

अप्रैल

April
2023

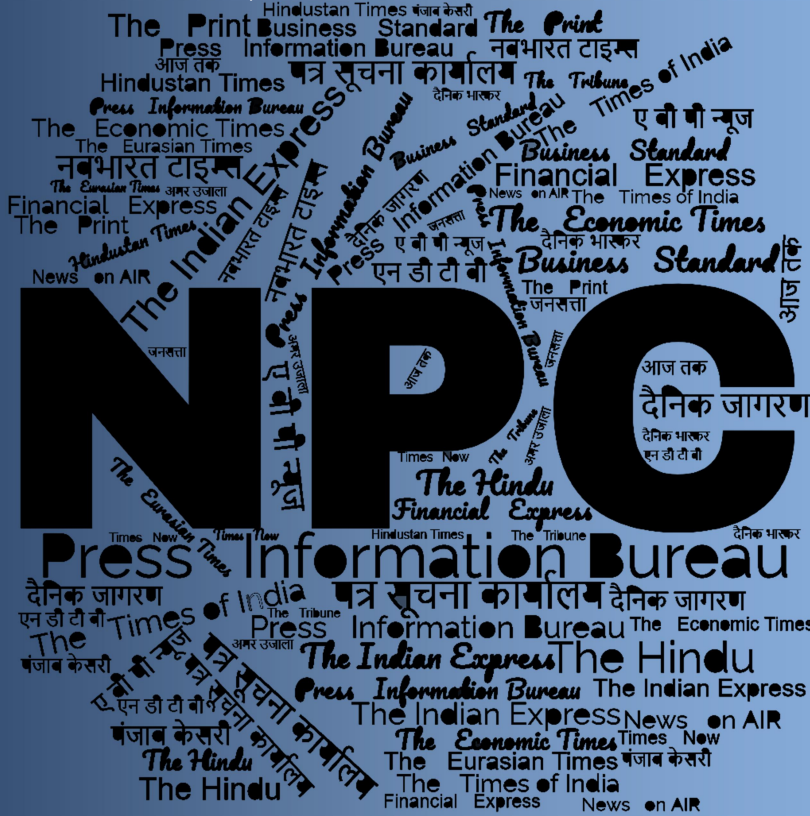
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समाचार पत्रों से चयित अंश Newspapers Clippings

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

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology



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Fri, 07 Apr 2023

DRDO ने एंटी-सबमरीन ASW रॉकेट RBU-6000 का सफल परीक्षण किया, दुश्मन की पनडुब्बियों की अब खैर नहीं

भारतीय नौसेना (Indian Navy) के युद्धपोतों में लगे एंटी-सबमरीन रॉकेट RBU-6000 के एक्सटेंडेड वर्जन का सफल परीक्षण किया गया है. टेस्टिंग डीआरडीओ (DRDO) ने किया. पहले इस रॉकेट की रेंज पांच किलोमीटर थी, जो अब बढ़कर दोगुनी हो गई है. ये ऐसा रॉकेट है जो दुश्मन की पनडुब्बियों को समंदर में दफना सकता है. परीक्षण भारत के जंगी जहाज आईएनएस चेन्नई (INS Chennai) पर किया गया.

इस रॉकेट सिस्टम को दुनिया की 20 सेनाएं इस्तेमाल कर रही हैं. भारतीय नौसेना के कई जंगी जहाजों पर यह सिस्टम तैनात है. ये हैं- राजपूत क्लास डेस्ट्रॉयर, दिल्ली क्लास डेस्ट्रॉयर, कोलकाता क्लास डेस्ट्रॉयर, विशाखापट्टनम क्लास डेस्ट्रॉयर, तलवार क्लास फ्रिगेट, शिवालिक क्लास फ्रिगेट और कमोर्ता क्लास कॉर्वेट. यह 213 मिलिमीटर कैलिबर वाला सोवियत जमाने का रॉकेट लॉन्चर है.

इस रॉकेट लॉन्चर सिस्टम को सोवियत संघ ने बनाया था. इसका पूरा नाम है RBU-6000 Smerch-2. यह 1960-61 में युद्धपोतों में लगने लगा था. इसमें ऑटोमैटिकली रीलोड हो जाता है. रॉकेट लॉन्चर 1, 2, 4, 8 और 12 राउंड के होते हैं. इसके लॉन्चर के मैगजीन की क्षमता 72 से 96 राउंड के होते हैं. यानी अगर चाहें तो दुश्मन की पनडुब्बी पर लगातार इते रॉकेट दागे जा सकते हैं.

जानिए इस रॉकेट के लॉन्चर के बारे में...

वजन: 3100 किलोग्राम (अनलोडेड)

लंबाई: 2 मीटर

ऊंचाई: 2.25 मीटर

चौड़ाई: 1.75 मीटर

एंगल: माइनस 15 डिग्री से +65 डिग्री तक

180 डिग्री पर घूम सकता है.

रॉकेट की क्या खासियत है...

वजन: 113.5 किलोग्राम

वॉरहेड: 23 किलोग्राम

व्यास: 0.212 मीटर

लंबाई: 1.83 मीटर

रेंज

बैलिस्टिक-1 वर्जन: 350 से 1700 मीटर

बैलिस्टिक-2 वर्जन: 1500 से 5500 मीटर

एक्सटेंडेड वर्जन: 9 से 10 किलोमीटर

गहराई: 10 से 500 मीटर तक जा सकती है.

क्यों पसंद किया जाता है यह रॉकेट लॉन्चर

RBU-6000 एंटी-सबमरीन रॉकेट दुनियाभर के अलग-अलग देशों की नौसेनाएं इस्तेमाल करती हैं. ये जिस समय बनाया गया था, उस समय इससे बेहतर रॉकेट सिस्टम नहीं था. असल में यह एंटी-सबमरीन वॉरफेयर के लिए बनाया गया बेहतरीन हथियार है. भारत ने इन रॉकेट्स का परीक्षण जरूर किया है लेकिन इन्हें जल्द ही बदलने की योजना है. भारतीय नौसेना अब इन रॉकेट्स के बदले नए लॉन्च प्लेटफॉर्म वाले ज्यादा बेहतर रॉकेट लॉन्चर्स लाएगी. इनकी जगह VLS Silos बनाए जाने की भी खबर है.

<https://www.aajtak.in/science/story/anti-submarine-asw-rocket-rbu-6000-tested-successfully-from-ins-chennai-cds-1669644-2023-04-07>

Anti-Submarine Rockets Developed by 2 Pune Labs Successfully Tested from INS Chennai

The Extended Range Anti Submarine Rocket (ER-ASR) designed by two Pune-based facilities of the Defence Research and Development Organisation (DRDO) was successfully test-fired for the first time from Navy's INS Chennai earlier on April 3. DRDO officials said the rocket has been designed to replace the existing Russian-origin Rocket Guided Bombs (RGBs).

The ER-ASR was designed and developed by Pune-based Armament Research and Development Establishment (ARDE) and High Energy Materials Research Laboratory (HEMRL). It is designed to intercept submarines at specific depths.

During the maiden tests conducted from Navy's guided missile destroyer INS Chennai on April 3, the performance of the rocket system was evaluated at the short range of 2.7 kilometers and in long range mode at 8.5 kilometers. The trajectory of rockets was tracked by onboard radar and telemetry systems. The underwater blast effect of the warhead was confirmed by the onboard sonar system.

The rocket system will be deployed in anti-submarine operations and will be fired from an indigenised rocket launcher mounted onboard various Indian naval ships. ER-ASR can be fired in single or in salvo mode depending on the tactical mission requirements. DRDO officials said the maiden successful test from the ship is a step towards enhancing the capability of the Indian Navy in anti-submarine warfare and towards achieving 'Atma Nirbharta' in defence.

DRDO officials said that ER-ASR has been designed to replace the existing Russian origin RGB rockets which are already fitted in ships. While the RGB has a range of five kilometers, the ER-ASR can achieve a range over eight kilometers.

<https://indianexpress.com/article/cities/pune/anti-submarine-rockets-pune-labs-successfully-tested-8542838/>

DRDO Approaches CCS for AMCA Project Approval

The Defence Research and Development Organization (DRDO) has approached the Cabinet Committee on Security (CCS), chaired by Prime Minister Narendra Modi, for approval of twin-engine advanced medium combat aircraft (AMCA) after the design of the fifth-generation stealth fighter has been frozen by the Aeronautical Development Authority. The first prototype of GE-414 powered AMCA is expected to roll out by 2026.

The DRDO's decision to approach the CCS for funding comes at a time when PM Modi has asked the organization to focus on its core competence and avoid time-delays and cost-overruns. The LCA Tejas Mark II with GE-414 engine is expected to roll out next year after completion of air intake test certification in France in May-June this year. Since the air intake of Mark II is similar to Mark I, the DRDO is confident about bagging the certification and rolling out the first prototype by next year.

It is understood that the government has asked the DRDO to stick to project timelines and avoid delays in the name of first time development. While the India-US talks are going on for 100 per cent transfer of technology production of GE-414 engines in India, the DRDO has decided to power both the Mark II and AMCA with the same engine.

While the DRDO maintains that Tejas Mark I has a range of 3000 km with GE-404 engine, the small fighter made is international debut in Abu Dhabi airbase in February and was conspicuous by its absence in bilateral exercises in UK and Australia. "The aircraft is capable and can make long range journeys through refueling. But the decision on which aircraft to send for international exercises lies with the Indian Air Force," said a DRDO senior official.

While the Narendra Modi government is committed to the Tejas program, it also wants to hold DRDO accountable for the fighter development as time is running out for the Indian Air Force with the rise of the Chinese air force and its armed drones. The DRDO must deliver on its timelines or else the IAF will be running short of squadrons in the next decade and force the government of the day to do emergency acquisitions for its air capabilities.

Taking this in account, the Modi government is also pursuing engine design, development, and joint production with France and also the possibility of manufacturing Rafale fighters in India for export to third countries. The US has also offered to shift its F-18 production line to India with an offer to acquire F-15 EX fighters.

Given the new Russia-China equation and changing geo-politics over Ukraine and Taiwan, India cannot afford to do business as usual as national institutions must work in synergy towards national interest and not in self-preservation.

<https://www.hindustantimes.com/india-news/drdo-approaches-ccs-for-amca-project-approval-101680755536904.html>



Thu, 06 Apr 2023

Ladakh: CEC Chairs Meet with DIHAR, DRDO, Highlight Importance of Technology in Making Agriculture Progressive

In Ladakh, to prepare a comprehensive and strategic plan for developing the agriculture and allied sectors in the district the Chairman/CEC, Ladakh Autonomous Hill Development Council (LAHDC), Kargil, Feroz Khan chaired a meeting with Director Defence Institute of High

Altitude Research (DIHAR), DRDO, Leh Dr OP Chaurasia and officials of other concerned departments.

The CEC highlighted the potentials of agriculture and allied sectors and importance of DIHAR, DRDO technology in making agriculture progressive in the district.

The meeting was held on the directions of Lieutenant Governor UT Ladakh, Brig. (Dr.) B.D. Mishra (Retd) to discuss inputs for plans in agriculture and allied sectors for the district.

The CEC appreciated the viewpoints presented by respective heads of departments in the meeting adding that the meeting remained fruitful. Talking about the suggestions of progressive farmers, Khan said the suggestions need to be focused and implemented so that crop production and entrepreneurship in agriculture gets boosted in the district with positive Cost-Benefit Ratio (CBR). The CEC also talked about the development of fodder and identification of areas for it. He suggested the DRDO impart training on research issues for officials, entrepreneurs and farmers of Kargil.

Earlier, Scientist DIHAR, DRDO, Leh in his presentation portrayed the purpose of transformation of the agriculture sector by innovative technology.

<https://newsonair.com/2023/04/06/ladakh-cec-chairs-meet-with-dihar-drdo-highlight-importance-of-technology-in-making-agriculture-progressive/>

DECCAN Chronicle

Mon, 10 Apr 2023

Parliament Body Seeks More Funds for DRDO

Unhappy with insufficient budget for defence R&D, the parliamentary standing committee on defence has recommended that in the current fiscal 2023-24 more funds must be granted to DRDO during the mid-year review in Revised Estimates.

The committee undertook a review of the funds allocated to the department of defence, R&D, during the last five years.

"In respect of the budgetary grants, the committee found a drop in DRDO expenditure as a percentage of total GDP over the past few years. From the data provided by the ministry of defence, the committee found that the percentage share of the defence R&D budget to total GDP has come down to 0.078 per cent in 2021-22 from 0.088 per cent in 2017-18," it said.

It said that the mandate for DRDO is to develop cutting-edge technologies and eventually through the transfer of such technologies to equip our services with internationally competitive systems and platforms.

"When the allocations are consistently going down, it would be difficult for DRDO to attain developmental goals, and to attain an edge over adversaries. The committee opined that budget grants of DRDO should be suitably enhanced for the growth of defence technologies," it said.

The panel said that it was informed that in the current year, DRDO projected Rs 23,263.89 crore at the Budget Estimate stage, which is 5.1 per cent of the defence budget.

"As per the ministry, the exclusive research and development budget is Rs 5,000 crore only, out of this 25 per cent that is around Rs 1,300 crore is earmarked for the private sector. Hence it can be very well understood that the amount actually left for DRDO projects is under constraints," it said.

The panel said that R&D is a prerequisite for a robust modern defence mechanism and the government has to take care of funds for in-house projects of DRDO along with outsourcing defence R&D. "The committee, therefore recommend that during 2023-24 adequate funds should be channelized to DRDO at subsequent stage i.e. RE for its ongoing and future projects," it said.

The committee also observed that data reveals that there has always been a decrease in the Budget estimate proposed and Budget estimate approved or allocated for defence R&D. "In the year 2021-22, the projected amount was Rs 23,460 and allocated amount was Rs 20,457 crore which was Rs 3,002 less than the projection. Likewise, in the year 2022-23, the projected amount was Rs 22,990 crore and the allocated amount stood at Rs 21,330 crore which was Rs 1659 crore less than the projection," it said.

However, the committee noted that during the financial year 2023-24, the projected amount was Rs 23,790 crore and the allocated amount is Rs 23,263.89 crore.

"The committee noted that for the first time, the difference is marginal and stands at Rs 526 crore," it said. The panel recommended that the defence ministry should undertake all out efforts in future and ensure that no cut is made in the budget while allocating the amount.

<https://www.deccanchronicle.com/nation/in-other-news/100423/parliament-body-seeks-more-funds-for-drdo.html>

Defence News

Defence Strategic : National/International



Press Information Bureau
Government of India

Ministry of Defence

Sat, 08 Apr 2023

Joint Military Exercise 'Ex KAVACH' Concludes at Andaman and Nicobar Command

Andaman and Nicobar Command (ANC) conducted a large-scale Joint Military Exercise 'Ex KAVACH' involving the assets of the Army, Navy, Air Force and Coast Guard. The exercise, which began on February 23, 2023, concluded on April 07, 2023. The exercise was aimed at fine-tuning joint warfare capabilities & Standard Operating Procedures (SOPs) and enhancing interoperability and operational synergy between the forces. Elements of the 'Shatrujeet Brigade'

of the Army, Armed Forces Special Operations Division (AFSOD), Special Forces of the Navy and Amphibious troops of the ANC, participated in the multi-domain exercise involving amphibious landing, air-landed operations, heliborne operations and rapid insertion of the Special Forces from mainland on a remote Island of the Andaman and Nicobar Islands.

‘Exercise KAVACH’ demonstrated the capabilities and preparedness of the Armed Forces to safeguard India's maritime interests and ensure the security of the Andaman and Nicobar Islands. The exercise effectively showcased the professionalism and synergy amongst the different components of ANC while conducting successful joint operations in a complex and dynamic environment.

Impressive demonstrations of rapid response capabilities during the exercise were witnessed by Commander-in-Chief Andaman and Nicobar Command Lt Gen Ajai Singh. He complimented the troops for their professional conduct and successful operations. Through such exercises, the nation continues to strengthen its defence capabilities, whilst promoting peace and security in the region, he said.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1914940>



Sun, 09 Apr 2023

PMO Urges HAL, DRDO to Speed up Indigenous Fighter Aircraft Program

The Prime Minister’s Office (PMO) recently had a meeting with the head of DRDO, ADA, and HAL and came hard on the shifting schedule in the Indigenous Fighter jets programme specifically Tejas MkII (17.5 tonnes) and AMCA (24.5 tonnes) programme without which IAF fighter squadrons levels will be below 10-12.

The conference was called after the Indian government led by PM Modi received harsh criticism from the Parliamentary Standing Committee on Defence (SCOD) for its lack of progress in acquiring fighter jets for the Indian Air Force (IAF).

In addition to the initial Rs 2,500 crore sanctioned for it, the Cabinet Committee on Security approved the Tejas MkII development project in September of last year for a total cost of nearly Rs 6,500 crore.

In the combat fleet of the Indian Air Force (IAF), the Tejas MkII is slated to replace fighter aircraft like the Mirage 2000, Jaguar, and MiG-29. PMO has contacted ADA and HAL to guarantee that it commences production by 2028–2029 as promised while obtaining CCS clearance.

With the arrival of Tejas Mk1 FOC Training aircraft, 73 Tejas Mark-1A (14-tonne weight) aircraft are expected to start flying in February 2024.

While the remaining 17 ordered Trainer aircraft have yet to start test flights and handover, which could delay Mark-1A deliveries, the first of the 18 ordered Trainer aircraft recently took to the skies.

<https://www.firstpost.com/india/pmo-urges-hal-drdo-to-speed-up-indigenous-fighter-aircraft-program-12430802.html>



Sat, 08 Apr 2023

New Military Hardware to be Bought Across Systems

Eyeing a sweeping military capability boost in the midst of a lingering border row with China in eastern Ladakh, which is set to enter its fourth year in May, India is likely to float tenders for different types of indigenous weapons and systems in financial year 2023-24 including light tanks, artillery guns, utility helicopters, modern combat vehicles and air defence weapons, officials familiar with the matter said on Saturday.

India cleared the decks for buying this military hardware in FY 2022-23. In the last 12 months, the defence acquisition council (DAC), India's top weapons procurement body, accorded its acceptance of necessity (AoN) for projects worth more than ₹2.71 lakh crore, according to defence ministry data. In a big push for self-reliance in the defence manufacturing sector, 99% of this procurement will be done from the domestic industry.

Modernising the armed forces with locally made platforms is a top priority for the government, and proposals made by the armed forces for upgrading their capabilities are being cleared at a swift pace, the officials said.

On April 1, Prime Minister Narendra Modi said the defence sector will be provided all the resources, weapons and technologies required at the Combined Commanders' Conference in Bhopal. Modi assessed the operational readiness of the armed forces, carried out a security review, and asked the military to stay prepared for new and emerging threats.

Under India's defence procurement rules, the AoN by the council is the first in a series of steps towards buying military hardware.

The ministry will now take the projects forward by issuing requests for proposals (RFP) to Indian vendors. After the RFP, the next steps include vendors responding to it with techno-commercial offers, opening and evaluation of technical offers, extensive trials, staff evaluation, opening of commercial offers that are technically compliant with the RFP, and finally, the contract being awarded.

Light tanks, futuristic infantry combat vehicles (FICV) and artillery guns were among the key army proposals cleared by the DAC, headed by defence minister Rajnath Singh, in FY 2022-23.

The light tank is a key capability the army needs to tackle the increased threat that persists along Line of Actual Control (LAC) with China. The future tank has already been named Zorawar after Dogra king Gulab Singh's legendary general, Zorawar Singh. It will be packed with cutting-edge

technologies including drone integration, active protection systems and superior situational awareness.

The FICV is one of the key indigenous capabilities that the mechanised infantry is eyeing, other than night-fighting gear, anti-drone weapons, and intelligence, surveillance and reconnaissance (ISR) platforms. These capabilities will transform the mechanised infantry into a more lethal, agile and integrated force capable of delivering a swift and effective response in battle, as previously reported by HT.

The army is also looking at inducting the 155mm/52-caliber advanced towed artillery gun systems (ATAGS). The Defence Research and Development Organisation (DRDO) began the ATAGS project in 2013 to replace older guns with modern ones. It partnered with two private firms, Bharat Forge Limited and Tata Advanced Systems Limited, for manufacturing the gun. It has a range of 48km.

Modi reviewed the progress in achieving self-reliance in the defence manufacturing sector at the commanders' conference. The government has taken several measures in recent years to promote self-reliance including creating a separate budget for buying locally made military hardware, increasing foreign direct investment (FDI) from 49% to 74%, and notifying hundreds of weapons and systems that cannot be imported.

The indigenisation drive is being pursued alongside a sharpened focus on boosting the country's arms exports. India exported military hardware worth ₹15,920 crore in FY 2022-23, the highest ever and a notable tenfold increase since 2016-17, with Modi recently attributing the growth to enthusiasm for Make in India, and key reforms to spur growth in the sector.

The exports stood at ₹1,521 crore in 2016-17, ₹4,682 crore in 2017-18, ₹10,745 crore in 2018-19, ₹9,115 crore in 2019-20, ₹8,434 crore in 2020-21, and ₹12,814 crore in 2021-22, according to government data.

<https://www.hindustantimes.com/india-news/india-to-boost-military-capability-with-indigenous-weapons-and-systems-amid-border-row-with-china-tenders-to-be-floated-in-fy-202324-101680974777263.html>

THE TIMES OF INDIA

Fri, 07 Apr 2023

India Gearing up for Ambitious Fifth-Generation Stealth Fighter Project

India is now finally moving ahead with its long-pending project to develop a fifth-generation stealth fighter, in a step that also effectively torpedoes feverish speculation that New Delhi may be interested in the F-35A jets showcased by the US at Aero-India in Bengaluru in February.

The full-scale engineering development case for the indigenous twin-engine advanced medium combat aircraft (AMCA), at a cost of around Rs 15,000 crore, will 'soon' be sent to the PM-led cabinet committee on security (CCS) for the final approval, sources told TOI on Thursday.

"Extensive inter-ministerial consultations on cost, design and level of indigenous content are virtually complete now. The DRDO case for the AMCA will soon be finalized for the CCS," a source said.

The ambitious AMCA project will involve development of five prototypes, one structural test specimen, extensive flight testing and certification for the eventual 25-tonne swing-role fighter.

As per the projected timelines, the first AMCA prototype will roll out four years after the CCS sanction, with the production to begin another six years after that. In effect, the IAF will begin inducting the AMCA from only around 2035 onwards.

The only operational 5th generation jets in the world currently are the American F/A-22 Raptors and F-35 Lightning-II Joint Strike Fighters, with the Chinese Chengdu J-20 and Russian Sukhoi-57 also somewhat there. "The US bringing two F-35s for the Aero-India was just strategic posturing and a sales pitch. We are pursuing our own AMCA programme," the source said.

The CCS in August last year had cleared the development of the indigenous Tejas Mark-2 fighter at an overall cost of over Rs 9,000 crore, which TOI had then reported would be followed by the AMCA project.

The 36 Rafales inducted by IAF under the Rs 59,000 crore deal inked with France in September 2016 and the planned Tejas Mark-2 are 4.5 generation fighters. The AMCA, in turn, will be a truly 5th generation fighter with advanced stealth features and the capability to super-cruise as well as data fusion and multi-sensor integration with AESA (active electronically scanned array) radars.

The IAF currently plans seven squadrons (126 jets) of the AMCA. With India failing to develop its own jet engine, the first two AMCA squadrons will be powered by the American GE-414 engines in the 98 Kilonewton thrust class, like the Tejas Mark-2 jets. The next five squadrons are planned to be equipped with a more powerful 110 Kilonewton engine to be developed with foreign collaboration.

The IAF is currently grappling with just 31 fighter squadrons when at least 42 are required to tackle China and Pakistan. The IAF induction plan includes 83 Tejas Mark-1A, 108 Tejas Mark-2, 114 multi-role fighter aircraft (to be manufactured in India with foreign collaboration) and finally 126 AMCA.

But the going has been excruciatingly slow. The 73 Tejas Mark-1A fighters (with GE-404 engines) and 10 trainers have to be delivered by Hindustan Aeronautics in the February 2024-February 2028 timeframe as per the Rs 46,898 crore contract inked in February 2021.

"But the first Tejas Mark-1A will probably come towards end-2024. First, every small equipment change requires extensive flight testing and certification. Moreover, HAL has to majorly upgrade its annual production capability. Tejas Mark-2, of course, is still in the design and development phase," another source said.

<https://timesofindia.indiatimes.com/india/india-gearing-up-for-ambitious-fifth-generation-stealth-fighter-project/articleshowprint/99316880.cms>

AMCA Program: Rolls Royce Confirms Export License for Engine Tech Transfer for Advance Jet

In a major boost to the Atmanirbhar Bharat initiative of the Indian govt, Rolls Royce has confirmed an export license from the UK govt for combat engine technology transfer to India. A report by an agency quoted Rolls Royce as saying, “The combat engine technology transfer to India will be for combat engine development with a unique co-creation model”.

The intellectual property rights for this technology will be developed and owned in India for the AMCA (Advanced Medium Combat Aircraft Program). General Electrics, a company in the US has also requested the American govt to provide a license to export their engines. This is so they can also present their engines and participate in the competition to win a contract to manufacture engines for Indian aircraft. General Electrics has gained backing for the program from various members of the US Congress and is waiting for approval.

About the AMCA program

For the Indian Air Force and Indian Navy, the fifth-generation stealth multirole combat aircraft are being developed under the HAL AMCA programme. Additionally, sixth-generation technologies will be included. The Aeronautical Development Agency (ADA) of the Defense Research Development Organization is responsible for the aircraft's design. (DRDO).

AMCA will be a single-seat, twin-engine aircraft. The AMCA Mk-1 will have 5.5-generation technology, while the MkII will gradually upgrade to 6-generation technology. The AMCA is built to perform a variety of operations, including air superiority, ground strikes, reducing enemy air defences, and electronic warfare operations and is also meant to be the IAF's most sophisticated fighter.

Low radar cross section and supercruise capability are goals of AMCA's design. The project reached the detailed design phase in February 2019 after feasibility studies for the AMCA and the preliminary design stage were finished. The only fifth-generation fighter being developed in India right now is the AMCA.

Implications for India's security scenario

The goal of the AMCA programme is to help India create a fighter plane that can compete with the PLA Air Force of China. It is expected to counter the JF-17 thunder fighter aircraft of China which is also used by the Pakistani air force (PAF). The AMCA program is a crucial step for India to develop 5.5 generation aircraft to strengthen the air force.

Earlier this year the DRDO announced metal cutting for the prototype of the AMCA. The Indian Air Force is suffering from a shortage of fighter aircraft. An indigenously developed aircraft is expected to fill this gap.

<https://www.republicworld.com/india-news/general-news/amca-program-rolls-royce-confirms-export-license-for-engine-tech-transfer-for-advance-jet-articleshow.html>

Defence Secretary Aramane Inaugurates New Production Line for Tejas Jets

Defence Secretary Giridhar Aramane on Friday inaugurated a new production facility in Nashik to boost manufacturing of indigenously-developed Light Combat Aircraft Tejas. It is the third production line of the Tejas jets set up by the Hindustan Aeronautics Limited (HAL), the maker of the aircraft.

HAL Chairman and Managing Director CB Ananthkrishnan said the new production line will enable the company to enhance production of LCA Tejas (MK1A) from current capacity of 16 jets to 24 aircraft per year.

The HAL has two manufacturing facilities for LCA Tejas in Bengaluru.

Tejas is a single-engine multi-role fighter aircraft capable of operating in high-threat air environments. The setting up of the new production facility for the Tejas jets came amid growing interests shown by a number of countries to acquire the aircraft.

Egypt, Argentina, the US, Australia, Indonesia, Malaysia and the Philippines are also among the countries showing interest in Tejas aircraft.

In February 2021, the defence ministry sealed a Rs 48,000 crore deal with HAL for the procurement of 83 Tejas jets for the Indian Air Force.

Aramane also handed over the 100th Sukhoi-30 MKI ROH (Repair and Overhaul) aircraft to the Indian Air Force.

HAL's Nashik division set up Su-30 MKI Repair and Overhaul (ROH) facility in 2014.

At the event, the defence secretary lauded HAL for establishing the new production line for Tejas jets and said the aerospace major has been fulfilling the needs of the country's security, according to a statement by HAL.

"The government has come out with several 'Aatmanirbhar Bharat' policies, and that puts HAL in a very important position. HAL will be producing more in the coming years, building more systems, coming out with new concepts and new platforms for future growth," he added.

He also urged HAL to take up new initiatives to aggressively compete in the defence market and look into new areas like unmanned vehicles as the country is in need of these advanced systems.

Aramane emphasised on "initiatives, innovation and excellence".

Ananthkrishnan said, "The new production line will enable the company to enhance LCA MK1A production capacity from 16 to 24 aircraft per year.

He said the HAL's Nashik division has achieved peak overhaul capacity of 20 Su-30 aircraft per year despite having supply chain issues in current geopolitical situations.

<https://economictimes.indiatimes.com/news/defence/defence-secretary-aramane-inaugurates-new-production-line-for-tejas-jets/articleshow/99323743.cms>

The Tribune

Sun, 09 Apr 2023

CDS General Anil Chauhan Visits Bengal, Sikkim; Reviews Infra Setup, Operational Readiness

Less than 10 days after Bhutan said it was ready to “demarcate boundary with China” raising fears in India over Chinese presence in Doklam plateau, Chief of Defence Staff (CDS) General Anil Chauhan today visited the forward areas in north Bengal and Sikkim to review infrastructure development and operational and logistics preparedness in the area.

The Indian boundary in Sikkim abuts Tibet. The Chumbi valley in Tibet sits between Sikkim and Bhutan. The Indian side fears that Bhutan could cede Doklam plateau and retains the areas to its north, which would mean China getting ensconced on Doklam plateau and from there, it gets a clear view of the sensitive Siliguri corridor in north Bengal, the narrow tract of land connecting mainland India with northeastern states. The CDS was on a two-day visit which ended today. He interacted with troops deployed in the remote areas. General Chauhan also visited the headquarters of 33 Corps where he was briefed about the operational situation along the borders in Sikkim. He asked the officers to ensure force preservation and asked the formation in Sikkim to focus on training and remain vigilant.

In last week of March, Bhutan PM Lotay Tshering, in an interview with Belgian Daily La Libre, had said, “Doklam is a junction point between India, China and Bhutan. It is not up to Bhutan alone to solve the problem. We are three equal countries. There is no big or small country.”

On Bhutan-China talks (on since 1984) on demarcating the border, the PM had said, “We do not encounter major border problems with China, but certain territories are not yet demarcated. We still have to discuss it and draw a line. We have come to understand each other. Last month, a Bhutanese delegation visited China and we are now awaiting the arrival in Bhutan of a Chinese technical team. After one or two more meetings, we will probably be able to draw a line.”

India’s contention

Indian side fears Bhutan could cede Doklam plateau and retain areas to its north

It would mean China getting ensconced on Doklam, gets a clear view of Siliguri corridor in Bengal

The corridor is strategic as it connects northeastern states with mainland India

<https://www.tribuneindia.com/news/nation/cds-visits-bengal-sikkim-reviews-infra-setup-operational-readiness-495823>

Fri, 07 Apr 2023

HAL Hands Over 100th Su-30 MKI Aircraft Handed to IAF; 3rd LCA Production Line Launched

In addition to launching the third LCA production line, Mr Giridhar Aramane presented the 100th Sukhoi-30 MKI ROH aircraft. The Indian Air Force's Assistant Chief of Air Staff, Air Vice Marshal Sarin, VSM, received it. On April 7, 2023, it was turned over to HAL's Nashik division in Nashik.

Air Vice Marshal Sarin, VSM, received the signal-out certificate for the 100th ROH aircraft from Mr Saket Chaturvedi, CEO (Mig Complex). It was delivered in the presence of Mr Ananthakrishnan, CMD of HAL. There were additional higher authorities who were present at the launch of third LCA production line.

HAL's ROH Facility

The defence secretary commended HAL for tackling the task of establishing a ROH facility for the Su-30 MKI. It also commended HAL for building a new line of production for the LCA's production. He claimed that HAL has been meeting the requirements for the nation's security.

He said that the government has come out with several 'Atmanirbhar Bharat' policies, and that has put HAL in a very important position. HAL will be producing more in the coming years. He added that by telling us to build more systems and come out with new concepts, and new platforms for future growth.

He said, "Build more systems and develop better, fresh ideas for future development." As the nation requires this cutting-edge equipment. He also asked HAL to launch fresh initiatives to compete fiercely in the defence market and explore new fields like unmanned vehicles. Initiatives, innovation, excellence, and a performance-focused approach were stressed by him.

The Sukhoi Su-30 MKI repair and overhaul facility was established in 2014 by HAL's Nashik division. To suit the operational needs of the IAF, it will be the first of its sort anywhere in the world. gaining expertise in the production of the Mig series and Su-30 MKI aircraft, as well as later MIG-series aircraft overhaul.

Thanks to the IAF and other regulatory organizations, HAL was able to perfect the technology. Several HAL sister divisions are involved in ROH activities. HAL plans to reduce the dependency on OEMs by indigenising the majority of components required for ROH in the next 3-5 years.

HAL CMD CB Ananthkrishnan said that the new production line will enable the company to enhance LCA MK1A production capacity from 16 to 24 aircraft per year. HAL has already set up two LCA manufacturing facilities in Bengaluru. He said the HAL's Nashik division has achieved peak overhaul capacity of 20 Su-30 aircraft per year despite having supply chain issues in current geopolitical situations.

<https://www.republicworld.com/india-news/general-news/hal-hands-over-100th-su-30-mki-aircraft-handed-to-iaf-3rd-lca-production-line-launched-articleshow.html>



Sun, 09 Apr 2023

Exhilarating Experience: President after Flying Maiden Sortie in Sukhoi-30

President Droupadi Murmu on Saturday flew a sortie in a Sukhoi-30 MKI fighter aircraft from Tezpur Air Force Station in Assam and, in a brief note in the visitor's book documenting her experience, called it an "exhilarating experience".

She flew for approximately 30 minutes over Brahmaputra valley with a view of the Himalayas before returning to the Air Force Station, Rashtrapati Bhavan said in a statement.

The President of India is the Supreme Commander of the Indian Armed Forces. Tezpur Air Force Station, which hosted the sortie, is a frontline IAF airbase facing China — it has fighter squadrons, a helicopter unit and radar and missile squadrons.

Murmu is the third President and the second woman President to fly such a sortie. Former President Pratibha Patil had flown in the Su-30 MKI jet from Pune Air Force base in 2009. Before that, A P J Abdul Kalam had flown in Su-30 when he was the country's President.

The statement said the aircraft was flown by Group Captain Naveen Kumar, Commanding Officer of 106 Squadron. It flew at a height of about 2 km above sea level and at a speed of about 800 km per hour.

Defence officials said maneuvering of the aircraft in such sorties is done keeping the health and age of the person flying to ensure he or she does not go through the stress involved in flying a fighter jet. "But at the end of the day it is a fighter aircraft, and the person flying may have to eject in case of a contingency. So extensive briefing is provided on safety aspects," an official said. "Even in the case of President Murmu an extensive amount of briefing was provided to her to reinforce safety aspects."

After her maiden sortie, Murmu wrote: “It was an exhilarating experience for me to fly in the mighty Sukhoi-30 MKI fighter aircraft of the Indian Air Force. It is a matter of pride that India’s defence capabilities have expanded immensely to cover all the frontiers of land, air and sea. I congratulate the Indian Air Force and the entire team of Air Force Station Tezpur for organising this sortie.”

Murmu was also briefed on operational capabilities of the aircraft and the IAF, and she expressed satisfaction on the operational preparedness of IAF, the statement said. “The President’s sortie in the Sukhoi 30 MKI fighter aircraft is a part of her efforts to engage with the armed forces as the Supreme Commander of Indian Armed Forces,” the statement mentioned.

Murmu was on a three-day visit to Assam from April 6. She was given the Guard of Honour when she arrived at Tezpur Air Force Station.

Last month, she visited INS Vikrant and interacted with officers and sailors on board of the indigenously built aircraft carrier.

<https://indianexpress.com/article/india/exhilarating-experience-president-after-flying-maiden-sortie-in-sukhoi-30-8546226/>



Fri, 07 Apr 2023

House Panel Apprised of Collusive Threat from China and Pakistan

The Indian Navy currently has a strength of around 130 ships and submarines and while the target is to have a 200-ship Navy, given the current trajectory it is likely to have 155-160 ships, Chief of Defence Staff and Secretary, Department of Military Affairs Gen. Anil Chauhan has said in a submission to the Parliamentary standing committee on defence.

This is while the Chinese Navy with around 355 ships has grown to be the world’s largest Navy in terms of numbers. The committee was apprised of the possible collusive threat from both China and Pakistan and the former’s role in expansion of Pakistan’s Navy.

“The Indian Navy’s strength today is about 131 ships... Our plan to build the Navy to around 200 ships. But the way we are going now, we will reach between 155-160. In terms of pure numbers, they are very less. However, a few factors have to be kept in mind as these issues are dependent on geography...,” Gen. Chauhan said in the report.

As per the standing committee report tabled in the Parliament in the just concluded session, Gen. Chauhan said that in 4-5 years from now the Chinese Navy will have a strength of about 555 ships. The name of China or Pakistan weren’t directly mentioned and left blank in the report while describing them.

The Indian Navy currently has 143 aircraft and 130 helicopters. In addition, 43 ships and submarines are under construction at various shipyards while initial approval exists for the indigenous construction of 51 ships, six submarines and 111 Naval Utility Helicopters.

While noting that the number of assets required for various types of aircraft is calculated based on Indian Navy's envisaged tasks and missions, available surface assets, areas of interest and other factors, as promulgated in the Long-Term Integrated Perspective Plan (LTIPP) 2012-27, the committee noted, "However, there is a shortfall of planes and helicopters for reconnaissance and transport, which is being mitigated through progressive procurement."

A Navy representative said in the submission to the committee that in just over a decade, China has grown from having 250 navy ships to more than 350 and become the largest navy in the world. Along with their numbers, their operations have also expanded and at any point of time, five to nine of their ships are operating in the Indian Ocean Region (IOR) and their research vessels are also operating which can influence our security, the representative said.

Further, the representative stated that there is also a possibility of collusion between China and Pakistan against India and referred to the expansion of the Pakistani Navy. From now to 2030, the Pakistani Navy is projected to expand by 50% with China playing the biggest role in the expansion. Hence, it is absolutely imperative that Indian Navy expand its capability, the representative added.

"To counter emerging threats, a balanced built-up of the Navy is required whether it is ships, submarines or aircraft which can only be enabled by sustainably assured funding."

The committee in this regard want to state that the Ministry should assess the threat perception which has increased many folds in view of hostile nations in the neighbourhood and the increase in trade in the Indian Ocean Region, the report said.

Chinese presence in the IOR began in 2008 under the garb of anti-piracy operations in the Gulf of Aden and the country have since maintained continuous presence in the region, even deploying nuclear attack submarines (SSN) on occasions. China has also since set up a military base in Djibouti and has developed several dual use ports in the IOR in Sri Lanka, Myanmar and Pakistan among other countries.

<https://www.thehindu.com/news/national/house-panel-apprieved-of-collusive-threat-from-china-and-pakistan/article66710973.ece>



Fri, 07 Apr 2023

Germany to Propose its Dolphin AIP Submarine for India's Project-75I

Germany is offering next-generation submarines to India to jointly build six conventional submarines. While there is no official confirmation, the talks over the submarine which took place during Chancellor Olaf Scholz's visit to India, are at the final stage, it is learnt.

Germany's offer to India is a significant change from its earlier approach where Germany sought clarification on the joint manufacturing of submarines.

Germany operates HDW Class Dolphin submarines which is equipped with Air Independent Propulsion (AIP) system. The HDW Class Dolphin submarine provides high operational value as it is integrated with a fuel cell AIP system.

The AIP is marine propulsion technology that allows a non-nuclear submarine to operate without access to atmospheric oxygen (by surfacing or using a snorkel).

The fuel cell AIP system significantly increases submerged endurance while it is also loaded with a state-of-the-art combat system. Dolphin submarine in its compact size carries a weapon expulsion system, torpedoes, missiles, and mines which can be launched from the weapon tube set. Besides the high firepower, this class of submarine provides a very high automation degree of the controls for the propulsion plant, navigation and handling of the boat.

The AIP system for the P-75I submarine

In 2021, the Ministry of Defence (MoD) issued Request for Proposal (RFP) for the first acquisition programme under the Strategic Partnership model for the construction of six conventional submarines named Project 75(India) [P-75(I)] for the Indian Navy. The key element of the strategic partnership is based on the specific technology—the AIP.

Germany's ThyssenKrupp Marine Systems (TKMS) is one of two international bidders for the proposed submarine project.

The ambitious Project-75(I) also proposes the plan for the indigenous construction of six conventional submarines, including associated shore support, engineering support package, training and spares package with contemporary equipment, weapons & sensors. Apart from the AIP Systems, the P-75 (I) must have advanced missile systems and torpedoes.

HDW fuel cell system delivers a unique AIP solution for direct integration into non-nuclear submarines. Fuel cells are energy converters that transform chemical energy directly to electrical energy without noise or combustion. Low noise and infrared signatures, high efficiency and low maintenance requirements make HDW fuel cell plants the ideal AIP solution for new non-nuclear submarines.

At the same time, India's Defence Research and Development Organisation (DRDO) has also developed its AIP systems for the submarines of the Indian Navy. In an interaction with Financial Express, Samir V Kamat, Secretary Department of Defence R&D and Chairman DRDO confirmed that the indigenous AIP propulsion system developed by DRDO is a modular system that can be easily configured for any conventional submarine platform. Fuel Cell based air-independent propulsion (AIP) system crossed important milestones of user-specific tests. It is one of the most advanced AIP Systems in the world, where Fuel Cell Technology is used to generate onboard power.

The AIP can augment or replace the diesel-electric propulsion system of non-nuclear vessels.

What remains is the lengthy timeline for the rigorous trials to be certified and fitted into the Scorpene-class submarine.

The Indo- German collaboration may fill the gaps as the delay over the submarine project is also posing a serious challenge for the Indian navy to address China's constant maritime

expansionism in the IOR. Besides, the collaboration will also help DRDO to embrace the next-generation systems with combat capabilities in terms of the overall design and development of the futuristic submarine under P-75I.

<https://www.financialexpress.com/business/defence-germany-to-propose-its-dolphin-aip-submarine-for-indias-project-75i-3038304/>

The Tribune

Fri, 07 Apr 2023

South Korea for Upgrade in Ties as it Seeks to Export Defence Items to India

South Korean Foreign Minister Park Jin on Friday said the country would like to upgrade its existing successful partnership with India and focus on trade, investment and supply chain stabilisation in the manufacturing sector and also critical minerals.

“Our discussions today will take forward our Special Strategic Partnership,” said External Affairs Minister S Jaishankar while welcoming Jin for their first bilateral meeting in India after the Korean Foreign Minister did not come for the G20 Foreign Ministers meeting held last month. “Commemorating half a century of our diplomatic relationship, we would like to upgrade our existing successful partnership with India. So, I’m going to meet with my counterpart S Jaishankar, the Foreign Minister of India to discuss our joint efforts to promote our partnership and to explore possibilities in deepening and widening our cooperation,” said the South Korean Minister.

He said important areas that require special attention are trade, investment and supply chain stabilisation in the areas of manufacturing sector and also critical minerals. In the area of science and technology, he said both nations can cooperate in artificial intelligence, big data, biotechnology and space exploration.

Jin is on a two-day official visit to India. He will visit Hyundai’s Chennai plant on Saturday which Jaishankar in his opening remarks described as “symbol of our relationship.” The company was also in the centre of a controversy a couple of years back when its Pakistan dealership commented on the Kashmir issue.

While Seoul wants to hold a two plus two meeting of the Defence and Foreign Ministers in order to push weapon exports to India, India wants a revision in the Comprehensive Economic Partnership Agreement (CEPA), which New Delhi maintains has failed to promote Indian exports and in fact has further widened the trade gap with India.

India is also an important country in South Korea's Indo-Pacific strategy as is Seoul in New Delhi’s Indo-Pacific strategy. Interestingly, South Korea has been engaging heavily with Japan and the US, two Quad partners, and its President is scheduled to visit Washington soon.

<https://www.tribuneindia.com/news/nation/south-korea-for-upgrade-in-ties-as-it-seeks-to-export-defence-items-to-india-495139>



Sun, 09 Apr 2023

Where India Stands in World Arms Bazaar as Defence Exports Reach All-Time High and \$100 Bn Orders Likely in Next Decade

By Ranjit Kumar

India achieved a record Rs 16,000 crore worth of defence equipment exports last financial year. The country may be far away from establishing a significant footprint in the international arms market, considering a poor track record, the defence establishment is upbeat over its rising penetration in the world market. From Rs 1,941 crore in 2014, the country increased the value eight times to export defence-related goods worth almost Rs 16,000 crore (US\$ 2 billion) last year. Though that was a meagre 0.2 per cent of the transactions that took place in the world arms bazaar last fiscal, the leap has enthused the Indian defence establishment. Efforts to increase defence exports have started to yield positive results, and India has set an ambitious target of US\$5 billion worth of annual exports in the next five years.

“Our government will keep supporting efforts to make India a defence production hub,” Prime Minister Narendra Modi recently said in a tweet. According to Ministry of Defence, India is now exporting defence equipment to over 85 countries. “Indian industry has shown its capability of design and development to the world, with 100 firms exporting defence products at present,” it said in a recent statement. These exports include the Supersonic BrahMos cruise missiles, Advanced Light Helicopters, multi-barrel rocket launcher Pinaka, light weapons , ammunitions etc.

Excellent! A clear manifestation of India’s talent and the enthusiasm towards ‘Make in India.’ It also shows the reforms in this sector over the last few years are delivering good results. Our Government will keep supporting efforts to make India a defence production hub. <https://t.co/AL3sLknFOL>

— Narendra Modi (@narendramodi) April 1, 2023

New Wave of Militarisation

In spite of rising exports, however, India is still the biggest arms importers, though its share in arms imports has gone down to 11 percent in 2017-22 from 12 percent in 2011-2016. India continues to be an attractive selling destination, and as revealed by Defence Minister Rajnath Singh, the Indian defence sector has emerged as a major demand creator. “Orders worth over \$100 billion are expected in the next 5-10 years,” he said last month.

This is a conservative estimate. In reality, the Indian armed forces would be requiring much more, as its weapon inventory is getting outdated very fast. In view of the rising security challenges from the neighbourhood, India cannot entirely depend on Made in India products and undermine the defence preparedness vis-a-vis China and Pakistan.

The country had in the past seen only a half-hearted focus on the development of export-led defence industry, though it created huge infrastructure of designing and producing defence equipment in the public sector, which includes over 40 DRDO labs, eight defence public sector undertakings and over 40 ordinance factories. The excuse for not encouraging defence exports was that these facilities are meant only to cater to the needs of Indian armed forces. Before the new millennium started, the successive governments, in fact as a policy matter, did not allow private sector in defence industry, and prevented them from investing in the defence arena, whereas the public sector defence companies were not encouraged to export their products and services, limited only to so-called friendly countries. However, the dawn of the new century saw the beginning of a gradual rise in the participation of the private sector, which though was initially restricted only to 26%, now permits 100 percent ownership in certain segments.

The world defence industry is set to see a new boom in its order book due to the Russian military invasion in Ukraine, which has created a new sense of insecurity not only among European nations, but in the Asian region also. Since the Russian invasion of Ukraine has changed the geopolitics of the entire world, there is going to be new alignments among nations and new aggressive security policy to safeguard their territories and strategic interests.

From Finland to Poland in Europe to East, South East and South Asia, and the Arab Gulf region to Africa, a new wave of militarisation has begun. Rich countries like Japan and South Korea are planning a heavy increase in their defence acquisition budget, as they feel the need to refurbish their armed forces because of new perceived security threats. India also feels the need to modernise its armed forces. Hence, the Indian defence minister's assessment of armed forces requirement of US\$100 billion.

Will India be Able to Meet the Demand?

This is quite lucrative for the world defence industry. The issue is whether the Indian defence industry will be able to meet this huge demand of Indian and foreign armed forces. Are we capable of producing cutting-edge weapon systems and platforms that can compete with weaponry in the rival neighbouring forces? If not, can Indian armed forces during a conflict overpower their enemy forces with Indian-made defence systems? The Indian armed forces have to be provided latest weapon systems and platforms, domestic or imported. Indian defence research entities have devoted lot of their energy and time, and has been able to equip Indian armed forces with world class systems like Agni series of Intercontinental ballistic missiles, naval ballistic missiles and Supersonic BrahMos cruise missiles, which India could not have acquired in the era of sanctions. But there are many other multi-billion dollar big-ticket defence equipment like latest generation fighter aircraft, submarines, combat drones etc which the Indian defence industry would not be able to offer presently, though indigenous development works are progressing.

Indian military aircraft designers are moving fast on indigenous production of fifth generation Advanced Combat Aircraft, but real product on the ground is at least a decade away. Indian armed forces need urgent induction of modern generation of fighters to effectively counter the dual China-Pakistan security threat.

The Indian defence ministry wants these new generation fighters to be produced in India with foreign partnership. But there is no visible development. Similarly, the ministry wants the requirement of six diesel submarines to be fulfilled in strategic partnership with a foreign

manufacturer. These fighters and submarines would thus be called Made In India product, which can also be produced for export.

As PM Modi has said, India can be production hub of defence equipment, and efforts are being made to attract countries like Japan, Israel, Korea , Gulf nations etc to make India as their production centres to meet the requirements of their armed forces, as India offers qualified manpower. Their advanced technology coupled with capable Indian workers can not only help to meet their own military requirement but also sell their products to Indian armed forces and for International arms market too.

The Ministry of Defence has already set up two defence corridors, one in Tamil Nadu and the other in Uttar Pradesh, where adequate facilities need to be urgently put in place to attract big players in the defence industry. To expand its footprint in international arms market, the country needs to adopt a multipronged approach. First, by encouraging the Indian private sector to join hands with Indian defence research laboratories, and secondly by attracting overseas defence giants to open their shops in India, either in joint venture or in 100 percent ownership. This has the potential of transforming the Indian defence sector and make India a big player in the international arms bazaar.

<https://news.abplive.com/india-at-2047/all-time-high-defence-exports-16000-crore-india-position-world-arms-bazaar-pm-narendra-modi-rajnath-singh-mod-indian-defence-sector-1594243>



Sun, 09 Apr 2023

Political and Social Discourse for National Security

By Maj Gen Ashok Kumar, VSM (Retd)

The Chinese aggressive stance is going to stay for times to come and so will be the the status of China-Pak collusivity. Not only this, there will be substantial time needed for requisite capacity creation for India that too not only for the defence forces but also in multiple other domains where India has to progress substantially. Indian capability needs to develop so much that it can prosper without logistics supply needed from China. Government has initiated multiple measures to address these concerns but it will take considerable time to develop the requisite capability.

The main challenge till then lies in managing the relationship in a manner that as against losing our territory further, we continue consolidating the same. This task itself is fairly difficult given the Chinese aggressive stance on the LAC which has manifested in the form of transgressions in Eastern Ladakh at multiple locations. It is reasonable to believe that the Government must be utilising its diplomatic, political and other tools to resolve the issue to its advantage. Since the entire effort being made by the Government is not fully in the public domain, it will be analysed as and when it comes in the public domain for learning lessons for the future.

There are two other areas which contribute to national security comprehensively. There is a definite and pressing need to address these two issues comprehensively. The best part is that

these two issues, once addressed, can be a real game changer. The best part is- these don't require any expenditure but statesmanship as well as national consciousness to make these two things happen. These two areas are covered as under:

National Security Truths. Given the nature of Line of Control (LOC) with Pakistan and Line of Actual control (LAC) with China and continued belligerence by these two adversarial nations will continue. The actions by these adversaries not only affect the security matrix of the day but affect for longer duration. These need a national response which should not be only that of the Government but must include elected representatives in the form of principal opposition parties / other parties with pre-defined strength. The information gap between these stakeholders must cease utilising a robust mechanism. Such a necessity has become more pronounced due to the current standoff on the LAC in the Eastern Ladakh wherein the Government has stated that Chinese have not entered our area while opposition has been countering such views with inputs from the satellite pictures. Whatever be the truth, the real beneficiary of such a stance remains the dragon. The following is recommended to be done to share the truth and bring entire polity on the same page:

Fixing Responsibility for Transgressions. It is obvious that such large transgressions across multiple points on the LAC haven't happened overnight. These have taken considerable time and therefore, the border guarding troops must assume the responsibility of such a situation in addition to our internal as well as external intelligence agencies. The responsibility needs to be fixed more for corrective actions and less for the prosecution as these things keep happening time and again which will be obvious whether we analyse the 1965 war or Kargil war.

Constituting National Security Dialogue Committee. A fresh committee needs to be constituted wherein Hon'ble RM could represent the Government of the day and each political party at the Centre having 10 or more Parliamentary seats be co-opted with a member each as part of this committee. The members from opposition political parties need not be leaders of these parties but nominated members having understanding of national security concerns. All these must function under Constitutional oath not to discuss the details in the public domain regarding their briefings done by the Government of the day. Whenever any such security issue comes up, the Government of the day must brief this committee with the truthful position so that there is no trust deficit between major political parties when it comes to national security concerns. There should not be any blame game on this issue as there is enough space for politics away from the national security concerns. The whole nation not only needs to stand together but also needs to be seen in the aforesaid manner.

Internal Population Fault Lines . There are various constituents of national security, external security and internal security playing important roles in their own way. A critical analysis of all wars fought by India, be it with China or Pakistan, will reveal that the people have played decisive roles in shaping the outcome of the conflicts. Same is equally true for the internal security dynamics as well. No external force can undertake proxy war if our people are with our national consciousness. In today's democratic world and open thought process, it cannot be a 'given' assumption. We all need to work towards this to ensure that regional, religious, linguistic, social, caste, and other such faultlines don't exist or at least reduced to a level where they don't affect our national security. There may be some segment of the population which may be feeling aggrieved on certain counts with policies of the Government of the day but a serious dialogue is needed to bring everyone 'on board' for the national cause. This responsibility is not only of the Government of the day but that of all the citizens of the country. We all win only

when the nation wins and it is therefore critical that we communicate and discuss the issues with all the stakeholders with an open mind. Once we adopt this approach, the majority of our internal issues will get addressed. Resources committed on such tasks can then be either utilised for external security or for nation building in the developmental works. These efforts will keep the population fully committed for the national cause.

Despite having gained a pre-eminence position in the world and having become the fifth largest economy, there are serious security challenges on the borders as well as within the nation. It's the 'people' who are key to address these issues and any amount of dialogue is worth it to understand their perspective and be bold enough to take corrective measures where needed. We all win and prosper when the nation wins and prospers.

<https://www.financialexpress.com/business/defence-political-and-social-discourse-for-national-security-3039663/>



Mon, 10 Apr 2023

Over 10% Women Officers to be Inducted into Army's Artillery Units

Over 10 per cent women officers of every batch commissioned into the Army this year onwards will be inducted into the Regiment of Artillery beginning with the batch of women officers joining the force this month, The Indian Express has learnt.

In a major development, the Army earlier this year had decided to open its artillery regiments to women Army officers. Army Chief General Manoj Pande had announced the move in January this year, and subsequently the government gave its nod to the proposal last month.

Designated as a combat support arm, artillery regiments comprise a range of guns of different calibres, mortars, rocket systems, missiles, remotely piloted aircraft, weapon locating radars, medium range battlefield surveillance radars, long-range surveillance systems, and is in the process of procuring a range of loitering munitions and other platforms as part of a modernisation plan. It is among the largest arms of the Army after the Infantry. Artillery firepower is also known to have caused major damages to both sides in the ongoing Russia-Ukraine war.

Around 40 women officers get commissioned into the Army from the Officers Training Academy, Chennai, every batch and two batches get commissioned into the Army every year.

The Passing out Parade will be held this month in OTA, Chennai, and the first of the women officers to join the Regiment of Artillery will be from this batch.

A senior officer told The Indian Express that as far as their training is concerned, the officers—along with their male counterparts—will be training for a few months in any of the artillery field regiments or medium regiments post commissioning.

“After spending a few months at the units, they will undergo the young officers’ course where they will be imparted specialised technical training on gunnery,” the officer said, adding that

they are training only in basics such as section or platoon level tactics prior to the course. “The duration of the course is less than six months. There will be no separate course or syllabus for the women Artillery officers and they will undergo the same course as their male counterparts,” the officer added.

After they complete the young officers’ course, they will be deployed to units including along the borders with China and Pakistan.

A second officer said it is likely they will get deployed as gun position officers once they are posted to units, which is a critical position as accurate and effective delivery of firepower depends on the officer.

<https://indianexpress.com/article/india/at-least-10-women-officers-to-be-inducted-into-armys-artillery-units-8547545/>



Mon, 10 Apr 2023

Armed Forces form Panel to Examine Disability Pension

The Indian Armed Forces have set up an inter-services panel chaired by the Army’s Adjutant General (AG) to examine different aspects of disability pension to their personnel, top officials familiar with the matter told The Indian Express.

Armed personnel receive higher payouts up to 30 per cent of their pension emoluments depending upon the percentage of disability. While the exact amount of total disability pensions — which is also exempt from income tax — is not available, sources in the government said it has grown substantially over the last two decades and was estimated to be around Rs 4,000 crore in 2022-23. The total defence pensions for 2023-24 is estimated at Rs 1.38 lakh crore.

The directive to set up the panel came from the Department of Military Affairs headed by Chief of Defence Staff (CDS) Gen Anil Chauhan after a Comptroller and Auditor General (CAG) report tabled in Parliament on March 27 had questioned the grant of the disability element of pension to a “higher percentage” of officers, including medical officers. It had asked the Defence Ministry to assess the reasons.

According to government officials, the panel to examine the disability pension was constituted on March 20, before the final CAG report was tabled in the Parliament. This decision was triggered by the draft report on disability pension, the observations of which were being discussed in the defence ministry in detail over the last few months. The panel is learnt to have held at least one meeting. It includes a senior medical officer from the Directorate General Armed Forces Medical Services (DGAFMS) and officers from Department of Ex-Servicemen Welfare, MoD (Finance), Department of Military Affairs (DMA) and the Adjutant General’s Branch. It will also have representatives from the personnel branch (for officers and men) of the three services.

Defence pensions in the last five years have increased to Rs 1.38 lakh crore in 2023-24 from Rs 1.08 lakh crore in 2018-19. Higher disability pensions and the revision of the ‘One Rank, One Pension’ scheme and arrears to the tune of Rs 28,138 crore have contributed to the rise in

defence pensions. The CAG report had noted that officers retiring with disability range between 36 per cent and 40 per cent of the total officer retirees. In case of personnel below officer ranks (PBOR), it ranged between 15 per cent and 18 per cent between 2015-16 to 2019-20. Further, the report said 22 per cent and 13 per cent of the disability pension cases granted to the officers and PBORs, respectively, were exclusively on the ground of lifestyle diseases, especially hypertension and diabetes mellitus.

Another observation in the report was that the percentage of medical officers who retired with disability pension was significantly higher as compared to other officers of the Army. According to the CAG data, 50 per cent and 58 per cent of medical officers retired with disability pension in 2015-16 and 2019-20, respectively.

Disabilities suffered by Armed Forces personnel include battle casualties (war wounded) and disabilities due to service conditions. The disability element for 100 per cent disability for various ranks is 30 per cent of emoluments last drawn, and is proportionately lower for disability less than 100 per cent. Personnel with less than 20 per cent disability are not entitled to any benefits. The grading of disability in percentage is carried out by a medical board.

The CAG report said absence of inputs in the database — category and disease — of the pension disbursing authority impeded a meaningful analysis on the causes of disability among the defence forces and possible remedial measures to bring down such cases.

It recommended that the defence ministry must maintain the complete database of pensioners to carry out an analysis on the main reasons of disability, including lifestyle diseases for possible corrective action.

Government officials said the stress involved in serving in difficult fields, including high altitude and insurgency-prone areas, left Armed Forces personnel with injuries leading to major and minor disabilities and aggravation in lifestyle diseases. Personnel also claim pensions for disabilities such as partial hearing loss and lower backache.

In 2019, the Central Board of Direct Taxes (CBDT) issued a notification stating that tax exemption on disability pension would be available only to personnel who had been invalidated from service and not to personnel who had retired otherwise. This was challenged in the Supreme Court which, in an order dated August 30, 2019, directed all parties to maintain 'status quo' on the matter.

<https://indianexpress.com/article/india/armed-forces-form-panel-to-examine-disability-pension-8547525>

THE ECONOMIC TIMES

Thu, 06 Apr 2023

Japan's Vice Minister of Defence for International Affairs calls on Rajnath Singh

Vice Minister of Defense for International Affairs of Japan Oka Masami called on Raksha Mantri Rajnath Singh in New Delhi on Thursday. During the meeting, Oka briefed the Raksha

Mantri on the discussions held during the 7th Defence Policy Dialogue, which he co-chaired with Defence Secretary Giridhar Aramane in New Delhi on Wednesday.

The visiting dignitary reiterated Japan's keenness to further enhance bilateral defence cooperation, including collaboration in defence equipment and technology.

Rajnath Singh conveyed that India shares Japan's vision for a free, open, secure and rules-based Indo-Pacific and stressed that both countries must continue to expand the scope of their bilateral cooperation.

"Wonderful meeting with Japan's Vice Minister of Defense, Mr Oka Masami in New Delhi. India shares Japan's vision for a free, open, secure and rules-based Indo-Pacific. Both the countries continue to expand the scope of their bilateral cooperation," Defence Minister Rajnath Singh tweeted.

"Oka was also accompanied by the Ambassador of Japan to India Suzuki Hiroshi, who thanked the Raksha Mantri for the impetus provided by his strong and positive leadership towards strengthening the bilateral defence ties. Defence Secretary Giridhar Aramane was also present on the occasion," Singh tweeted further.

Both sides agreed to further enhance bilateral defence cooperation.

<https://economictimes.indiatimes.com/news/defence/japans-vice-minister-of-defence-for-international-affairs-calls-on-rajnath-singh/articleshow/99304956.cms>



Thu, 06 Apr 2023

India, Japan Agree to Diversify Cooperation in Defence, Space

India and Japan on Wednesday reviewed their defence ties and agreed to diversify cooperation in new fields like defence, space and cyber during the seventh India-Japan Defence Policy Dialogue here. It was co-chaired by Defence Secretary Giridhar Aramane and Vice Minister of Defence for International Affairs Oka Masami.

Giving details of the talks, officials said a wide range of issues, including Service-level exercises and engagements, regional security issues and cooperation in defence equipment and technology, were discussed. The Japanese Vice Minister also presented policy updates from their recently released National Security Strategy and National Defense Strategy.

Both the countries appreciated the growing cooperation between the Services through Staff talks and exercises. They welcomed conduct of inaugural fighter exercise 'Veer Guardian' between Indian Air Force and Japanese Air Self Defence Force in January this year in Japan. The Defence Secretary emphasised that both the countries should aim to deepen collaboration between the respective defence industries. He also invited Japanese defence industries to look at investment opportunities in India under 'Make in India' initiative. Both sides agreed to diversify cooperation in new and emerging domains like defence space and cyber.

India and Japan reiterated their commitment towards a strong defence partnership and agreed to find opportunities to further enhance bilateral cooperation. Both sides also agreed to hold next Defence Policy Dialogue at mutually convenient dates. The Defence Policy Dialogue is an institutionalized mechanism between India and Japan to discuss bilateral defence cooperation.

<https://www.dailypioneer.com/2023/india/india--japan-agree-to-diversify-cooperation-in-defence--space.html>

THE ECONOMIC TIMES

Thu, 06 Apr 2023

UK Defence Firms keen to Expand in India: Business Council

British defence companies are planning to boost tie ups or make new investments in India, amid broader efforts to diversify their supply chains, an industry body said on Thursday.

Britain has sought to deepen economic, defence and security ties with India, committing to closer links with the Indo-Pacific region, while casting China as an "epoch-defining challenge" to the world order.

"We have got a group of 22 British defence companies, with collective revenues of about \$60 billion, really focused on doing business with and in India," UK-India Business Council (UKIBC) Chief Executive Richard McCallum told Reuters.

About 11 have already established joint ventures or subsidiaries in India, and all are looking to do more, he said.

Among those with a presence in India's aerospace and defence sector, BAE Systems has an Indian unit, while MBDA has a venture with Larsen & Toubro, and Rolls-Royce is looking to collaborate on jet engine technology.

McCallum did not say which firms will make new investments or which Indian companies they might be in talks with. "We think it is important to embed India into your supply chain," McCallum said in an interview. India and Britain are also negotiating a free trade deal that could boost annual bilateral trade by billions of dollars.

UKIBC Chair Richard Heald told Reuters that sustainable energy and green finance were among other areas of collaboration. But challenges on enforcement of contract and past decisions on retrospective taxes that led to years of legal disputes between the Indian government and companies like Vodafone had dented India's image as an investment destination.

Even though Prime Minister Narendra Modi's government has corrected some of these issues investors remain cautious. UKIBC hopes to see more clarity on protection of investments to further boost confidence, Heald said. India's disputes with British firms, resolved over several years, had "cast a long shadow on the operating environment", Heald said, adding that huge strides have been made since.

<https://economictimes.indiatimes.com/news/defence/uk-defence-firms-keen-to-expand-in-india-business-council/articleshow/99303057.cms>

THE ECONOMIC TIMES

Mon, 10 Apr 2023

Pakistan to Ship 230 Containers of Defence Items to Ukraine in April

Ukraine-Pakistan defence nexus looms large on the horizon even as the Ukrainian deputy foreign minister undertakes a four-day visit to India from Sunday.

Signalling to deepen defence partnership, Pakistan will ship 230 defence containers this month from the Karachi Port via two vessels MV Bokram and MV Kherson, ET has reliably learnt.

Ships transferring weapons from Pakistan to Ukraine are increasingly using the US and European flags, ET has learnt from persons familiar with the issue. Ports in Poland and Germany are the main gateway to transfer arms from Pakistan that included tanks and rockets, ET had earlier reported.

Interestingly, Pakistan is assisting Ukraine even as it seeks Russian assistance to upgrade aircraft engines. Islamabad is claiming that it will receive discounted oil from Russia beginning at the end of April. However, there is no concrete evidence of any Russia-Pakistan energy deal.

It has come to light that Ukraine-Pakistan-China in the past had created a nexus to share missile technology among themselves. The Indian establishment is trying to verify if Ukraine is still involved in sharing any missile technology to Pakistan, ET has learnt. In 2021, Pakistan was keen to purchase an anti-tank guided missile (ATGM) system from Ukraine. Kiev has also been accused of assisting North Korea in the past with missile technology.

Ukraine has been facing shortage of arms and ammunition and Pakistan has emerged as a key supplier of defence equipment in lieu of western aid. Last year, the UK used Pakistan as an air bridge to supply arms to Ukraine via Romania. Nur Khan Air Base in Rawalpindi was part of the air bridge reportedly 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. ET was the first report on this development. Some of the shipments were based on a memorandum of understanding between Pakistan and the UK's defence ministry.

<https://economictimes.indiatimes.com/news/defence/pakistan-to-ship-230-containers-of-arms-to-ukraine/articleshow/99362810.cms>

THE ECONOMIC TIMES

Sat, 08 Apr 2023

N. Korea says Tested Another 'Underwater Nuclear Attack Drone'

North Korea claimed on Saturday it had tested another underwater nuclear attack drone, in its latest response to South Korean and United States military drills, though analysts have questioned whether Pyongyang has such a weapon.

In recent weeks, North Korea has tested what state media have described as an underwater nuclear-capable drone, and also carried out the launch of an intercontinental ballistic missile.

"A national defence science research institute in the DPRK carried out a test of underwater strategic weapon system from April 4 to 7," the official Korean Central News Agency said.

"The underwater nuclear attack drone 'Haeil-2'... cruised 1,000 km of simulated underwater distance ... for 71 hours and 6 minutes."

KCNA added that "the test warhead accurately detonated underwater. The test perfectly proved the reliability of the underwater strategic weapon system and its fatal attack ability."

North Korea has claimed to have conducted three tests of underwater drones in less than three weeks so far.

On March 23, it claimed to have conducted the first test of the Haeil, which means tsunami in Korean, able to unleash a "radioactive tsunami" as it blamed US-South Korea exercises for a deteriorating regional security situation.

Five days later it said it had carried out a second test.

In response South Korean Defence Minister Lee Jong-sup told MPs Seoul was "capable of monitoring and detecting such drones infiltrating underwater".

Satellite imagery has also indicated a high level of activity at North Korea's main nuclear complex after leader Kim Jong Un ordered the production of weapons-grade nuclear material be ramped up.

North Korea last year declared itself an "irreversible" nuclear power and Kim recently called for an "exponential" increase in weapons production, including tactical nuclear weapons.

South Korea and the United States on Wednesday staged joint air drills involving at least one US nuclear-capable B-52H strategic bomber, Seoul's military said.

North Korea views such exercises as rehearsals for invasion, and has responded to other recent drills with a spate of increasingly provocative banned weapons tests. North Korea is seeking to diversify its delivery mechanisms in addition to increasing its nuclear stockpile.

Russia has also reportedly developed a similar weapon -- nuclear-capable Poseidon torpedoes -- but mastering the complex technology required for such weaponry might yet be beyond North Korea, experts said.

But the North's claims about the tests should not be "easily dismissed for being exaggerated", Choi Gi-il, professor of military studies at Sangji University, told AFP.

"While the North could have exaggerated the degree of success to some extent, they appear to show Pyongyang's underlying confidence in this technology, some of which could have been transferred from Russia."

Russia and North Korea have not officially commented on the transfer of the underwater drone technology, Choi added.

<https://economictimes.indiatimes.com/news/defence/n-korea-says-tested-another-underwater-nuclear-attack-drone/articleshow/99329366.cms?from=mdr>

Fri, 07 Apr 2023

US Resumes Construction of Biolabs in Ukraine amid the Ongoing War, Says Russian MoD

Amid the raging Russia-Ukraine war, the Russian defence ministry accused the United States of resuming the construction of bio labs in Ukraine. On Friday, Igor Kirillov, the head of the radiation, chemical and biological defence troops of the Russian Armed Forces, stated that the US is not only resuming its construction of the biological laboratories, but they are also expanding its operations by training Ukrainian biologists, Sputnik reported. The Russian scientist made the assertions based on the analysis of the minutes of the meeting of the working group of US and Ukrainian specialists. The meeting in question took place in October last year.

"Despite the forced pause pertaining to the Russian special military operation (in Ukraine), American activities under the program have now been resumed," Kirillov told the Russian media on Friday, as per the report by Sputnik. "The main tasks at this stage are to continue the construction of biological laboratories in Ukraine, as well as expand the format for training Ukrainian biologists," Kirillov further added. The Russian official further explained that the meeting which took place in October last year was led by the US Defense Threat Reduction Agency (DTRA). According to Kirillov, delegations from both countries talked about the plans for the implementation of the "Biological Threat Reduction Program" in Ukraine.

Who are the main perpetrator?

According to Sputnik, the Russian official stated that the Russian Ministry of Defense (MoD) believed that the US Department of Energy and the Pentagon were directly involved in resuming the construction of bio labs in the war-stricken country. During the conversation with the Russian media, Kirillov also touched upon the claims made by the US Department of Energy about COVID being linked to a Chinese Lab leak. "A legitimate question arises — what does the US Department of Energy have to do with combating biological threats and implementing projects that have signs of dual use?" Kirillov exclaimed. According to Sputnik, in 2023 alone, the US Department of Energy allocated \$105 million for research under the Bio-preparedness Research Virtual Environment project.

<https://www.republicworld.com/world-news/russia-ukraine-crisis/us-resumes-construction-of-biolabs-in-ukraine-amid-the-ongoing-war-says-russian-mod-articleshow.html>

The Tribune

Sun, 09 Apr 2023

20 Warships in Combat Mode, China-Taiwan Standoff Persists

Nearly 20 military ships, about 10 Chinese and 10 Taiwanese, are involved in a stand-off near the Taiwan Strait's median line, a source familiar with the situation said on Sunday.

China's military simulated precision strikes against Taiwan in a second day of drills around the island on Sunday, with the island's defence ministry reporting multiple air force sorties and that it was monitoring China's missile forces.

China, which claims democratically governed Taiwan as its own territory, began three days of military exercises around the island on Saturday, the day after Taiwan President Tsai Ing-wen returned from a brief visit to the United States.

Chinese state television reported that the combat readiness patrols and drills around Taiwan were continuing. "Under the unified command of the theatre joint operations command centre, multiple types of units carried out simulated joint precision strikes on key targets on Taiwan island and the surrounding sea areas, and continue to maintain an offensive posture around the island," it said.

The Chinese military's Eastern Theatre Command put out a short animation of the simulated attacks on its WeChat official account, showing missiles fired from land, sea and air into Taiwan with two of them exploding in flames as they hit their targets.

<https://www.tribuneindia.com/news/world/20-warships-in-combat-mode-china-taiwan-standoff-persists-495960>



Sun, 09 Apr 2023

China Simulates Striking Taiwan on Second Day of Drills

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A source familiar with the security situation in the region told Reuters that China had been conducting simulated air and sea attacks on "foreign military targets" in the waters off Taiwan's southwestern coast.

"Taiwan is not their only target," the source said, speaking on condition of anonymity as they were not authorised to speak to the media. "It's very provocative."

Taiwan's defence ministry said that as of 0800 GMT on Sunday they had spotted 70 Chinese aircraft, including Su-30 fighters and H-6 bombers, as well as 11 ships, around Taiwan.

The ministry said they were paying particular attention to the People's Liberation Army's Rocket Force which is in charge of China's land-based missile system.

"Regarding the movements of the Chinese communists' Rocket Force, the nation's military also has a close grasp through the joint intelligence, surveillance and reconnaissance system, and air defence forces remain on high alert," the ministry said.

It reiterated that Taiwan's forces will "not escalate conflicts nor cause disputes" and would respond "appropriately" to China's drills.

The security source said about 20 military ships, half from Taiwan and half from China, were engaged in a stand-off near the Taiwan Strait's median line, which has for years served as an unofficial barrier between the two sides, but did not behave provocatively.

China's aircraft carrier Shandong, which Taiwan has been monitoring since last week, is now more than 400 nautical miles off Taiwan's southeast coast and is carrying out drills, the source said. Zhao Xiaozhuo of China's Academy of Military Sciences told the Chinese state-backed Global Times newspaper this was the first time China had openly talked of simulated attacks on targets in Taiwan.

Key targets would include infrastructure such as runways, military logistics facilities and mobile targets "to annihilate them in one fell swoop if necessary", the report cited Zhao as saying.

'COMFORTABLE, CONFIDENT' U.S. MONITORS DRILLS

Life in Taiwan has continued as normal, with no sign of panic or disruption from the Chinese drills. Last August, following a visit to Taipei by Nancy Pelosi, then the speaker of the U.S. House of Representatives, China staged war games around Taiwan, including firing missiles into waters close to the island. It has not announced similar drills this time.

While in Los Angeles last week, on what was officially billed a transit on her way back from Central America, Tsai met the current speaker of the House, Kevin McCarthy, despite Beijing's warnings against it.

The de facto U.S. embassy in Taiwan said on Sunday the United States was monitoring China's drills around Taiwan closely and is "comfortable and confident" it has sufficient resources and capabilities regionally to ensure peace and stability.

U.S. channels of communication with China remain open and the United States had consistently urged restraint and no change to the status quo, said a spokesperson for the American Institute in Taiwan, which serves as an embassy in the absence of formal diplomatic ties.

Washington severed diplomatic relations with Taipei in favour of Beijing in 1979 but is bound by law to provide the island with the means to defend itself.

China, which has never renounced the use of force to bring the island under its control, says Taiwan is the most important and sensitive issue in its relations with the United States, and the topic is a frequent source of tensions.

Beijing considers Tsai a separatist and has rebuffed her repeated calls for talks. Tsai says only Taiwan's people can decide their future.

CHINESE FIGHTERS, WARSHIPS

China has over the past three years or so stepped up its military pressure against Taiwan, flying regular missions around Taiwan, though not in its territorial air space or over the island itself.

Taiwan's defence ministry said earlier on Sunday that in the previous 24 hours it had spotted 71 Chinese air force aircraft and nine navy vessels around Taiwan.

The ministry published a map showing around half of those aircraft, including Su-30s and J-11s, crossed the strait's median line.

Chinese state media said the aircraft were armed with live weapons. Taiwanese air force jets also typically carry live weapons when they scramble to see off Chinese incursions.

<https://www.reuters.com/world/us-says-it-is-monitoring-chinas-drills-around-taiwan-closely-2023-04-08/>

Science & Technology News



Press Information Bureau
Government of India

Ministry of Science & Technology

Sat, 08 Apr 2023

NM-ICPS Mission can Accelerate Technology Translation and Commercialization through TIHs Spanning all over the Country: Experts

Experts deliberated on ways to strengthen the National Mission in Interdisciplinary Cyber Physical Systems (NM-ICPS) with the help of disruptive technologies, effective translation, and commercialization of technologies so that it can become a major driver of economic growth of the country at the National Workshop on Technology Innovation in Cyber-Physical Systems (TIPS).

“Cyber Physical Systems (CPS) will play a major role in areas like health and medicine, intelligent transportation, as well as smart manufacturing in the future. Such a role needs a change in the trajectory of CPS through the introduction of new technologies like Artificial Intelligence, IoT, and Robotics, which will be the future drivers of CPS,” said Dr. V.K. Saraswat, Member (S&T), NITI Aayog at the 2nd TIPS workshop.

He also insisted on identifying the windows that have been created by the NM-ICPS mission that was launched in 2018 and on quantification of the value addition that has already been done to make India ready to participate in the globally growing CPS market.

MD4A4510

The Union Cabinet approved the National Mission on Interdisciplinary Cyber

Physical System (NM-ICPS) in December, 2018 at a total outlay of Rs.3660 Crores for a period of five years to be implemented by the Department of Science and Technology (DST). As part of the Mission implementation, 25 Technology Innovation Hubs (TIHs) have been established in advanced technologies in reputed institutes across the country. These TIHs focus on technology development and translation, human resource and skill development, entrepreneurship and start-ups development, and international collaborative research. For effective implementation of the Mission and to carry out the mandated activities by the TIHs, a series of workshops are being conducted for direct interaction between the Mission Office and its Expert Committee members and the TIHs.

Dr. Kris Gopalakrishnan, Chairman, Axilor Ventures, Bengaluru, and Chairman Governing Body, NM-ICPS, stressed in the need for growth in research and technology translation and for developing capacity in the system to utilize increased funding from the industry and from other sources at the 2nd National Workshop on Technology Innovation in Cyber Physical Systems (TIPS) during 6-8 April, 2023 at IIT, Delhi.

He highlighted the need for different types of collaborations through which the Technology Innovation Hubs can help in elevating technologies to higher TRL levels.

Prof. Ashok Jhunjhunwala, IIT Madras, elaborated on the steps the hubs can take in nurturing innovation and entrepreneurship and making innovators successful, while Prof. V Ramgopal Rao, Former Director, IIT Delhi, focused on how the hubs could bridge academic R&D with product innovation.

Dr. Akhilesh Gupta, Secretary SERB and Sr. Adviser, DST, explained how the hubs would work with the Governing Body and the Scientific Advisory Committee in synergy with the industry for translation and commercialization of technology while Prof. Rangan Banerjee, Director, IIT Delhi, outlined some of the achievements of the hub at IIT Delhi.

Each hub is a Section-8 Company, an independent entity within the host institute, and has been assigned a technology vertical in the areas of advanced technologies such as artificial intelligence and machine learning; technologies for the Internet of Things & Internet of Everything; Data Banks & Data Services, Data Analysis; Robotics & Autonomous Systems; Cyber Security and Cyber Security for Physical Infrastructure; Quantum technologies, etc. The NMICPS Mission aims to develop technology platforms to carry out R&D, translational research, product development, incubating & supporting start-ups, and commercialization.

NM-ICPS is a comprehensive Mission that brings together academia, industry, government and international organizations and has created an ecosystem that fosters entrepreneurship, develops next-generation skilled manpower, catalyses translational research, and promotes the commercialization of CPS technologies.

The Mission is being implemented with all the TIHs undertaking activities under technology development, entrepreneurship development, human resource development, and international collaborations. It aims at technology development, translational research and commercialization in Cyber Physical Systems (CPS) and associated technologies, adoption of CPS technologies to address India specific National and regional issues, production of next-generation skilled manpower, catalyzing translational research, accelerating entrepreneurship and start-up

ecosystem development in CPS technologies, giving impetus to advanced research in CPS technologies and higher education in Science, Technology and Engineering disciplines and bringing India at par with other advanced countries. It can transform key sectors of the Indian economy like healthcare, transportation, education, infrastructure, etc. and make them more efficient, safe, and sustainable to place India at par with other advanced countries.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1914750>



Sun, 09 Apr 2023

India Discovers Rare Earth Elements Critical for Self-Reliance in Defence, Aerospace

Scientists at a research institute in India's Hyderabad discovered light rare earth elements (REE) in Anantapur district of Andhra Pradesh, about 2,000 km south of national capital New Delhi. All these elements are deemed essential components in the manufacturing of electronic devices, medical technology, clean energy, aerospace, automotive, and defence industries.

The discovery was made by Hyderabad-based National Geophysical Research Institute.

India rare earth elements discovery: What are they?

The light rare earth element minerals found in Ananthapur district include allanite, ceriate, thorite, columbite, tantalite, apatite, zircon, monazite, pyrochlore euxenite and fluorite.

What does it mean?

The discovery of these elements has implications for the country's electronics and clean energy sectors. This will reduce India's reliance on foreign imports of these critical minerals.

Rare earths are 15 elements referred in the lanthanide and Actinide series of the periodic table of elements.

How the discovery was made?

NGRI scientists were conducting a survey for non-traditional rocks like syenites when they made the significant discovery of the minerals in the lanthanide series. NGRI scientist PV Sunder Raju said, "Zircon of varying shapes was observed in Reddypalle and Peddavadaguru villages."

"The monazite grains showed high-order multiple colours with radial cracks within grains, suggestive of the presence of radioactive elements," he added.

Raju said that more feasibility studies will be conducted by deep drilling to learn more about these REEs.

Earlier in February, India discovered 5.9 million tonnes of lithium reserves in Jammu and Kashmir. Lithium is a non-ferrous metal and is one of the key components in Electric Vehicle batteries.

<https://www.wionews.com/india-news/india-discovers-rare-earth-elements-critical-for-self-reliance-in-defence-aerospace-580546>

What is LIGO-India, the Indian Node in the Global Network of Labs to Probe the Universe

By Amitabh Sinha

The government has given the final go-ahead to India's Laser Interferometer Gravitational-Wave Observatory, or LIGO, project, clearing the way for the construction of the country's biggest scientific facility that will join the ongoing global project to probe the universe by detecting and studying gravitational waves.

LIGO is an international network of laboratories that detect the ripples in spacetime produced by the movement of large celestial objects like stars and planets. These ripples were first postulated in Albert Einstein's General Theory of Relativity that encapsulates our current understanding of how gravitation works.

LIGO-India will be located in Hingoli district of Maharashtra, about 450 km east of Mumbai, and is scheduled to begin scientific runs from 2030. Here's what you need to know about gravitation, Einstein's General Theory of Relativity, and the purpose and significance of the LIGO project.

Newton's law of gravitation

Almost everyone with a high-school background would be familiar with Newton's law of gravitation. The English mathematician Sir Issac Newton (1643-1727) had postulated that the force that makes any object fall to the ground was also the one that makes heavenly bodies go around in their orbits.

Newton proposed that this was due to the fact that every celestial body exerted an attractive force on every other body in the universe. He worked out a mathematical formulation to calculate the strength of this attractive force which, he found, was directly proportional to the masses of the two bodies and inversely proportional to the square of the distance between them.

For more than two centuries, this remained the best understanding of gravitation. It could explain the motion of all celestial objects, and the mathematical framework was able to produce results that matched precisely with the observations. Newton's law of gravitation is an integral part of elementary science education even today, and its mathematics continues to be applied in a wide variety of modern-day scientific investigations with a remarkable degree of accuracy.

Deficiencies in Newton's law

Its success notwithstanding, the theory suffered from a couple of major deficiencies, one of which was evident even during Newton's time. Newton himself acknowledged it while describing the gravitational force in his landmark publication, *The Mathematical Principles of Natural Philosophy* in 1687, and his contemporaries were aware of it. The theory did not explain the reason for the existence of the attractive force between any two bodies. Why should every piece of matter feel attracted towards everything else?

The second problem became apparent much later, at the start of the 20th century, as a consequence of Albert Einstein's Special Theory of Relativity. Special Relativity, published in 1905, established that nothing could travel faster than the speed of light. But the gravitational force seemed to be propagating instantaneously, over any large distance, without any delay at all. Time does not even figure in Newton's gravitational equation.

General Theory of Relativity

Ten years later, in 1915, Einstein altered our understanding of gravitation with his General Theory of Relativity. He had already shown, with Special Relativity, that space and time were not independent entities but had to be woven together as spacetime. With General Relativity, which was essentially a new theory of gravitation, Einstein took a huge leap of thought.

He proposed that spacetime was not just a passive backdrop to the events happening in the universe. It was not a mere transparent, inert, and static stage. Instead, spacetime interacted with matter, was influenced by it, and in turn, itself influenced events. It was like a soft fabric that responds to a heavy object placed on it, and curls around it.

The curvature in spacetime so produced was the reason other smaller bodies in the vicinity felt the gravitational pull. In fact, there is no force at all. Gravitation is just the curvature in spacetime. Since the spacetime itself is curved around the heavier mass, other nearby objects, moving normally in straight lines in their spacetime, find themselves going around the central mass. The heavier the mass in the centre, the steeper and bigger is the curvature in spacetime, and stronger and more extended is the gravitational field.

With one mind-bending idea, Einstein was able to explain the origin of the gravitational force, and also the reason for perpetual, near-circular, motion of all heavenly bodies. As physicist John Wheeler described very succinctly, matter tells spacetime how to curve and spacetime tells matter how to move. Also, this model of gravity does not involve instantaneous propagation of force. The experience of a pull towards the central mass happens at the speed of light.

Gravitational waves

General Relativity also predicted that moving objects would generate gravitational waves in spacetime, just like a moving boat produces ripples in water. Because these are ripples in spacetime itself, gravitational waves have the effect of causing a temporary deformation in a body when it comes in contact. Since the spacetime itself elongates or contracts during the propagation of the gravitational wave, everything lying in that spacetime also goes through the same experience.

This effect is similar to a ball being slightly squeezed along any of its diameters. The ball flattens a bit in the direction of pressure that is applied, while it bulges out in the perpendicular direction. When a gravitational wave passes the Earth, for example, the Earth gets similarly squeezed in one direction, and bulges in the perpendicular direction.

Because gravity is the weakest of all natural forces, the deforming effect of gravitational waves is extremely tiny, the reason why it could not be experimentally verified for 100 years even though many other predictions of General Relativity were tested repeatedly during this period.

How LIGO works

It is to measure these tiny effects of gravitational waves that scientists have set up the Laser Interferometer Gravitational Wave Observatory (LIGO), one of the most complex pieces of

scientific equipment ever built. The observatory comprises two 4-km-long vacuum chambers, built perpendicular to each other. Highly reflective mirrors are placed at the end of the vacuum chambers.

Light rays are released simultaneously in both the vacuum chambers. They hit the mirrors, get reflected, and are captured back. In normal circumstances, the light rays in both the chambers would return simultaneously. But when a gravitational wave arrives, one of the chambers gets a little elongated, while the other one gets squished a bit. In this case, light rays do not return simultaneously, and there is a phase difference. The presence of a phase difference marks the detection of a gravitational wave.

The precision of the measurements required to detect gravitational waves is mind-boggling. At a 4-km scale, the changes in distance that light has to travel because of the gravitational wave are 10,000 times smaller than the width of the proton, and LIGO instruments are designed to pick this up. According to the LIGO website, this is similar to measuring the distance to a neighbouring star 4.2 light years away with an accuracy smaller than the width of human hair.

The first ever detection of a gravitational wave happened on September 14, 2015, by the two US-based LIGO detectors. These gravitational waves were produced by the merger of two black holes, which were about 29 and 36 times the mass of the Sun, 1.3 billion years ago. Black hole mergers are the source of some of the strongest gravitational waves. But even these are extremely feeble to detect. Scientists checked the results for four months before announcing their result in February 2016.

This achievement was promptly rewarded with the Nobel Prize in 2017. Since then, nine more gravitational wave events have been detected by the four observatories in the United States, Europe and Japan.

Why LIGO India matters

LIGO India, for which the government approval was given on Thursday, would be the fifth node of this international network of gravitational wave observatories, and possibly the last. The instruments at these observatories are so sensitive that they can easily get influenced by events like earthquakes, landslides, or even the movement of trucks, and produce a false reading. That is why multiple observatories are needed to revalidate the signals.

The chances of two observatories, located in different geographies, producing the exact same false reading are negligible. But two detectors are the bare minimum. More are needed to tap all possible sources of gravitational waves, and to improve the quality and accuracy of information. The LIGO website indicates that the India detector, the fifth node in the international network, could be all that is required for the time being.

For India, LIGO is a momentous milestone. India has been an active collaborator in a number of international science projects. These include the Large Hadron Collider experiments, and ITER, the effort to create a thermonuclear reactor that would enable controlled nuclear fusion reactions. India is also expected to be a partner country in setting up the next space station after the current International Space Station comes to the end of its life later this decade.

However, India has not yet built a cutting-edge scientific facility on this scale on its own soil, something that can have huge spin-off benefits for its science and technology sector. The India-based Neutrino Observatory, one such facility that has been planned in India, has been facing

delays. LIGO, therefore, is crucial to demonstrating India's intent and capability to pull-off complex science projects on its own.

<https://indianexpress.com/article/explained/explained-sci-tech/ligo-india-global-network-labs-study-gravitational-waves-8545293>



Sun, 09 Apr 2023

Gaganyaan: From Astronauts' Training to Tech Upgrade, ISRO Making Leaps to Meet 2025 Target for Manned Mission

From human rating LVM3 launch vehicle to upgrading the mission control complex, building an 'umbilical tower' on the second launch pad for maintenance of the rocket while on the launch platform, agreement with Australia for setting up a mobile unit for direct-to-ground communication at Cocos Island, the Indian Space Research Organisation has been busy working towards sending humans to space, says the recently released annual report of the organisation.

The Gaganyaan Mission will be undertaken from the second launch pad at the country's only spaceport in Sriharikota. The selected astronauts have completed the first semester of the mission-specific training in India, after completing a generic training for spacefaring in Russia. During the training, the astronauts attended 218 lectures and 75 physical training sessions. There were two flying practices, two medical evaluations and two course-related evaluations in this period.

The theoretical courses trained them in the basics of spaceflight, propulsion, aerodynamics, and details of the launch vehicle and spacecraft. The practical training included flying practice, aeromedical training, yoga, and virtual reality training focused on familiarising the crew to the hardware and interiors of the crew module and operating it during the mission.

Minister of State for Space Jitendra Singh had earlier said that the space agency will undertake two test vehicle missions to demonstrate crew escape systems mid-flight and the retrieval of the crew module once it splashed down in the ocean. This will be followed by the first unmanned Gaganyaan mission that will carry an unpressurised crew module. The space agency is trying to carry out at least one unmanned mission this year depending on the performance during the test vehicle missions.

The test vehicle mission will use a single-stage rocket to take the orbital module to space and then test the crew abort and escape parachute systems, the deceleration and splashdown of the spacecraft, systems to keep the spacecraft upright after splashdown, and processes to get the astronauts out from the module.

Subsequently, there will be two more test vehicle missions to check all systems before the second unmanned flight. As of now, the final manned flight is scheduled for 2025.

Missions for the year

The ISRO report states that the space agency has planned 15 satellite and launch vehicle missions this year, including the launch of the recently operationalised small satellite launch vehicle and three space science mission

Other than the human spaceflight, several other big ticket missions of the space agency have been on hold owing to the pandemic, including the third lunar mission, the first solar mission, and another space observatory mission.

The report states that there will be one mission of the heavy rocket LVM3, which is likely to carry on-board Chandrayaan-3. ISRO chairperson S Somanath had earlier said that Chandrayaan-3 mission is likely by mid-2023. The mission will complete the objectives of Chandrayaan-2, attempting a soft landing and then roving on the lunar surface close to the south pole of the celestial body.

The report states that high-pressure leak checks of gas bottles and propellant tanks have already been carried out. A leak in the helium gas bottle, used to pressurise the cryogenic fuel in the rocket's upper stage, had resulted in Chandrayaan 2 mission being halted on the launch pad minutes before the launch.

According to officials, everything for Chandrayaan-3 mission is ready and the systems are undergoing final checks. "A battery of tests is being conducted to check the robustness of the systems. The systems are being tested under various simulated scenarios such as what happens if there is a dust cloud during landing, what happens if there are pebbles at the landing site."

The Aditya L1 mission, the ISRO chairperson had previously said, is likely to take place in June or July in 2023 on board the workhorse PSLV. The report states that all payloads are at an advanced stage of development to meet the launch schedule. "Three of the payloads of the mission have already been delivered for assembly, integration and testing."

The report states that nine missions were carried out in total during the financial year 2022-23. The previous year's report had estimated a total of 19 missions, including one launch under the Gaganyaan mission and three space science missions, none of which happened during the year.

Gaganyaan preparedness

India's heaviest rocket LVM3 has been human-rated for the Gaganyaan mission, meaning more redundancies and margins have to be added to ensure safety of the crew. The rocket uses two solid boosters, the core liquid fuel-based stage, and the cryogenic upper stage. The human-rated solid boosters were used during the March launch of OneWeb satellites.

Towards the qualification of the core stage, eight tests have been carried out, firing the engine for medium duration, long durations, and under conditions that are not ideal. Similarly, for the qualification of the upper cryogenic stage, eight tests have already been carried out. Three more hot tests scheduled for the second quarter of 2023 will qualify the engine as human-rated, as per the report.

With two test vehicle demonstration due before the first unmanned Gaganyaan mission, ISRO in its report said the first single-stage vehicle has already been manufactured and transported to the

spaceport in Sriharikota. The launch was scheduled for the first quarter of the year. The manufacturing of the second test vehicle is also underway, the report said.

Important spacecraft systems

One of the most important systems being developed for the human spaceflight is Environment Control and Life Support System, which is tasked with maintaining pressure, temperature, humidity and gas exchange for the crew. The report says the design and configuration of several of the components of the system have been finalised. “Preliminary accommodation of the ECLSS system and half-humanoid in G1 (first unmanned mission) is completed,” the report says. ISRO will send a half-humanoid in the unmanned mission to assess likely impacts on human beings.

The space agency has also been working to qualify the parachute systems that will ensure that crew module slows down and safely splashes in the water after the mission. A ten-parachute system will be used for the crew module, with three main ones, two of which would be sufficient to bring the astronauts back safely. A total of 13 “drop tests” have been planned to test the deployment of the parachutes and simulate failure conditions, of which at least three have been completed successfully.

Other than that, various institutes have also been working on five micro-gravity experiments that will be carried onboard the uncrewed flights. This includes experiments such as how spaceflight changes in kidney stone formation in fruit fly, crystallisation of two active pharmaceutical ingredients or API with neutraceuticals in space, and instabilities in micro-gravity conditions.

Crew escape and recovery

The crew escape system for pad abort — where the mission needs to be aborted and the crew taken out safely from the rocket while on the launch pad — has already been demonstrated in 2018. The performance of the system will be demonstrated for escape of the crew while at different Mach speeds during the test vehicle missions. Static tests for the five quick acting solid motors that will be used to jettison the crew out of the main module have already been carried out, as per the report. Three sets have been manufactured to test the structure of the crew escape system.

The space agency is modifying the existing control centre to make the Gaganyaan Control Facility with a different configuration of display and consoles. An ‘umbilical tower’ – which can be used for maintenance of the launch vehicle while on the launch pad – has been created in the second launch pad and a trial for high speed bubble lift was carried out. The white room and crew access arm – from where the astronauts walk into the spacecraft – is also being developed.

Other than that the space agency is also working to create a network of ground stations that will allow direct-to-ground communication. Support for this has been finalised from European ground stations. Ship-borne terminals will also be required for telemetry, tracking and communication with the spacecraft during the ascent phase of the mission. A transportable terminal will be set up at Cocos Island, Australia, for which arrangements have been made.

<https://indianexpress.com/article/india/gaganyaan-from-astronauts-training-to-tech-upgrade-isro-making-leaps-to-meet-2025-target-for-manned-mission-8546259>

Fri, 07 Apr 2023

Indian Space Policy 2023 Takes off; a New Era of Space Tech for Private Industries

The Central government approved the Indian Space Policy (ISP) 2023 on Thursday. This new space policy seeks to regulate and boost private sector participation in the space sector. The ISP also looks to increase investments in the space sector from private companies.

The union minister Jitendra Singh said, “In brief, the Indian Space Policy will offer clarity in the role of the components set up (in the past).”

The Policy thrust on privatization will enable the space sector to be more innovative and sustainable. It is crucial if India wants to be competitive in global space ecosystems. The space sector has remained within the confines of Indian Space Research Organization (ISRO) with full budgetary support from the government.

Despite leading in complex space tech and launch vehicles, the Indian space market is worth \$7 billion, which is just about 2% of the global space market.

The entry of the private sector in the space sector would enable the ISRO to channelise its focus on research and development of advanced space technologies.

The Indian Space Policy was approved by the Cabinet Committee on Security chaired by Prime Minister Narendra Modi.

Lt. Gen. AK Bhatt (retd.), Director General, Indian Space Association said “This is a historic moment as the cabinet today approved the Indian Space Policy 2023. It will pave the way forward with much-required clarity in space reforms and augment private industry participation to drive the space economy opportunity for the country.”

The promising space policy 2023

Fundamentally, through the ISP, the government aims to drive the overall growth of Indian commercial space activities by creating a regulatory environment in compliance with international law and by addressing the previous hurdles to the goal of encouraging the private sector.

By institutionalizing the sector, the ISP breaks the monopoly ISRO-driven space sector.

Notably, the ISP also addresses the liability issue in case of any fallout or destruction of space assets. Since India is a party to the Outer Space Treaty, the Liability Convention, and the Registration Convention, the responsibility for any destruction or damage lies with the government.

Within the policy framework, the government aimed to address the crucial issue of the control and access of the dual-use space technology or IP that protects or threatens national security. Industry demanded that IP must be examined on a case-by-case basis.

The Policy will throw much clarity on the regulatory framework which concerns the diverse activities which range from remote sensing to deep-space exploration.

The policy also directs and provides the greater opportunity, more time and resources to focus on deep-space scientific and technological research.

“We have been waiting for it for quite some time and today’s announcement has come as a pleasant surprise. We keenly await and look forward to going through the details of the policy. We would like to thank Prime Minister for his visionary leadership with a special focus on long-due reforms in the Indian space sector.”

<https://www.financialexpress.com/business/defence-indian-space-policy-2023-takes-off-a-new-era-of-space-tech-for-private-industries-3037906/>



Sat, 08 Apr 2023

C.R. Rao Wins Top Statistics Award – a Look Back at his Pioneering Work

The Indian-American statistician Calyampudi Radhakrishna Rao has been awarded the 2023 International Prize in Statistics, which is statistics’ equivalent of the Nobel Prize. It was established in 2016 and is awarded once every two years to an individual or team “for major achievements using statistics to advance science, technology and human welfare.”

Prof. Rao, who is now 102 years old, is a ‘living legend’ whose work has influenced, in the words of the American Statistical Association, “not just statistics” but also “economics, genetics, anthropology, geology, national planning, demography, biometry, and medicine”. The citation for his new award reads: “C.R. Rao, a professor whose work more than 75 years ago continues to exert a profound influence on science, has been awarded the 2023 International Prize in Statistics.”

What was Rao’s 1945 paper about?

Rao’s groundbreaking paper, ‘Information and accuracy attainable in the estimation of statistical parameters’, was published in 1945 in the Bulletin of the Calcutta Mathematical Society, a journal that is otherwise not well known to the statistics community. The paper was subsequently included in the book Breakthroughs in Statistics, 1890-1990.

This was an impressive achievement given Rao was only 25 at the time and had just completed his master’s degree in statistics two years prior.

He would go on to do his PhD in 1946-1948 at King’s College, Cambridge University, under the supervision of Ronald A. Fisher, widely regarded as the father of modern statistics.

The Cramér-Rao inequality is the first of the three results of the 1945 paper. When we are estimating the unknown value of a parameter, we must be aware of the estimator’s margin of error. Rao’s work provided a lower limit on the variance of an unbiased estimate for a finite sample. The result has since become a cornerstone of mathematical statistics; researchers have

extended it in many different ways, with applications even in quantum physics, signal processing, spectroscopy, radar systems, multiple-image radiography, risk analysis, and probability theory, among other fields.

In an article published in the journal *Statistical Science* in 1987, the American statistician Morris H. DeGroot set out an intriguing story (corroborated by Rao's own account) of how Rao arrived at the lower limit. Prof. Fisher had already established an asymptotic (i.e. when the sample size is very large) version of the inequality, and it seems a student had asked Rao, "Why don't you prove it for finite samples?" in 1944. A then-24-year-old Rao did so in under 24 hours!

The second outcome of the 1945 paper was the Rao-Blackwell Theorem, which offers a method to improve an estimate to an optimal estimate. The Rao-Blackwell theorem and the Cramér-Rao inequality are both related to the quality of estimators.

A new interdisciplinary area called 'information geometry' was born as a result of the paper's third finding. This field integrated principles from differential geometry into statistics, including the concepts of metric, distance, and measure. Erich L. Lehmann, a renowned statistician, said in 2008 that "this work [of Rao's] was before its time and came into its own only in the 1980s".

So overall, Rao's 1945 paper made an outstanding contribution, boosting the development of modern statistics and its widespread application in modern research. In a 2008 book, *Reminiscences of a Statistician: The Company I Kept*, Lehmann also discussed the generative nature of the paper – i.e. the goldmine of insights that it was – and acknowledged that "several of my early papers grew out of Rao's paper of 1945".

How did Rao enter the field of statistics?

The Australian statistician Terry Speed claimed that the "1940s were ungrudgingly C.R. Rao's. His 1945 paper ... will guarantee that, even had he done nothing else – but there was much else."

Indeed, one of Rao's papers in 1948 offered a novel generic approach to testing hypotheses, now widely known as the "Rao score test". In fact, the three test procedures – the likelihood ratio test of Jerzy Neyman and E.S. Pearson (1928), the Wald test (1943) of Abraham Wald, and the Rao score test (1948) – are sometimes called "the holy trinity" of this branch of statistics.

Rao also contributed to orthogonal arrays, a concept in combinatorics that is used to design experiments whose results are qualitatively good, as early as 1949. A 1969 *Forbes* article described it as "a new mantra" in industrial establishments.

Given the magnitude and relevance of his contributions, it might seem surprising that Rao entered the field of statistics by chance.

Despite scoring first in mathematics at Andhra University, a 19-year-old Rao didn't secure a scholarship there for administrative reasons. He was also rejected for a mathematician's job at an army survey unit because he was judged to be too young.

When he was staying at a hotel in Calcutta, he met a man who was employed in Bombay and had been sent to Calcutta to be trained at the Indian Statistical Institute. He asked Rao to apply to the institute as well. Rao did so, for a year-long training programme in statistics, hoping the additional qualification would help him land a job.

P.C. Mahalanobis, then director of the institute, replied promptly and Rao was enrolled. That marked the beginning of a four-decade-long stay at the institute. Rao retired in 1979 and afterwards settled in the U.S.

The first half of the 20th century was the golden period of statistical theory in general, and Rao is undoubtedly one of the reasons for this being the case, thanks to his mathematical ingenuity. In the words of the late mathematician Samuel Karlin, Rao's contributions to statistical theory have "earned him a place in the history of statistics".

Indian statisticians also owe Prof. Rao gratitude for his enormous contributions to the growth of statistics in the country, notably at the Indian Statistical Institute (where this author works). As Lehmann wrote, Rao was "the person who did the most to continue Mahalanobis's work as a leader of statistics in India."

<https://www.thehindu.com/sci-tech/science/cr-rao-international-prize-statistics-2023-pioneering-contributions/article66710819.ece>

