ब्रह्मोस एक्सटेंडेड रेंज एडिशन** - ब्रह्मोस मिसाइल का परीक्षण मई के महीने में किया गया था. इसके सफल होने के साथ ही अब एयरफोर्स सुखोई फाइटर एयरक्राफ्ट से बहुत लंबी दूरी तक जमीन या समंदर में किसी लक्ष्य पर सटीक निशाना लगाकर हमला करने में सक्षम हो गया है.
- **के-4 मिसाइल**- के-4 मिसाइल को भारत की तीसरी सबसे ताकतवर मिसाइल के तौर पर जाना जाता है. इसका परीक्षण इसी साल किया गया था. इसे पनडुब्बी से लॉन्च किया जा सकता है. इस मिसाइल की मारक क्षमता 3 हजार किमी है. साथ ही यह 3 टन तक का

परमाणु हथियार भी ले जा सकता है.

- बराक-8 मिसाइल- भारत की खतरनाक मिसाइलों में से एक है. इस मिसाइल को हमारे देश ने इजरायल के साथ मिलकर बनाया है और इसका परीक्षण भी इसी साल यानी 2022 में किया गया था. इस मिसाइल को सतह से हवा में टारगेट कर छोड़ा जा सकता है. बराक-8 मिसाइल 70 किलो तक का वजन के बराबर हथियार उठाने में सक्षम है.
- वर्टिकल लॉन्च शॉर्ट रेंज सरफेस-टू-एयर मिसाइल (VL-SRSAM)- वीएल एमआरएसएम का परीक्षण 23 अगस्त 2022 को ओडिशा में किया गया था. इस परीक्षण को डीआरडीओ और भारतीय नौसेना ने मिलकर किया था. यह प्रणाली भारतीय नौसेना को सी-स्किमिंग लक्ष्यों सहित निकट दूरी पर विभिन्न हवाई खतरों को बेअसर करने के लिए मजबूती प्रदान करेगी.
- सबमरीन लॉन्च बैलिस्टिक मिसाइल- अक्टूबर महीने में आईएनएस अरिहंत ने पनडुब्बी से छोड़ी जाने वाली बैलिस्टिक मिसाइल का प्रभावी परीक्षण किया था मिसाइल का आवश्यक रेंज में परीक्षण किया गया और बंगाल की खाड़ी के भीतर लक्ष्य स्थान पर बड़ी सटीकता के साथ निशाना साधा गया.

हाल ही में किया गया था अग्नि-5 का ट्रायल

इस हफ्ते की शुरुआत में भारत ने अग्नि-5 न्यूक्लियर बैलिस्टिक मिसाइल का परीक्षण किया था. उस वक्त इस मिसाइल की रेंज 5 हजार किलोमीटर बताई गई थी, जो अब बढ़ाकर 7 हजार से ज्यादा कर दी गई है. हालांकि, इसका वजन 20 प्रतिशत तक कम किया गया है.

रक्षा सूत्रों ने बताया है कि रक्षा अनुसंधान और विकास संगठन यानी डीआरडीओ ने मिसाइल में लगे स्टील को हटाकर कंपोजिट मटेरियल लगा दिया गया है. इससे मिसाइल का वजन अब 20 प्रतिशत कम हो गया है. इसके साथ ही ये भी बताया गया है कि अगर सरकार चाहे तो इसकी मारक क्षमता को 7 हजार किलोमीटर से भी आगे बढ़ाया जा सकता है. इसको लेकर सूत्रों ने कहा है कि मिसाइल की रेंज बढ़ाने के लिए सरकार की तरफ से रिकमंड किया गया था.

रॉकेट फोर्स बनाने पर विचार कर रहा है भारत

इस साल कई मिसाइलों के सफल परीक्षण के बाद भारत ही में नौसेना प्रमुख एडमिरल आर हरि कुमार ने इसका खुलासा किया था. भारत में चीनी सैनिकों की घुसपैठ को देखते हुए भारत अब LAC पर सैन्य ताकत को बढ़ाने में लगा हुआ है. चीन से खतरे को देखते हुए भारतीय सेना एक 'रॉकेट फोर्स' बनाने पर विचार कर रही है. रॉकेट फोर्स के गठन का प्रस्ताव रक्षा मंत्रालय में विचाराधीन है. इस सप्ताह होने वाली बैठक में इस प्रस्ताव पर भी विचार किया जा सकता है.

<https://www.abplive.com/india-at-2047/how-many-missiles-did-india-test-in-the-year-2022-abpp-2287700>

As Army Puts in Request for Towed Artillery Guns, Israeli ATHOS is Back in Race for Mega Deal

The Indian Army has issued a fresh Request for Information (RFI) to acquire a 155mm/52 caliber towed gun system for modernising artillery regiments as part of a plan drafted in 1999. However, the RFI opens up a new avenue to Israeli firm Elbit whose Autonomous Towed Howitzer Ordnance System (ATHOS) was in the reckoning for a mega contract from the Indian Army for over a decade.

This comes even as Indian firms Kalyani Group and TATA have collaborated with the Defence Research and Development Organisation (DRDO) to develop the Advanced Towed Artillery Gun System (ATAGS), which was used for the ceremonial firing in Independence Day at the Red Fort. Issued 20 December, the RFI notes that the weight of the gun system “be preferably less than 15 tons”. And this clause is why the Israeli firm, which has a tie up with Adani Group, is back in the race for supplying the ATHOS to the Indian Army. Given that the ATHOS weighs less than 15 tons while the ATAGS is well over 18 tons, industry sources see the new RFI as an opening for the Israeli weapon system. The 155mm x 52 caliber towed artillery gun figured in the first negative list of defence imports. While the embargo was to kick in from December 2020, the cut-off date for this specialised gun was subsequently changed to December 2021. But, a rule was brought in which allowed armed forces to import defence equipment in certain circumstances even if it figures in the negative import list.

The Israeli gun made it to the negative list because the DRDO was working on an indigenous version of towed 155 mm/52 calibre howitzer – ATAGS.

The history of ATHOS

The process for acquiring towed guns began in 2001 as part of the Army’s Field Artillery Rationalisation Plan, which was drawn up in 1999. Multiple requests for proposal (RFPs) were issued since then, with Elbit along with France’s Nexter participating in the last RFP issued under the UPA government. The deal was for the supply of 400 guns and indigenous production of the remaining 1,180 guns by Ordnance Factory Board (OFB), under a full Transfer of Technology (TOT) process. While RFIs are issued to request information from suppliers about goods or services, RFPs are used in a bidding process to solicit offers for a project.

In March 2019, following what was meant to be an exhaustive ‘Field Trial Cum Evaluation Process’ spread over several years, which saw several ups and downs, Elbit Systems was declared the lowest bidder (L1). However, the DRDO went on record to oppose any import plans, contending that ATAGS was better than ATHOS and is the gun of the future. The Army, which backs the ATAGS programme, pitched for 400 of these guns (for 20 regiments) to be procured from Elbit to “overcome operational voids in the medium artillery in high altitude area along the northern borders”, citing the tensions at the Line of Actual Control (LAC). As reported by ThePrint, the Israel firm then wrote to the Ministry of Defence stating that in case, it preferred to acquire only the first 400 towed guns, the related cost corresponding to TOT can be deducted

from the total contract price. In the letter, Elbit Systems had offered the TOT for the future 1,180 guns as an option for India, at the same cost as mentioned in the commercial offer made.

Elbit also said it has finalised the approach and strategy to achieve 70 per cent indigenisation within the contract of the first 400 towed guns, starting from the first set of guns. The ATHOS is tailored to the special requirements of the Indian Army, it said, adding that it has invested tens of millions of dollars in the design and development of the gun in accordance with Army requirements and in the field trials. The defence sources said Elbit also promised to supply the guns much earlier than the contract delivery schedule — the first six within 10 months from contract signing, and an additional six within 14 months. All the remaining guns were promised to be delivered according to an accelerated delivery schedule, not later than 54 months from contract signing, instead of the 72 months stipulated in the draft contract. In its communications with the Indian defence establishment, Elbit said the ATHOS will end up being an indigenous gun — mass produced, assembled and integrated in India.

<https://theprint.in/defence/as-army-puts-in-request-for-towed-artillery-guns-israeli-athos-is-back-in-race-for-mega-deal/1274814/>



Wed, 21 Dec 2022

India to Buy MQ-9 Reaper, the Drone that Killed Al-Qaeda Chief Ayman al-Zawahiri

India is likely to purchase MQ-9 Reaper drones in a billion-dollar deal with the US. These drones, which use laser-guided Hellfire missiles for precision strikes, fall in the category of hunter-killer Unmanned Aerial Vehicles (UAVs). The US had reportedly used the MQ-9 Reaper drone for an air strike on a compound in Kabul, Afghanistan that had allegedly killed Al-Qaeda chief Ayman al-Zawahiri. According to media reports, India is preparing to acquire the MQ-9 Reaper drone for all the three military services of the Indian Armed forces. However, the Indian government is yet to come out with an official statement on this issue.

In 2017, the Indian Navy had taken these drones on lease for two years. They were being operated for surveillance of activities by the PLA Navy (PLAN) of China in the Indian Ocean. During the peak of the military stand-off with China in eastern Ladakh in 2020, India had leased two MQ-9A drones from US-based company General Atomics under a Company-Owned, Company-Operated (COCO) lease agreement. According to a report by New Indian Express, the purchase of the MQ-9 Reaper is one of the proposals listed for discussion in the Defence Acquisition Council (DAC) meet scheduled on Thursday. This drone is used for surveillance, intelligence gathering and precision strikes. It can also be controlled from ground stations and naval vessels.

The Indian government is reportedly planning to acquire a total of 30 MQ-9 Reaper drones – 10 each for the Indian Navy, Indian Air Force (IAF) and the Indian Navy. The MQ-9 Reaper, manufactured by General Atomics, will be bought through the Foreign Military Sales route used by the US for government-to-government deals. Media reports claimed that though the drone has

been acknowledged as a tri-service requirement in India and the deal has been under discussion for some time, it was not brought to the DAC earlier as there was no scope for local production because the US manufacturer refused to share its knowhow for a Make-in-India component. Another factor was its high cost. The government had reportedly looked at other options but nothing came anywhere close to the MQ-9. As a result, General Atomics will continue to provide spares and service the UAVs.

<https://www.firstpost.com/india/india-to-buy-mq-9-reaper-the-drone-that-killed-al-qaeda-chief-ayman-al-zawahiri-11848261.html>

THE HINDU BusinessLine

Wed, 21 Dec 2022

Pune-based Start-up to Supply 840 Anti-Submarine Warfare Training Targets to Navy

A Pune-based deep tech start-up has won an innovation challenge posed by Navy for indigenous production of “expendable mobile anti-submarine warfare training target (EMATT)” capable of simulating sound and movement of a submarine. The Defence Ministry on Wednesday signed the contract with Altair Infrasec Private Limited under the Defence India Start-up Challenge (DISC 7) edition to acquire EMATTs for Navy. This was the 150th contract signed under Department of Defence Production’s initiative called Innovations for Defence Excellence (iDEX). The challenge envisaged development of a training target capable of being deployed from P8I aircraft, MH60R helicopters, ships doing speed up to 10 knots and other remotely piloted aircraft without undertaking any modification on the platform from which the EMATT is required to be launched, the ministry said.

Altair Infrasec Pvt Ltd COO Anil Anand told businessline that EMATT prototype is at an advanced stage of production and should be ready in next six months and it will delivered to Indian Navy in less than nine months. Our contractual obligation is to provide 840 EMATTs but we expect the number to go up since its a training target, Anand added. The innovation in the anti-submarine warfare space will propel India into elite club dominated by the US. So far, only America’s Lockheed Martin and SAAB, a Swedish aerospace and defence company, manufactured them, Altair Infrasec COO said. He declined to comment on the worth of the contract and stated that the company has plans to export the product to other countries, including the US. Altair, however, will have to seek permission before striking any business deal with other countries or foreign manufacturers, the COO clarified.

Defence Secretary Giridhar Aramane, who was also present at the event, elaborated on the initiatives taken by the government that helped private sector companies in contributing to the nation building.

<https://www.thehindubusinessline.com/news/national/pune-based-start-up-to-supply-840-anti-submarine-warfare-training-targets-to-navy/article66289345.ece>

Rajnath Singh to Meet CDS, Head of Three Services Tomorrow: What's on Agenda for BIG Defence Meet

Light tanks, infantry combat vehicles, portable air-defence systems and artillery may be up for discussion at the next Defence Acquisition Council meeting on Friday. Defence minister Rajnath Singh will be chairing the meeting and senior officials, as well as Chief of Defence Staff General Anil Chauhan and the three service chiefs, will be part of the meeting.

The light tank can be particularly useful in east Ladakh and parts of Sikkim. The Centre is considering helping with the development of the tank, lighter than the standard MBT or main battle tank, but with a 105mm gun. It will move faster than the T-72 or T-90. Prototypes will have to be readied initially. The FICV or Futuristic Infantry Combat Vehicle is also being seriously looked at by the Army. There is already talk of about 1750 of them to replace the BMP-2, Soviet-made and ageing. The Army is on the hunt for the MGS or the Mounted Gun System, which can work well in the desert and the plains. These are 155mm, 52 calibre guns and can be indigenously developed with three or four Indian firms having the necessary technology. Also in the mix is the VSHORAD or the Very Short Range Air Defence system. This could be made indigenously by firms like Bharat Dynamics or Bharat Electronics after tie-ups with foreign firms. The VSHORAD could be made both for the Indian Army and the Indian Air Force and is seen as an effective weapon as it is portable and easily used by a two-member team.

Unmanned Aerial Vehicles or UAVs are being looked at for surveillance. Now called Tactical Remotely Piloted Aircraft Systems (TRPAS), they can be indigenously procured. Overall, indigenisation is still the mantra. Most weapon systems on the agenda can either be made here or need a foreign collaborator.

<https://www.timesnownews.com/india/rajnath-singh-to-meet-cds-head-of-three-services-tomorrow-whats-on-agenda-for-big-defence-meet-article-96413365>

The INS Mormugao and its Capabilities

What are the features of the Visakhapatnam-class destroyers? How is the latest addition to the Indian Navy's fleet a shot in the arm for the nation's self-reliance efforts? How will the warship be a strategic advantage for the country in the Indian Ocean region where China is rapidly expanding its influence?

The story so far: In a boost to the country's maritime capabilities, INS Mormugao has officially joined the Indian Navy's fleet, marking a significant milestone for indigenous military expedition. The warship 'Yard 12705', named after the Goan port city of Mormugao, is the second of the four Visakhapatnam-class destroyers being built under the Indian Navy Project

15B, or P15B. The destroyer has multi-dimensional combat capabilities which include surface-to-surface missiles, surface-to-air missiles and modern surveillance radar.

What is Project 15B?

Project 15 was launched in the 1990s to add guided missile destroyers to the inventory of the Indian Navy. The project was named 'Delhi class'. It was followed by Project 15A or Kolkata class which primarily focused on advanced technology and equipment in surface ships. Project 15B or the Visakhapatnam class is a follow-on class of weapon-intensive Project 15A destroyers. The project was launched in January 2011 to incorporate advanced design concepts such as state-of-the-art weapons and sensors, advanced stealth features and a high degree of automation for "improved survivability, sea keeping, stealth and manoeuvrability". The lead ship of Project 15B, INS Visakhapatnam, was the first of the class to be commissioned. Besides INS Mormugao, the other two destroyers are expected to be commissioned between 2023 and 2025.

What are the capabilities of INS Mormugao?

Regarded as "one of the most potent warships to have been constructed in the country", the destroyer is 163 metres long, 17 metres wide and displaces 7,400 tonnes when fully loaded. The ship is propelled by four gas turbines in a combined gas and gas (COGAG) configuration. The propulsion system allows the ship to achieve a speed of more than 30 knots (50km/h) and a maximum range of 4,000 nautical miles. It can accommodate a crew of about 300 personnel.

INS Mormugao's firepower comprises BrahMos surface-to-surface missiles (SSM), Barak-8 surface-to-air (SAM) missiles for a long range of shore and sea-based targets and a 76mm super rapid gun mount. The ship is armed with RBU-6000 anti-submarine rocket launchers and 533mm torpedo launchers. It is also equipped to carry and operate multi-role helicopters. Its enhanced stealth features ensure a reduced Radar Cross Section or radar signature. It is automated with sophisticated digital networks such as the Gigabyte Ethernet-based Ship Data Network (GESDN), the Combat Management System (CMS), Automatic Power Management System (APMS), Integrated Platform Management System (IPMS) and Ship Data Network (SDN). While the CMS performs threat evaluation and resource allocation based on the tactical picture compiled and ammunition available onboard, APMS controls power management. IPMS is used to control and monitor machinery and auxiliaries and the SDN is the 'information highway for data' from sensors and weapons. The ship has multiple fire zones, battle damage control systems, distributional power systems to enhance survivability in emergencies and a total atmospheric control system to protect the crew against nuclear, biological and chemical threats.

Built with over 75% indigenous content, the commissioning of INS Mormugao is a shot in the arm for India's self-reliance efforts and crucial for the 15-year Indian Naval Indigenisation Plan (INIP) 2015-2030 implemented in 2014 for indigenous development of its resources, equipment and to make the nation self-reliant in defence technology.

What is the strategic importance?

While India's interests are closely tied to the Indian Ocean, China has been rapidly expanding its naval footprint in the region. Amid growing Chinese strategic interests, India renewed its focus on bolstering its maritime capabilities in the region to counter the threat. During the commissioning ceremony of INS Mormugao, Defence Minister Rajnath Singh reiterated the government's resolve to prepare the nation to deal with any situation arising due to the changing global scenario. "Economic, political and trade relations between countries are constantly

evolving. The COVID-19 pandemic, the situation in the Middle East, Afghanistan and now Ukraine. It directly or indirectly impacts every country in one way or another. In this era of globalisation, almost all nations are dependent on each other in the field of trade. Hence, rule-based freedom of navigation, security of sea lanes etc. have become more important than ever for stability and economic progress of the world,” he said. The addition of a technologically advanced stealth warship to the naval inventory provides a strategic advantage to India and adds to the combat capabilities of the armed forces. Besides surface operations, guided missile destroyers are capable of engaging in anti-aircraft and anti-submarine warfare.

<https://www.thehindu.com/news/national/explained-the-ins-mormugao-and-its-capabilities/article66290203.ece>

ThePrint

Wed, 21 Dec 2022

New Satellite Images Show Major India-China Military Buildup in Arunachal’s Yangtse in Past Year

Over the past year, Indian and Chinese military have been beefing up their positions and infrastructure on Arunachal Pradesh’s Yangtse plateau, which witnessed a fierce clash between the two sides earlier this month, latest satellite images reveal. A series of high-resolution satellite images put out by Canberra-based think tank Australian Strategic Policy Institute (ASPI) show both armies initiated major construction projects along the Line of Actual Control (LAC) in the region over the last 12 months — from multiple defence outposts to key access roads within a few hundred metres of the LAC. With all eyes on the eastern Ladakh border, where India and China have been engaged in a standoff since May 2020, these satellite images highlight the dramatic shift in the region over the past year. “Although Indian forces occupy a commanding position along the ridgeline, their position is not impregnable, especially in a scenario of open conflict where these current positions may not hold up to a concerted assault,” reads the report by ASPI.

What the images reveal

The report, which aims to contextualise India-China border tensions by examining the terrain in which the clashes took place, mentions India’s defence strategies in the region, including a network of six frontline outposts of the Indian army, consisting of a few buildings and layers of stone walls, along the LAC. It also notes a forward base, approximately 1.5 km from the LAC. While citing numerous Indian armed forces basings in the valleys below the Yangtse plateau — connected by steep dirt tracks — the report adds that the Army has over the past year restored many roads on the Indian-controlled side of the plateau, besides constructing new dirt tracks.

The report also suggests that though India has a dominant position along the ridgeline, its position is vulnerable, especially in case of open assault since access roads to many of the larger Indian Air Force (IAF) bases in the region are extremely steep dirt tracks, vulnerable to erosion. “Satellite imagery shows that these roads are already suffering from erosion and landslides due to their steep grade, environmental conditions and relatively poor construction, and in open conflict, attacks on these dirt tracks would easily leave frontline positions cut off

from resupply.” On the Chinese positions and buildup, the report says that while their positions are much lower on the Yangtse plateau, the People’s Liberation Army (PLA) has over the past year made greater investment in infrastructure and construction of roads in the region than the Indian Army. “China has upgraded several key access roads and constructed a sealed road leading from Tangwu New Village to within 150m of the LAC ridgeline, enhancing their ability to send troops directly to the LAC. There is also currently a small PLA camp at the end of this road,” notes the report, while exploring how these developments on both sides of the Yangtse plateau in Arunachal Pradesh’s Tawang sector led to the clashes earlier this month. It further hints that it was the “construction of this new road that enabled Chinese troops to surge upwards to Indian positions during the 9 December skirmish”. Noting that China was strategically disadvantaged in the region, the report suggests that it compensated for this ‘tactical disadvantage’ by swiftly deploying land forces in the area.

The report claims China’s lower position along the plateau and more Indian troops on the commanding ridgeline along the LAC puts the PLA at a disadvantage in the case of small clashes such as the ones reported on 9 December, but the dynamic shifts in the case of more significant clashes. “But in a more significant conflict, the durable transport infrastructure and the associated surge capability that the PLA has developed could prove decisive, especially in contrast to the less reliable access roads that Indian troops would be required to use,” the report by ASPI argues.

<https://theprint.in/defence/new-satellite-images-show-major-india-china-military-buildup-in-arunachals-yangtse-in-past-year/1274351/>

THE ECONOMIC TIMES

Wed, 21 Dec 2022

Pakistan to Supply Arms to Ukraine through Firms in Eastern Europe

Pakistan is allegedly planning to dispatch ammunition including mortars, rocket launchers and artillery to Ukraine via a country in eastern Europe, ET has reliably learnt. The ammunition is being shipped from a port in Karachi to a port in an eastern European country bordering Ukraine. Pakistan had earlier this year played a critical role in transfer of arms on behalf of the UK to Ukraine.

Defence firms located in some eastern European states bordering Ukraine have also emerged as a gateway for transferring Pakistan-manufactured military equipment, ET has learnt. In return, Pakistan may receive Ukrainian assistance to upgrade its Mi-17 helicopters. A Ukrainian firm involved with manufacturing of aircraft engines as well as industrial marine gas turbines is allegedly assisting in upgradation of Pakistan helicopters, according to persons familiar with the matter. Islamabad-based arms supplier DMI Associates is working in collaboration with defence firms in eastern Europe for transferring orders placed by the Ukrainian military.

Ukraine and Pakistan share close military and industrial ties. It is well known that Pakistan had purchased over 320 Ukrainian T-80UD tanks in service with a fully formed ecosystem for their

upkeep, use, ammunition and spare parts. Between 1991 and 2020, Ukraine concluded arms contracts worth nearly \$1.6 billion with Pakistan. Islamabad has reportedly clinched a deal with Kyiv for the repair of its T-80UD fleet at a cost of \$85.6 million. Last year, Pakistan and Ukraine agreed to optimise military ties, particularly in the defence production, training, counter-terrorism activities, and intelligence domains, ET had earlier reported. ET had earlier reported that the Nur Khan air base in Rawalpindi was part of the air bridge allegedly used by the UK for military aircraft flights to Avram Iancu Cluj International Airport in Romania via a British air base in the Mediterranean to transfer arms to Ukraine.

The air bridge had avoided Iran and Afghanistan airspace and allegedly used the West Asian air space to transfer arms between August 6 and 15. A Globemaster plane was used to transfer the arms. A British Air Force C-17A Globemaster III (call sign: ZZ173) is also said to have been used for daily sorties between the aforementioned period using the Pakistan air bridge, ET had reported in September. Artillery ammunition for the Ukrainian army may have been ferried via this air bridge.

<https://m.economictimes.com/news/defence/pakistan-to-supply-arms-to-ukraine-through-firms-in-eastern-europe/articleshow/96407158.cms>

THE ECONOMIC TIMES

Wed, 21 Dec 2022

Russia's Defence Minister Sergei Shoigu Calls for Expanding Military

Russia's defence minister says the country's military must be expanded from its current 1 million personnel to 1.5 million amid the fighting in Ukraine. Defence Minister Sergei Shoigu said Wednesday that the number should include 695,000 volunteer contract soldiers. He didn't say when the military planned to reach the increased strength.

Shoigu also said the Russian military would form new units in the country's west in view of plans by Finland and Sweden to join NATO. Shoigu spoke during a meeting between Russian President Vladimir Putin and the top military brass.

<https://economictimes.indiatimes.com/news/defence/russias-defence-minister-sergei-shoigu-calls-for-expanding-military/articleshow/96403335.cms>

THE ECONOMIC TIMES

Thu, 22 Dec 2022

Russia to Continue to Strengthen Armed Forces: Vladimir Putin

The combat capability of the Russian armed forces is "increasing day by day" and Russia will certainly step up this process, President Vladimir Putin said. "Today, our goal is to implement

the entire scope of necessary measures to achieve a qualitative renewal and improvement of the armed forces," Putin added on Wednesday at an expanded meeting of the Russian Defence Ministry Board. He ordered the military to maintain and improve the combat readiness of the nuclear triad, which is "the main guarantee that our sovereignty and territorial integrity, strategic parity and the general balance of forces in the world are preserved".

The level of modern armaments in Russia's strategic nuclear forces has exceeded 91 per cent and "we will carry out all of our plans" to equip the strategic forces with the latest weapon systems, he said. Putin also stressed the importance of increasing the numbers of fighters and bombers operating in the zone covered by modern air defence systems, and called it "a pressing task" to upgrade drones, Xinhua news agency reported. While delivering a report at the meeting, Defence Minister Sergei Shoigu proposed to increase the number of the Russian armed forces to 1.5 million servicemen, including 695,000 contract soldiers.

<https://economictimes.indiatimes.com/news/defence/russia-to-continue-to-strengthen-armed-forces-vladimir-putin/articleshow/96411691.cms>



Wed, 21 Dec 2022

Russia almost Ready to Deploy Satan II Missile, Says Putin during Meeting with Officials

Russia's powerful 'Satan II' hypersonic missile will soon be ready for deployment, President Vladimir Putin confirmed during an end-of-year meeting with top Russian military officials on Wednesday. Satan II, also known as the RS-28 Sarmat, has the potential to carry at least ten warheads and accurately hit targets at a long distance with its range of 12,000 miles, according to Metro UK. It was test fired earlier this year in April. Discussing Russia's defence plans, Putin assured his top officials that Moscow will be successful in achieving all the goals of its ongoing conflict in Ukraine, thanks to Russian soldiers and military chiefs, who the Russian president labelled "heroes." Putin also claimed that NATO nations have been using their full potential against Russia.

"It's well known that today the military potential and capabilities of almost all major NATO countries are being actively used against Russia," he said, while urging officials of the Russian defence ministry to boost its operations by carefully evaluating all the data acquired about NATO forces. Putin touches upon NATO, partial mobilization in meeting with top officials. "All the information about NATO forces, the means which are actively used in the course of the special military operation [in Ukraine], to oppose us are well known. You have all this information before you, and it must be thoroughly analyzed, and used in the construction of our armed forces to increase the combat capabilities of the troops, as well as Russia's special services," he told officials, urging them to boost their efforts, Sputnik reported.

"I ask the Ministry of Defence to be attentive to all civilian initiatives, including taking into account criticism and responding correctly, in a timely manner," he emphasized. Furthermore, Putin acknowledged that the Kremlin's partial mobilization move that aimed to induct 300,000 reservists did not go as planned. "The partial mobilisation that was carried out revealed certain problems, as everyone well knows, which should be promptly addressed," he said. Earlier on

Friday, the Kremlin announced that Putin will be making “important” comments at the meeting, which coincides with Ukrainian President Volodymyr Zelenskyy’s visit to Washington, United States, where he will be meeting President Joe Biden and addressing the US Congress.

<https://www.republicworld.com/world-news/russia-ukraine-crisis/russia-almost-ready-to-deploy-satan-ii-missile-says-putin-during-meeting-with-officials-articleshow.html>



Wed, 21 Dec 2022

Russia’s Zircon Hypersonic Missiles to Enter Combat Duty by Jan 2023; Serial Deliveries Begin for Navy

Russia has launched serial deliveries of Tsirkon/Zircon hypersonic missiles to the Russian Navy, Defense Minister Sergey Shoigu confirmed. “We have launched serial deliveries of the Navy-based Tsirkon hypersonic missiles,” Shoigu said. “The frigate Admiral of the Fleet of the Soviet Union Gorshkov with top-notch Tsirkon seaborne hypersonic missile systems undergoes final preparations before embarking on a mission in the world ocean.” President Vladimir Putin said at the meeting that Admiral Gorshkov, armed with Tsirkon hypersonic missiles, would begin combat duty by January 2023. Putin also said that Russia would maintain combat readiness and improve the nuclear triad, which is the main guarantee of Russia’s sovereignty. “We will continue to maintain combat readiness and improve the nuclear triad. This is the main guarantee of preserving our sovereignty and territorial integrity, strategic parity, and general balance of power in the world,” Putin said at a meeting of the Russian Defense Ministry board.

The president added that modern weapons made up 91% of Russia’s strategic nuclear forces. Russia’s newest land-based intercontinental ballistic missile (ICBM), Sarmat, will be put on combat duty in the near future, Putin said. “Successful launches of the Sarmat heavy intercontinental ballistic missile during state tests made it possible to start working on its deployment,” Russian Defense Minister Sergei Shoigu said.

The Sarmat system is meant to replace RS-20 Voevoda missile systems. The new missile is capable of striking targets at long ranges using various flight trajectories and is guaranteed to overcome any existing and prospective anti-missile defense systems. Having the longest range of target engagement, Sarmat is also expected to reinforce the combat capabilities of the Russian strategic nuclear forces. The first test launch of the Sarmat missile was carried out on April 20.

The Russian nuclear triad will be also replenished with the first strategic bomber, Tu-160M, Shoigu added. Putin said that the nuclear triad, the aerospace forces, and the navy made up Russia’s strengths and, as such, were maintained in good condition. However, more work needed to be done to improve the country’s ground forces and communications systems, according to the president. At the same time, Putin noted that Russia has everything it needs to build up military potential using its own scientific, technological, industrial, and personnel resources without damaging its economy and social sectors.

Partial Mobilization

Partial mobilization in Russia was conducted to stabilize the situation on the front, defend the country's new territories and create conditions for a further offensive, Russian Defense Minister Sergei Shoigu said. "Stabilization of the situation, protection of new territories and further offensive operations required the increase in fighting strength of our troops. Partial mobilization was conducted for that purpose," Shoigu said at a collegium meeting at the Defense Ministry. The minister noted that Russia had not carried out mobilization and related activities since the end of World War II, which was why the country faced some difficulties at the early stage of the partial mobilization. As many as 300,000 Russian citizens were drafted as a result of the mobilization. Another 830,000 Russians were exempted from it since they work at socially, militarily and economically significant facilities and another 20,000 people joined the special military operation as volunteers.

Russian President Vladimir Putin ordered partial mobilization in the country on September 21, the day after the Donetsk and Luhansk breakaway republics, as well as the Russian-controlled parts of the Zaporizhzhia and Kherson regions, scheduled referendums on accession to Russia. The partial mobilization was prompted by the need to control the 1,000-kilometer (621-mile) contact line between Ukrainian- and Russian-controlled territories, according to Shoigu.

<https://eurasianimes.com/russias-zircon-hypersonic-missile-to-enter-combat-duty-by-jan-2023/>



Wed, 21 Dec 2022

China, Russia Begin Naval Drills in Waters near Taiwan, Japan

By Minnie Chan

China and Russia kicked off a week of naval drills in the East China Sea on Wednesday, the closest they have been held to the Taiwan Strait since the annual war games began a decade ago. China's defence ministry said the exercise, known as Joint Sea 2022, would be held in waters off the coast of eastern Zhejiang province. The area spans from Zhoushan to Taizhou, which is about 350km (about 200 miles) from the Taiwan Strait. Military analysts said the drills aimed to send a message to self-ruled Taiwan – which Beijing regards as part of China – as well as to Japan over a new security strategy to boost its military strength unveiled last week. China has sent five warships – two destroyers, two frigates and a supply ship – and a submarine, as well as early warning aircraft, an anti-submarine patrol plane and ship-borne helicopters to take part in this week's drills, according to a report in military mouthpiece PLA Daily on Wednesday.

Russia's defence ministry on Monday said a detachment of its Pacific Fleet had left the far eastern port of Vladivostok on the weekend to join the exercise. It included a missile cruiser, the Marshal Shaposhnikov anti-submarine destroyer, two corvettes, a supply ship and aircraft. "The Marshal Shaposhnikov is the largest and most powerful anti-submarine destroyer in the Russian navy, meaning anti-submarine exercises will be a key part of the drills," according to Beijing-based naval expert Li Jie.

Li said that could be a response to Taiwan's indigenous submarine programme, noting that the exterior of the first vessel in the fleet appeared to resemble the design of Japan's Soryu-class

submarine, according to openly available information. “As well as the exterior design, Taiwan’s indigenous submarines will also use lithium batteries – like Japan’s Soryu-class sub, which suggests Tokyo may have transferred some of its submarine technologies to Taipei,” Li said.

Taiwan’s navy is expected to take delivery of its first locally built submarine by September 2024 – a year ahead of schedule – after the first and most important phase of construction was completed in 2021. Zhou Chenming, a researcher with the Yuan Wang military science and technology think tank in Beijing, said the joint war games were mainly aimed at Japan over the changes to its defence and national security strategy. The move will see Japan’s security budget reach 2 per cent of gross domestic product by 2027 – double the informal cap of 1 per cent of GDP that has been in place since 1976. “Japan’s increased defence spending is obviously aimed at Beijing – that’s why the location for the China-Russia military drills is the East China Sea, which is also close to Japanese waters,” Zhou said.

According to the PLA Daily report, the war games will include a joint blockade and air defence exercises with rockets and artillery fire, as well as rescue and anti-submarine drills. It said the exercises aimed to “further deepen” cooperation and highlighted the two sides’ determination to deal with maritime security threats and safeguard international and regional peace and stability.

https://www.scmp.com/news/china/military/article/3204157/china-russia-begin-naval-drills-waters-near-taiwan-japan?module=perpetual_scroll_0&pgtype=article&campaign=3204157

THE ECONOMIC TIMES

Wed, 21 Dec 2022

France Sends Air Defence Missiles to Ukraine: Emmanuel Macron

France has delivered more air defence missile systems and other weapons to Ukraine and will send more early next year, French President Emmanuel Macron said in an interview aired Tuesday. "In recent days, France has sent Ukraine more arms, rocket launchers, Crotale (air defence batteries), equipment beyond what we had already done," Macron told France's TF1 and LCI television. He was speaking aboard the French aircraft carrier Charles de Gaulle off Egypt's coast, a day before visiting Jordan for a regional summit on Tuesday. "We are also working with the armed forces minister (Sebastien Lecornu) to be able to deliver useful arms and ammunition again in the first quarter (of 2023), so that the Ukrainians would be able to defend themselves against bombardments," said Macron.

The planned shipments include new Caesar mobile artillery units, but Macron provided no precise figures. The president said the number "will depend" on the outcome of ongoing discussions with Denmark, which had ordered the Caesar guns from France and may agree to give at least some of them to Kyiv. Since Russia's invasion in February, France has sent Ukraine 18 Caesar units, a 155-mm howitzer mounted on a six-wheeled truck chassis, capable of firing shells at ranges of more than 40 kilometres (25 miles).

Macron said that he had two "red lines" when it came to arms deliveries: that it did not affect France's ability to defend itself, and did not make Paris a co-belligerent in the war. The arms were to "enable Ukraine to defend itself" in the face of a relentless barrage of Russian missiles

and drone attacks, he said. Paris has also already delivered anti-tank and anti-aircraft missiles, as well as armoured personnel carriers. The 44-year-old leader also repeated his controversial statement that Russia would require security guarantees as part of a negotiated end to the conflict. Critics in eastern Europe and Ukraine believe Macron should not be publicly raising making concessions to Russia, at a time when its army is occupying parts of Ukraine and deliberately targeting civilians.

"If anyone criticises me for projecting forward to this issue, let them explain what they are proposing," Macron said in the interview. "What the people who refuse to prepare or work for it are proposing is total war. It will affect the whole continent," he added. Macron maintains that only Ukraine should define the terms of any armistice with Russia, not the country's Western backers.

<https://economictimes.indiatimes.com/news/defence/france-sends-air-defence-missiles-to-ukraine-emmanuel-macron/articleshow/96403442.cms>

THE ECONOMIC TIMES

Thu, 22 Dec 2022

US to Provide \$1.85 Billion Military Aid to Ukraine, Including Critical Patriot Missile System

The Biden administration has announced that it would provide its key Patriot missile defence system to Ukraine to assist it in its fight against Russia. The Patriot missile system can be used as a shield against short-range ballistic missiles, cruise missiles, and incoming jets. This will be the first-ever handover of such a defence system to Ukraine and strengthen the Ukrainian defence. The new systems aim to assist Ukraine in improving its air cover, as the country has recently faced several problems, including power outages, due to Russian missiles. The White House stated that the Patriot missile system would be part of another £1.53 billion (\$1.85 billion) in aid to Ukraine.

The package also includes military vehicles, mortars, ammunition for HIMARS (High Mobility Artillery Rocket Systems), and small arms. Meanwhile, an expert claimed that although the transfer of the defence system is a significant aid to Ukraine, it would make only a "minor difference." The package consists of only one Patriot battery, which will have eight launchers, each having a capacity of four missile interceptors.

The aid has been announced at a time when Ukrainian President Volodymyr Zelensky is visiting the US to strengthen the military ties between the two countries. Notably, the US had previously been reluctant to supply the system to Ukraine due to a possible response from Russia. Earlier, Russia had warned that a missile system like the Patriot would be considered a "provocative move" by the US.

<https://economictimes.indiatimes.com/news/international/us/us-to-provide-1-85-billion-military-aid-to-ukraine-including-critical-patriot-missile-system/articleshow/96407930.cms>

Zelensky Visits US: A Renewed Pitch for ATACMS, Reaper Drones, Abrams Tanks & Fighter Jets to Push Back Russian

By Sakshi Tiwari

During a speech to a joint session of Congress, Zelenskyy said Ukrainian armed forces are capable of operating American tanks and aircraft. Kyiv has been requesting Abrams tanks and fighter jets to use against Russia amid its special military operation in Ukraine. “I assure you that Ukrainian soldiers can perfectly operate American tanks and planes themselves,” Zelenskyy said on Wednesday night.

Earlier on Wednesday, a Fox News correspondent said Zelenskyy was expected to ask Congress for additional Patriot air defense systems, High Mobility Artillery Rocket Systems (HIMARS), long-range Army Tactical Missile Systems (ATACMS), and DPICM cluster munition, US battle tanks, and the start of pilot training.

Russia launched its special military operation in Ukraine on February 24 after the Donetsk and Luhansk people’s republics appealed for help defending themselves against Ukrainian provocations. In response to Russia’s operation, Western countries have rolled out a comprehensive sanctions campaign against Moscow and have been supplying weapons to Ukraine. Incidentally, the visit, which was in the works for a long time, corresponds with the announcement of a 1.8 billion dollar military package for Ukraine. For the first time since the war began, the massive aid includes Patriot missile defense battery and precision-guided bombs for Ukraine’s fighter jets. Approximately \$1 billion in weapons from Pentagon stockpiles and another \$800 million in funding through the Ukraine Security Assistance Initiative, which funds weapons, ammunition, training, and other assistance, will be included in the package. While the delivery of Patriot marks a significant shift in Washington’s approach, the Ukrainian President has been interested in longer-range lethal weapons. For several weeks now, Kyiv has requested more sophisticated weapons from the Biden administration, which they claim may pave the door for victory. While the Biden administration has vowed to continue assisting Kyiv in its fight against Russian forces inside Ukraine, American officials have refused to provide any aid that would enable Ukrainians to fire long-range missiles at Russian positions inside Russia, which Kyiv claims are essential for regaining lost ground and putting Russia on the defensive.

The Ukrainian delegation is anticipated to make yet another round of requests for long-range Army Tactical Missile Systems, or ATACMS, as well as Gray Eagle and Reaper drones. “For us, the strategy is to continue attacking because we cannot afford to freeze the frontline. We need to press constantly,” said Oleksandr Danylyuk, Ukraine’s former national security adviser. “We have reached the limit of what we can do with the advanced weapons the US has already provided. For the next stage, we need the longer-range weapons to achieve [our] goals,” he said.

The US and other NATO allies have made progress — albeit slowly — in granting such requests, striving to assess their potential utility on the battlefield and whether they needed additional training and specialized transportation. For instance, the US-dominated NATO

alliance has been sitting over Ukraine's request to arm its Air Force with Western-made advanced fighter jets. The move, it is believed, would breach the red lines with Russia. However, Washington has given the green light to Germany to supply its Leopard-2 Main Battle Tanks. If Berlin takes an affirmative decision, it would be the first-ever Western tank to reach Kyiv. The approach, thus, has been selective and well-calibrated against risks. Against that backdrop, a request for ATACMS might not find an audience in the US Congress.

Ukraine Wants ATACMS, But US Unlikely To Budge

President Zelensky's visit to Washington comes when Russia is constantly pounding its energy infrastructure to cripple the country with Iranian kamikaze drones and cruise missiles. The Ukrainian demand for long-range weapons like the ATACMS, thus, comes at an opportune moment. The MGM-140 ATACMS is a 610-millimeters tactical ballistic missile manufactured by Lockheed Martin. It has been claimed that the missile can reach supersonic speeds of Mach 3.5, making it nearly impossible to intercept. Most importantly, the ATACMS can hit targets up to 300 kilometers against the 84 kilometers possible by the GMLRS currently in use with Ukraine's Armed Forces. Such a long-range strike capability packed with a powerful punch will allow Ukraine to obliterate any high-value target inside Russia. Russian officials have warned the US against supplying a long-range weapon like ATACMS to Kyiv.

Russian Foreign Ministry spokeswoman Maria Zakharova said in a briefing on September 15: "If Washington decides to supply longer-range missiles to Kyiv, then it will be crossing a red line and will become a direct party to the conflict." Russia had warned the US against supplying the Patriot missile defense to Ukraine, saying it would become a legitimate target for Russian attacks. However, the PAC-3 Patriot missile battery is a defense system to protect against Russian ballistic missiles. In contrast, the ATACMS would deal a severe blow to Russian troops deep inside their territories. American officials are unwilling to respond positively to Kyiv's pleas. Sending the ATACMS has been categorically refused by the White House. They have reasoned that sending long-range missiles to Kyiv would put Putin in a position where they could use deadlier weapons against Ukraine.

The US Air Force (USAF) is keen to send its older Reaper drones to Ukraine. However, the Pentagon has been unresponsive, frustrating the Ukrainian leadership. The service suggested giving Ukrainian forces access to its older Reaper drones a month after Russia seized Ukraine in February. However, there have been concerns that the delicate technology of these drones could end up in the hands of the Russians, given that some drones would most likely be shot down. Officials in the Biden administration concur that the situation in Ukraine is dangerous. According to a senior US official, the situation on the ground is likely to worsen this winter due to Russia launching more missiles at Ukraine's military and vital infrastructure. This will cause more civilians to evacuate to other parts of Ukraine and neighboring nations.

<https://eurasianimes.com/zelensky-visits-us-a-renewed-pitch-for-atacms-reaper-drones-abrams/>

Science & Technology News



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Ministry of Science & Technology

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Improved, Heavy Rare Earth-free, Low-cost Magnets for EV Vehicles could Reduce Mobility Costs

Scientists have fabricated improved low cost heavy rare earth-free high Nd-Fe-B magnets, which are in high demand for Electric Vehicles and can make them more affordable. More than 90% of EVs use brushless DC (BLDC) motors made up of rare earth Neodymium Iron Boron (Nd-Fe-B) magnets. Since its discovery by Sagawa in 1984, the Nd-Fe-B magnet has been one of the most sought-after permanent magnetic materials for many applications due to its exceptional combination of magnetic properties.

Nd-Fe-B magnets used in EVs operate at high temperatures of 150 – 200oC and need to exhibit high resistance to demagnetization, a capability that pure Nd-Fe-B magnets do not have. Hence Dysprosium (Dy) metal is added as an alloy to improve the resistance to demagnetization. World over, researchers are trying to enhance coercivity (resistance to demagnetisation) of Nd-Fe-B magnets without the addition of costly Dy. A strategy adopted by the research community to enhance coercivity is to enrich the region between the grains of the Nd-Fe-B magnet with “non-magnetic” elements through suitable heat treatments (grain boundary diffusion).

Recently, scientists from the Centre for Automotive Energy Materials at the International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), an autonomous Research and Development Centre of the Department of Science and Technology (DST), Govt. of India, have enhanced the coercivity of Niobium (Nb)-containing Nd-Fe-B melt-spun ribbon by grain boundary diffusion process (GBDP) using a low melting point alloy of Nd70Cu30 which acts as the source for the “non-magnetic” element. They have reported restricted grain growth during grain boundary diffusion due to the precipitation of Nb, which facilitates the enrichment of Copper (Cu) at the grain boundaries aiding the increased resistance to demagnetization of Nd-Fe-B powders. The coercivity value of 1 T at 150oC critical for automotive applications achieved in this research published in Materials Research Letter could be a useful strategy to develop magnets without Dy for EV applications. ARCI has ventured into setting up of pilot plant for manufacturing of near net shaped Nd-Fe-B magnets through a major project funded by the Science and Engineering Research Board (SERB) in line with the Atmanirbhar Bharat mission of the Government of India, and the above strategy will be explored for the magnets manufactured in the pilot plant. The new strategy could also be used for

commercial production of Nd-Fe-B magnets in India, reducing imports that meet the major requirements of the automotive sector.

Publication link: <https://doi.org/10.1080/21663831.2022.2104139>

<https://pib.gov.in/PressReleasePage.aspx?PRID=1885270>



Wed, 21 Dec 2022

Fostering Flight: India's Plan for Indigenous Drone Manufacturing

Unmanned Aerial Vehicles (UAVs), also known as drones, are witnessing development in India that is comparable to that of electric vehicles and other emerging sectors. There is no limit to the possibility of the uses that may be found for drones, which include delivering food, increasing workplace productivity, increasing agricultural yields, and improving the effectiveness of the defence forces. The Government aims to make India a Global Drone Hub by the year 2030, which will cause the domestic drone industry to see explosive growth.

In the fiscal year 2020, the unmanned aerial vehicle (UAV) market in India was valued at \$830 million, and it is anticipated that it will increase at a compound annual growth rate (CAGR) of 14.5% during the period 2021–2026, despite the impacts of the worldwide pandemic on several sectors of the economy. The government projects that the whole revenue generated by the drone manufacturing industry will increase to Rs 900 crores by the end of the financial year 2024.

The Ministry of Civil Aviation (MoCA) issued a brand new collection of drone laws and regulations in June 2021. These laws and regulations apply to everyone who flies an unmanned aerial vehicle (UAV) in India. Suppose an operator does not qualify for an exemption under the new regulations, they will be required to submit an application for and be issued a one-of-a-kind identification number in order to fly a UAV. UAV operators will need to submit details on the Digital Sky platform, a programme headed by MoCA to control UAV operations and traffic in India. In order to get this identification number, UAV operators would be required to comply with this requirement. Additionally, the governments of a few Indian states have developed their own one-of-a-kind UAV policies in an effort to entice investments in this sector. Recently, Prime Minister Narendra Modi opened an event called “Drone Mahotsav” to promote the drone industry. During his speech, he highlighted the significance of drone technology in a variety of fields, including agriculture, tourism, disaster management, and the military.

The Indian drone sector is expected to produce total revenue of Rs. 15,000 crores by the year 2026, according to a prediction made by the Minister of Civil Aviation, Jyotiraditya Scindia. Says Smit Shah, the president of the Drone Federation of India, the market for drones in India is expected to reach Rs 50, 000 crores during the next five years and Rs 30,000 crores within the next three. The number three customer of unmanned aerial vehicles (UAVs) with military capability is India. At the moment, India gets certain components from China, the United States of America, and Europe. India plans to manufacture its own drones and take full control of the

supply chain for the technology. India is also expected to manufacture its own silicon chips, but this is a long-term plan. Between August 2021 and February 2022, the number of drone-based enterprises in India increased by 34.4%. The primary contributor to this growth was the introduction of the Production Linked Incentive (PLI) plan in August 2021. The PLI programme prohibits the importing of drones as well as allots Rs. 120 crores over the course of three years for the development of drones. It was projected that this strategy would result in a doubling of the overall sales of all Indian drone manufacturers. Because there is currently some trepidation regarding Chinese drones, India may see a shift in the demand for Chinese drones. The fact that information goes back to China, which is where the servers are, poses a threat to the confidentiality of the data. As a direct consequence of this, drones manufactured in India are in high demand all over the world.

In India, there are over 200 drone startup companies, and the number is expanding. Garuda Aerospace is the largest drone production facility in India and plans to build 1 Lakh UAVs next two years. And the country will become a hotspot for drone technology and will need at least one million drone pilots by the end of next year. Currently, drones perform different tasks in India. The police use them to monitor traffic, while border security personnel use them to look for smugglers and traffickers. They are also becoming increasingly prevalent in the agricultural sector, where they are used to monitor crop health and apply fertiliser and pesticides. Although India has declared a goal of becoming a hub for drones by 2030, one must be careful because the country currently needs an ecosystem and technological initiatives. The sector requires a competent regulator who can oversee safety and assist in the development of a drone air traffic control system. This will become increasingly critical as aircraft size increases. India also lacks the network of companies required to manufacture all of the drone's components. Currently, many components, including batteries, motors, and flight controls, are imported. However, the Government is optimistic that an incentive programme will assist domestic enterprises to grow.

<https://www.financialexpress.com/defence/fostering-flight-indias-plan-for-indigenous-drone-manufacturing/2922067>



Wed, 21 Dec 2022

Threatened Tiger, Daring Dragon: Indo-China Equation in the Age of Artificial Intelligence

By Girish Linganna

A country is always at war. Even in the backdrop of diplomatic relations, strengthened ties, adherence to political borders, there goes on a covert effort to create inroads that can be exploited to undermine the other. Once the realm of strictly intelligence agencies, the information age has thrust upon the globalised world means of readily exploiting and plotting the adversary without even physically crossing the boundaries.

Something so sinister often in conspiracy theories, but is it?

The Curious Case of Big Data

Big Data is a peculiar buzzword that everyone knows of but not about. This catch all term refers to various technical concepts centred on capturing any and all data generated by a user. What does it mean for an average Joe? Most businesses use some kind of service to capture data about the users frequenting their website or app. Google Analytics, one of the most popular tracking services, collects anonymised data at a larger level about the number of users, their sessions, approximate location, the kind of device and browser they use. This seems boilerplate until you see the exhaustive list of parameters collected by Google.

Google Analytics tracks events triggered by your interaction with the website. When you click an ad, even when you only look at an ad, when you remove an app, when you first open an app. Even when you clear or remove app data on your device or something as simple as scroll, Google knows and collects it. Apart from your interaction with the website, Google not only knows but also passes on to the website or app your age, city, device brand, device model, etc. Surely, Google ensures the data passed on is anonymised, but just because your information is anonymised when passed on will not necessarily preserve your privacy.

The Myth of Anonymity

In 2017, those who grew up with Pokémon, a popular game franchise, rejoiced as it released its mobile game, Pokémon Go, wherein players would use augmented reality to participate. The game was developed on top of Google Maps. The premise was to give users locations to go to where they could capture Pokémon. Sounds like a fun way to get the gamers to touch grass? The Chinese government disagrees. The Chinese government swiftly moved to ban the game's release in the country citing consumer safety and threat to national security. What can a game do to a country's national security?

Strava, an app used by fitness enthusiasts to track their runs, cycling, etc, released a map in November 2017. After each run, Strava generates a heat map which not only tracks what route the user took but also their effort with a colour. So, if you ran through a stretch, it would be shown as red while that peculiar uphill section would obviously be green. A worldwide map, of all users and their runs, would surely be a motivation for all. It would also be a threat to national security. And that is exactly what happened. In Syria, Afghanistan and Djibouti, soldiers at various US military bases kept in shape for the job by tracking their runs on the app. When the map was released, many wondered who was running in these war torn areas, in the middle of a desert. By overlaying anonymised data with a map, it exposed several American military bases. Zooming in on these also revealed the military base's internal layout. The global pastime, TikTok, owned by a Chinese company Bytedance, has often been accused of aggressive data collection. In 2021, TikTok updated its US privacy policy to collect biometric data from the user's device including fingerprints and face unlock. The policy also mentioned 'voiceprints' without specifying any definition of either. This seemingly deliberate vagueness raised questions about their objectives. In fact, many analysts point out how TikTok in China is vastly different from the one in the US. The Chinese version promotes academic and athletic achievements instead of dancing on trendy songs as in the US. The algorithm also includes a youth mode which limits the usage of those under 14 years of age to only 40 minutes a day and a shutoff time of 10 PM.

Dragon in the Backyard: India's Challenge

If apps can be data hoarders of such scale, what about the actual device you use? With Chinese manufacturers undercutting the industry with cheap entrants, paired with customised operating systems, customised system apps, etc, one begs the question, what is the threat posed by these mobile phones to the users and the nation at large. In today's globalised world, it will be impossible to cut off any country let alone a tech giant like China; however, we can pick and choose who we trust. In the mobile phone space, the only major competitor is the South Korean giant, Samsung. Since 2020, Indian agencies have been investigating various Chinese apps that have been running scams in India. Many of these would lend money and use extortion to get much more than the agreed amount. These apps first took permissions to look at files, then downloaded entire user data onto a server. Many of the users stored private data including private images that they were threatened with. Because the app also collected their entire contact list, the scammers threatened to share all these images with their entire contact list.

Many now opine that India not only lags behind China by a decade but may slip towards digital colonisation. China has always set sights on the US as a competition and has repeatedly tried to weaponize its AI to leapfrog ahead of the US to achieve global domination. For India, the challenge is to sustainably open up its population to AI, for many lurk to pounce upon and eat up the nation from within.

<https://www.financialexpress.com/defence/threatened-tiger-daring-dragon-indo-china-equation-in-the-age-of-artificial-intelligence/2922173>



Wed, 21 Dec 2022

Gaganyaan Mission Delayed: Indian Astronauts to be Launched to Space in Late 2024

Amid continuous delays, the Gaganyaan mission has once again been pushed behind as the Indian Space Research Organisation continues to develop and test systems for India's maiden human space mission. The Gaganyaan mission will now launch in the fourth quarter of 2024.

Science & Technology Minister Dr. Jitendra Singh on Wednesday said that India's maiden human space flight 'H1' mission is targeted to be launched in the fourth quarter of 2024. The minister in a written reply informed that the paramount importance is that of the safety of the crew. "Two Test Vehicle missions are planned before the 'H1' mission to demonstrate the performance of the crew escape system and the parachute-based deceleration system for different flight conditions," Dr. Jitendra Singh said. He added that the uncrewed 'G1' mission is targeted to be launched in the last quarter of 2023 followed by the second uncrewed 'G2' mission in the second quarter of 2024, before the final human space flight 'H1' mission in the fourth quarter of 2024. The minister further informed that, "the first uncrewed flight of Gaganyaan programme 'G1' mission is aimed at validating the performance of the human rated launch vehicle, Orbital module propulsion system, mission management, communication system, and recovery operations. The mission will carry a humanoid as a payload."

The astronauts, who have been selected from the Indian Air Force are currently undergoing mission-specific training at Bengaluru. The astronaut designate have already completed the first-semester training, wherein they have undergone course modules on Theoretical basics, Space medicine, Launch vehicles, spacecraft systems, and ground support infrastructure.

"Regular physical fitness sessions, aeromedical training, and flying practice are also part of crew training. Corresponding evaluation and assessment activities have also been completed. The second semester of crew training is currently in progress," the minister added. ISRO in November this year conducted the Integrated Main Parachute Airdrop Test (IMAT) of its crew module deceleration system. The test was conducted at the Babina Field Fire Range (BFFR) in the Jhansi district of Uttar Pradesh during which a 5-ton dummy mass, equivalent to the Crew module mass, was taken to an altitude of 2.5 kilometers and dropped using the Indian Air force's IL-76 aircraft. The test simulated a unique situation when one main parachute failed to open. Experts had already indicated that the mission is likely to face another two years of delay as Isro focuses on perfecting the system that will launch and land Indians on missions to space. Gaganyaan was initially planned to be launched in 2022 to mark India's 75th year of independence. However, it faced several setbacks due to the Covid-19 pandemic and successive lockdowns.

<https://www.indiatoday.in/science/story/gaganyaan-mission-isro-indian-astronauts-to-be-launched-to-space-in-late-2024-2311920-2022-12-21>



Thu, 22 Dec 2022

The 'Invincible Originality' of Srinivasa Ramanujan

By S. Varahasimhan

Opinion

It was Shakespeare who said, "To hold as 'twere, the mirror up to nature".

The English computer scientist Alan Turing's "imitation game" or "Turing test" takes the stance that a machine successfully represents a human if it responds to a question like a human mind does. From Plato's mimesis (representation) as the principle of art, to the Turing test, and to recent progresses in artificial intelligence, "the key to artificial intelligence has always been the representation" (Jeff Hawkins).

Taking representation further, can a machine "create" new things? Latest advancements in technology have attempted to "create". The recent buzz around ChatGPT (Chat Generative Pre-trained Transformer), a software tool that can answer questions on almost any topic, carry on conversations with humans, write poems, computer programs and perform many more complex tasks that require intelligence, is testimony that artificial intelligence can "create". One can also mention here Google's product LaMDA (Language Model for Dialogue Applications) that is similar to ChatGPT and other sophisticated products (Dall E) that can create image from verbal descriptions. Broadly speaking, the products mentioned above learn to be creative from already existing information: human conversations and documents and pictures, to synthesise and create.

Research by a machine

Extending these capabilities, can a machine do research? In early 2021, a team of Israeli scientists announced a software tool called The Ramanujan Machine that creates mathematical conjectures which are equations without proof. Mathematicians then prove or disprove these conjectures, thereby establishing theorems. Conjectures in mathematics shed light on newer frontiers that otherwise lurk in tenebrous corners. Srinivasa Ramanujan was famous for such conjectures. From 1904 till his passing in 1920, Ramanujan, recorded more than 3,000 equations that were mostly conjectures because he did not supply proof. The American mathematician Bruce C. Berndt, an expert on Ramanujan's works, says that most of Ramanujan's conjectures are correct as established by the proofs provided *pari passu* with their generalisation in the last 100 years.

'Unparalleled ability'

How does the Ramanujan Machine imitate Ramanujan? To understand this, one may consider Ramanujan's formulae on π ($22/7$ is only an approximation to π). In 1914, Ramanujan published multiple formulae to compute using modular equation which is, roughly speaking, an equation in x that equals the same equation in powers of x , i.e., x^n ; the solutions of the equation were manipulated to yield the decimals of π to astonishing accuracy. The mathematicians J.M. Borwein and P.B. Borwein who computed to great accuracy in the 1980s said, "Ramanujan was unparalleled in his ability". However, the Ramanujan Machine adopts a different approach to compute formulae for mathematical constants such as π , e , etc. It does so by taking a mathematical structure such as a continuous fraction on one side of an equation and the mathematical constant such as π on the other side, with the two sides yet to be matched. The software then employs high computing power and algorithms to iteratively match both sides and a conjecture is discovered. In the last couple of years, dozens of conjectures have been discovered this way.

Is this advancement a pronouncement that Ramanujan's creativity was held high solely by the stanchions of his calculating speed and memory? Mathematicians aver that Ramanujan's intuition, as seen in his works, was non pareil; Ramanujan could connect different mathematical domains deeply with "invincible originality" (G.H. Hardy). The ramifications of such connections between mathematical abstractions that Ramanujan was prescient of have continued to unravel for over a century now, leading to remarkable technological applications. For example, elliptic curves are widely studied in number theory because of their properties that have applications in cryptography which make computer network communications secure. Ramanujan's contributions here are significant: he developed certain equations called class invariants which generate elliptic curves suitable for encryption and this led to Elliptic Curve Cryptography, an efficient cryptographic technique, in 1985, many decades after his demise.

A leap of genius

Another instance of his originality was his discovery of mock-theta functions, his swan song; working on it might have been a palliative to him in his painful last days. George Andrews, an American mathematician and an expert on mock theta function, elegantly surmised that Ramanujan might have discovered it by starting from hypergeometric series whose consecutive terms form ratios that follow a pattern. George Andrews adds that it is a plausible method to arrive at mock-theta functions "provided you had the genius to recognize". In the light of such deep insights from Ramanujan, George Andrews remarked on the eponymous machine, "I expect

its role to be that of an important auxiliary tool.” Formulae involving fundamental constants such as π have been discovered only sporadically in mathematical history; and by making such discoveries automatic and more frequent, the machine can lead to more frequent mathematical advancements. In general, artificial intelligence tools are expected to make things happen faster because they now imitate cogitation. As for Ramanujan, he is inimitable even in the age of artificial intelligence — as any genius is.

<https://www.thehindu.com/opinion/op-ed/the-invincible-originality-of-srinivasa-ramanujan/article66289747.ece>

