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Press Information Bureau
Government of India
Ministry of Defence

Sat, 12 Feb 2022 2:27PM

LCA Tejas to participate in Singapore Air Show-2022

A 44 member contingent of Indian Air Force reached Changi International Airport in Singapore today to participate in the 'Singapore Air Show-2022'. The Air Show will be held from 15th to 18th February 2022. Singapore Air Show is a biennial event which provides a platform for the Global Aviation Industry to showcase their products.

IAF will be pitching the indigenous Tejas MK-I ac alongside participants from across the world. The Tejas aircraft will be enthralling the audience with its display of low level aerobatics displaying its superior handling characteristics and maneuverability. The participation of Indian Air Force in the Air Show provides India with the opportunity to showcase the Tejas aircraft and to interact with counterparts from RSAF (Royal Singapore Air Force) & other participating contingents.

In the past, Indian Air Force had participated in similar Air Shows like LIMA-2019 in Malaysia and Dubai Air Show-2021 to exhibit indigenous aircraft and formation aerobatic teams.



<https://pib.gov.in/PressReleasePage.aspx?PRID=1797867>



पत्र सूचना कार्यालय
भारत सरकार
रक्षा मंत्रालय

Sat, 12 Feb 2022 2:27PM

एलसीए तेजस सिंगापुर एयर शो-2022 में भाग लेगा

भारतीय वायु सेना की एक 44 सदस्यीय टुकड़ी 'सिंगापुर एयर शो- 2022' में भाग लेने के लिए आज सिंगापुर के चांगी अंतरराष्ट्रीय हवाई अड्डे पर पहुंची। इस एयर शो का आयोजन 15 से 18 फरवरी, 2022 तक किया जाएगा। सिंगापुर एयर शो एक द्विवार्षिक कार्यक्रम है जो वैश्विक उड़यन उद्योग को अपने उत्पादों को प्रदर्शित करने के लिए एक मंच उपलब्ध कराता है।

भारतीय वायु सेना विश्वभर के प्रतिभागियों के साथ स्वदेशी तेजस एमके-1 एसी प्रस्तुत करेगी। तेजस विमान अपनी उत्कृष्ट हैंडलिंग विशेषताओं तथा गतिशीलता को प्रदर्शित करते हुए नीची ऊंचाई के एरोबैटिक्स को प्रदर्शित करते हुए दर्शकों को मंत्र मुग्ध कर देगा। एयर शो में भारतीय वायु सेना की प्रतिभागिता भारत को तेजस विमान को प्रदर्शित करने तथा आरएसएएफ (रॉयल सिंगापुर एयर फोर्स) तथा अन्य प्रतिभागी टुकड़ियों के साथ परस्पर संपर्क करने का अवसर प्रदान करती है।

इससे पूर्व, भारतीय वायु सेना ने स्वदेशी विमानों को प्रदर्शित करने तथा एरोबैटिक्स टीमों का निर्माण करने के लिए मलेशिया में एलआईएमए-2019 तथा दुबई एयर शो-2021 जैसे समान प्रकार के एयर शो में भाग लिया था।



<https://pib.gov.in/PressReleasePage.aspx?PRID=1797880>

Business Standard

Sat, 12 Feb 2022

Eye on Malaysia, Tejas fighter to perform in Singapore

The IAF will be pushing hard to bag an order from the Royal Malaysian Air Force, which is looking to buy a mix of 36 light fighter variants under its 'Capability 55' plan

By Ajai Shukla

New Delhi: A detachment of Tejas Mark 1 fighters flew on Saturday from the Indian Air Force (IAF) base in Coimbatore to Changi International Airport in Singapore to participate in the Singapore Airshow – 2022 from February 15-18.

The aircraft are accompanied by a 44-person IAF team, which will be responsible for flying, displaying and maintaining the Tejas fighters during its daily aerobatics displays in the show.

The IAF will be pushing hard to bag an order from the Royal Malaysian Air Force (RMAF), which is looking to buy a mix of 36 light fighter variants under its “Capability 55” plan.

Launched in 2018, the plan envisions procuring a mix of light combat aircraft (LCA) and fighter lead-in trainers (FLIT) in two phases – 18 aircraft to be supplied from 2022-23 and another 18 from 2025 onwards.

According to authoritative aerospace publishing house, Jane’s, the RMAF will distribute the 36 aircraft between one LIFT and two LCA squadrons.

In June 2021, Malaysia’s defence ministry kicked off the acquisition of the initial 18 aircraft, of which eight will be LIFT and ten will be LCAs. Hindustan Aeronautics Ltd (HAL), which manufactures the Tejas, submitted its bid by the due date of September 22, 2021.

The IAF had already been showcasing the Tejas’ performance by fielding the aircraft in global defence and aerospace exhibitions, including the Bahrain International Air Show in 2016, the



Tejas Mark-1 aircraft

Langkawi International Maritime Aerospace Expo (LIMA) in 2019 and the Dubai Air Show-2021 last November.

“The IAF will be pitching the indigenous Tejas Mark-1 aircraft alongside participants from across the world. The Tejas will be enthraling the audience with its display of low level aerobatics, displaying its superior handling characteristics and maneuverability,” stated an IAF press statement on Saturday.

Aerospace industry watchers say that in the supersonic LCA category the RMAF is deciding between three light fighters on offer: the Tejas Mark 1, the South Korean FA-50 Golden Eagle, the Russian MiG-35 and the Chinese-Pakistani JF-17 Thunder, which already equips the Pakistan Air Force (PAF).

Competing in the sub-sonic FLIT category are three less powerful jet trainers: Italian firm Leonardo’s M-346FA aircraft, the South Korean T-50 trainer and the Russian Yakovlev-130.

“The participation of the IAF in the air show provides India with the opportunity to showcase the Tejas aircraft and to interact with counterparts from the RSAF (Royal Singapore Air Force) and other participating contingents,” stated the MoD.

The RMAF’s “Capability 55” modernisation programme envisages adding a single-engine, supersonic fighter to the current RMAF fleet, which consists mainly of twin-engine fighters. These include eight Boeing F/A-18D Hornets and 18 Russian Sukhoi-30MKM Flankers. Efforts to replace the RMAF’s aged MiG-29 Fulcrum interceptors have stalled due to lack of funds.

The RMAF has specified exacting tender requirements, which include mid-air refuelling, beyond-visual-range (BVR) combat and supersonic flight capabilities. Manufacture must be localised in Malaysia to the extent of 30 per cent of the aircraft and delivery must begin within 36 months of signing the contract.

HAL chief, R Madhavan, told *Business Standard* that almost every one of the RMAF requirements had been met and others, such as an on-board oxygen generating system (OBOGS) could be easily engineered.

HAL has offered the RMAF the sophisticated Mark 1A version of the Tejas, which has mid-air refueling, active electronically scanned array (AESA) radar, electronic warfare (EW) capability and the ability to fire BVR missiles.

On the other hand, competitors are falling short on many of the RMAF requirements. The JF-17 Thunder does not have the specified AESA radar. Turkey does not yet have a flying aircraft, while any Chinese offering will be treated with suspicion, given Kuala Lumpur’s wariness of Beijing after recent incursions by Chinese aircraft and warships into disputed waters in the South China Sea.

Price is important too for the RMAF, which, sources say, expects to pay in the region of \$900 million for 18 fighters, or \$45-50 million per fighter. The Tejas is understood to be falling in that price band.

The Korean fighter is understood to be slightly more expensive than the Tejas and the Russian MiG-35 significantly so. Meanwhile, the Chinese are believed to have slashed the price of the JF-17 by about 30 per cent, a loss it is willing to bear in order to capture the market.

https://www.business-standard.com/article/current-affairs/eye-on-malaysia-tejas-fighter-to-perform-in-singapore-122021201053_1.html

India to showcase Tejas at Singapore air show, tap export potential

The Tejas's participation in the Singapore air show comes in the backdrop of India taking steps to transform itself from one of the world's biggest weapons importers into an export powerhouse

By Rahul Singh

New Delhi: India will showcase Tejas Mk-1 fighter jets at the upcoming Singapore Air Show, from February 15 to 18, the Indian Air Force said on Saturday, with the move aimed at tapping the export potential of the locally-made light combat aircraft (LCA).

Three Tejas Mk-1 jets will take part in the air show. A 44-member IAF contingent reached Changi International Airport in Singapore on Sunday to participate in the biennial event.

“IAF will be pitching the indigenous Tejas MK-I aircraft alongside participants from across the world. The Tejas aircraft will be enthralling the audience with its low-level aerobatics and displaying its superior handling characteristics and manoeuvrability,” the IAF said in a statement. Tejas previously took part in the Malaysia, Dubai and Bahrain air shows.

The Tejas's participation in the Singapore air show comes in the backdrop of India taking steps to transform itself from one of the world's biggest weapons importers into an export powerhouse. The military hardware that holds export potential includes the LCA, Astra beyond-visual-range air-to-air missile, Akash surface-to-air missile system, BrahMos supersonic cruise missiles, tanks, sonars and a variety of radars, officials said.

India's BrahMos Aerospace and the Philippines last month signed a deal worth almost \$375 million for the Philippine Marines to acquire three batteries of the BrahMos cruise missile, a shot in the arm for New Delhi's efforts to emerge as an exporter of major defence hardware.

In December 2020, the Union Cabinet, chaired by Prime Minister Narendra Modi, gave its go-ahead to the sale of Akash missile systems to friendly foreign countries and created a high-powered panel for swifter approval to export of military hardware. India has set a target of clocking defence exports worth \$5 billion by 2024.

The committee to speed up exports has the defence minister, external affairs minister and the national security advisor on board. Several foreign countries have shown interest in the Akash missile system during international and local defence exhibitions. Apart from authorising the export of defence platforms, the mandate of the committee is to explore opportunities for the government-to-government sale of military hardware to foreign countries.

“This year's defence budget had a significant thrust of Make in India, a reflection of the government's commitment to boost defence production in the country. It will enable us to develop systems that have export potential. LCA can help India get a toehold in foreign markets,” said Air Marshal Anil Chopra (retired), director general, Centre for Air Power Studies.

Defence items already being exported include the advanced light helicopter, offshore patrol vessels, personal protective gear, surveillance systems and a variety of radars.

State-run plane maker Hindustan Aeronautics Limited (HAL) is expected to carry out the first test flight of the Tejas's latest variant, Mk-1A, soon. Last year, the defence ministry awarded a Rs.48,000-crore contract to HAL for 83 LCA Mk-1A jets for IAF. The first Mk-1A aircraft will be delivered to the air force by March 2024, with the rest slated to join its combat fleet by 2029.

<https://www.hindustantimes.com/india-news/india-to-showcase-tejas-at-singapore-air-show-tap-export-potential-101644663466757-amp.html>

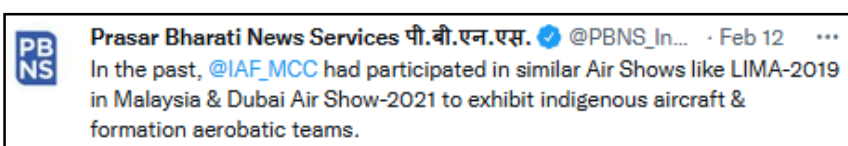
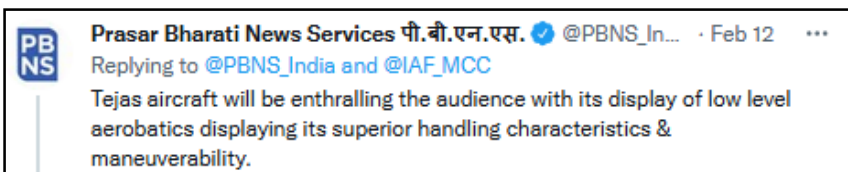


Three Tejas Mk-1 jets will take part in the upcoming Singapore Air Show, from February 15 to 18. (PHOTO: IAF.)

DRDO on Twitter



12 February 2022



Presidential fleet review to feature over 60 warships, 50 aircraft

A fleet review is usually conducted once during the term of a President, who is the supreme commander of the armed forces

New Delhi: President Ram Nath Kovind will review the Indian Navy's fleet at a ceremonial event at Visakhapatnam on February 21, which will witness the participation of over 60 warships and submarines as well as around 50 aircraft, officials familiar with the development said on Friday. The high-profile presidential fleet review will be followed by the Milan multi-nation naval exercise, from February 25 to March 4, for which India has invited 45 countries, the officials said.

A fleet review is usually conducted once during the term of a President, who is the supreme commander of the armed forces. The navy has conducted 11 Presidential Fleet Reviews (PFRs) since Independence. This year's event will commemorate 75 years of the country's independence, with the theme Indian Navy: 75 years in Service of the Nation.

"As part of the PFR, all participating units will be anchored in a formation of four precise columns. The President will review all the ships by 'steaming past' them, embarked on a naval vessel designated the 'Presidential Yacht'," said one of the officials cited above. Naval aircraft will fly overhead the formation and render their salute.



President Ram Nath Kovind will review the Indian Navy's fleet at a ceremonial event at Visakhapatnam on February 21.

The Milan exercise, a biennial event, is expected to be the biggest ever since its inaugural edition at Port Blair in 1995 when only four foreign countries took part in the drills: Indonesia, Singapore, Sri Lanka and Thailand.

"Since then, the exercise has transitioned by leaps and bounds in terms of number of participants and complexity of exercises," said a second official. Response from friendly foreign countries has been encouraging, he added. Of the 45 nations invited, around 35 have confirmed their participation. China and Pakistan have never been invited for the drills.

"The aim of the exercise is to hone operational skills, imbibe best practices and procedures, and enable doctrinal learning in the maritime domain through professional interaction between friendly navies."

The exercise was traditionally staged off Port Blair but has been moved to the eastern seaboard as it offers better bandwidth for conducting bigger drills. The 2020 edition of Milan, which was to be staged off Visakhapatnam, was not held that year due to the Covid-19 outbreak. The exercise will be organised in the backdrop of China's growing naval activity in the Indian Ocean region.

<https://www.hindustantimes.com/india-news/presidential-fleet-review-to-feature-over-60-warships-50-aircraft-101644602925144.html>

Anti-submarine warfare, a first for Milan 2022: Indian Navy's biggest multi-nation exercise

The Indian Navy's largest multi-nation exercise, Milan 2022, will feature anti-submarine warfare for the first time.

By Abhishek Bhalla

New Delhi: The Indian Navy will host its biggest maritime exercise, involving at least 35 countries, from February 26 to March 4 off the coast of Visakhapatnam, which will include anti-submarine warfare drills for the first time.

Invitations to the navies of 46 countries have been extended to Milan 2022, and about 35 have confirmed participation, sources said.

Around 15 countries are expected to send their ships and submarines for the exercise, while others will send a delegation.

Among the many countries that will be sending ships or delegations are the United States, Russia, Japan, and Australia.

The multinational exercise began in 1995, but it was initially limited to South Asian and Southeast Asian countries. In 2014, participation increased from six regional countries to eighteen.

"This addition of Milan envisages further enhancement of the scope and complexity with a focus on exercises at sea in surface, subsurface, and air domains, including weapon firings," said an Indian Navy official.

To begin, only four countries will be considered: Singapore, Sri Lanka, Thailand, and India participated in the exercise.

In the Middle East, the most invitations have been sent this year, including Saudi Arabia, Iraq, Iran, Oman, Qatar, Kuwait, and the UAE.

Other countries invited include the United Kingdom, France, Israel, Kenya, Indonesia, Malaysia, and Mauritius, among others.



Image for representation (Photo: Twitter)

This is the first time the exercise has been shifted from the Andaman to Vizag, as the scale of the exercise has been enhanced.

The exercise was supposed to take place in 2020 as it's a biennial event, but was called off due to Covid-19. In 2020, invitations were sent to 41 countries. It was decided that the exercise would take place in 2022, since it also coincides with the 75th anniversary of India's independence.

The exercises aim to hone operational skills, instil best practises and procedures, and enable doctrinal learning in the maritime domain through professional interaction between friendly navies.

The exercise is divided into two phases- the harbour phase (February 26-28) and the sea phase (March 1-4).

<https://www.indiatoday.in/india/story/anti-submarine-warfare-first-for-milan-2022-indian-navy-biggest-multi-nation-exercise-1911928-2022-02-11>



Modernisation fund for the Armed Forces

Details of allocation made to the Armed Forces under Capital Acquisition (Modernisation) Head of Defence Services Estimates for the Financial Year 2021-22 and 2022-23 are as under:

(Rs in Crore)

Year	BE Allocation
2021-22	1,11,463.21
2022-23	1,24,408.64*

* Figures are yet to be approved by the Parliament

The allocated funds cater to the Committed Liabilities and New Schemes of the Armed Forces under Capital Acquisition (Modernisation) head. These funds are optimally utilized towards operational activities and if required, the schemes are reprioritized to ensure that urgent and critical capabilities are acquired without any compromise to operational preparedness of Defence Services.

Allocation made under Modernisation Head to the Armed Forces form a part of the Capital Budget of the Defence Services. The following proposals are being planned under the Strategic Partnership Model:

SI No	Scheme
1.	Naval Utility Helicopter (NHU)
2.	Project 75(I) Submarines

This information was given by Raksha Rajya Mantri Shri Ajay Bhatt in a written reply to Shrimati Rita Bahuguna Joshi in Lok Sabha on February 11, 2022.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1797640>

Navy Vice Chief reviews progress of new personal air mobility vehicle 'Varuna'

Pune (Maharashtra) [India], February 11 (ANI): Navy Vice Chief Vice Admiral SN Ghormade reviewed the progress and witnessed flight trials of 'Varuna' - a personal air mobility vehicle capable of being launched and recovered from moving ships, said the Navy on Thursday.

The vehicle is planned to be used for inter-ship transfer of stores and personnel.

Varuna has been made by M/s Sagar Defence Engineering and the Naval Innovation & Indigenisation Organisation (NIIO). NIIO is working closely with the firm for variants of the vehicle for inter-ship transfer of stores and personnel.

Autonomous launch and QR code-based recovery on moving platforms at sea has already been previously demonstrated.

Ghormade also saw the autonomous boats and prototype of Autonomous Modular Inflatable Target (AMIT) for which a patent application has been filed by Indian Navy.

These projects are a result of close collaboration between the private sector, academia, R&D Establishment (Engrs)/DRDO and NIIO.

M/s Sagar Defence Engineering is one amongst the deep tech start-ups identified by NIIO for handholding by being designated as the 'Industry Innovation Partner'. (ANI)

<https://www.aninews.in/news/national/general-news/navy-vice-chief-reviews-progress-of-new-personal-air-mobility-vehicle-varuna20220211100031/>



Visual from the flight trials of 'Varuna' (Photo/ANI)

सिख सैनिकों के लिए बनाया गया खास हेलमेट, जानें कैसा है यह कॉम्बेट हेलमेट

Sikh Soldier New Helmet: इस कॉम्बेट हेलमेट को कानपुर की रक्षा फर्म एमकेयू ने डिजाइन किया है और विकसित किया है। यह कॉम्बेट हेलमेट हर मौसम में सुरक्षित है, साथ ही यह केमिकल से भी सुरक्षा देगा और आग से भी। इसमें झटके सहने की क्षमता भी है। यह कॉम्बेट हेलमेट हल्का भी है और एंटी-फंगल और एंटी- एलर्जी है।

हाइलाइट्स

- सैनिकों को गोली या गोलों के छरों से चौतरफा सुरक्षा देगा नया हेलमेट
- कॉम्बेट हेलमेट हल्का भी है और एंटी-फंगल और एंटी- एलर्जी वाला है
- सिख सैनिक अपनी पगड़ी के कपड़े के ऊपर आराम से पहन सकते हैं

नई दिल्ली: पहली बार सिख सैनिकों की जरूरतों के हिसाब से कॉम्बेट हेलमेट तैयार किया गया है। यह सैनिकों को गोली या गोलों के छरों से चौतरफा सुरक्षा देगा। यह कॉम्बेट हेलमेट हल्का भी है और एंटी-फंगल और एंटी- एलर्जी है।

हेलमेट को वीर नाम दिया गया

इस कॉम्बेट हेलमेट को कानपुर की रक्षा फर्म एमकेयू ने डिजाइन किया है और विकसित किया है। यह कॉम्बेट हेलमेट हर मौसम में सुरक्षित है, साथ ही यह केमिकल से भी सुरक्षा देगा और आग से भी।

इसमें झटके सहने की क्षमता भी है। एमकेयू के प्रेसिडेंट मनोज गुप्ता के मुताबिक इस हेलमेट को वीर नाम दिया गया है। इसे सिख सैनिक अपनी पगड़ी के कपड़े के ऊपर आराम से पहन सकते हैं।

आस्था या पहचान से समझौता नहीं

मनोज गुप्ता ने कहा कि हमने अपने सिख सैनिकों के लिए बेहतर हेलमेट की जरूरत देखी और वीर को डिजाइन किया। हमने उनकी आस्था या पहचान से समझौता किए बिना उनके सिर की पर्याप्त सुरक्षा के लिए इसे बनाया है। यह वीर हेलमेट इस तरह डिजाइन किया गया है कि उसमें हेड माउंटेड सेंसर और आधुनिक लड़ाकू उपकरण जैसे कम्युनिकेशन सिस्टम, नाइट विजन गॉगल्स और कैमरे आसानी से फिट किए जा सकते हैं।

जरूरत के हिसाब से हेलमेट तैयार किया

एमकेयू के मैनेजिंग डायरेक्टर नीरज गुप्ता ने कहा कि सिख की पगड़ी उसका गौरव है। यह न केवल आस्था है बल्कि साहस, स्वाभिमान, समर्पण का प्रतीक भी है। उनके साहस को सलाम करते हुए हमने उनकी जरूरत के हिसाब से हेलमेट तैयार किया है।



<https://navbharattimes.indiatimes.com/india/indian-army-sikh-soldiers-new-special-combat-helmet-with-better-safety-designed-by-kanpur-mku/articleshow/89518480.cms>

Mon, 14 Feb 2022

Jaishankar's visit to the Philippines – What does it mean for India?

The successful Quad Foreign Ministers meet in Australia earlier this week, comes simultaneously with the release of the recent US Indo Pacific Strategy.

By Dr Pooja Bhatt

Jaishankar's upcoming visit to Manila is crucial for furthering India's regional aspirations of strengthening its bilateral relationships. In the face of recent geopolitical realities that have been worsened by the Covid-19, the Philippines is seeking to diversify its defence and economic portfolio as a part of its foreign policy engagements. In this background, India and Philippines' relationship needs to find their unique lock-and key component that fits each- other's requirements and ambitions seamlessly.

The successful Quad Foreign Ministers meet in Australia earlier this week, comes simultaneously with the release of the recent US Indo Pacific Strategy. Both the documents have stressed Free and Open Indo-Pacific, maintaining regional security and stability, rejecting coercive use of coercive power, and providing strategic autonomy to the nations. Similar views are reflected in India's regional vision under Act East policy and SAGAR that seek bolstering relationships with the South East neighbours and security of growth of all the nations in the larger Indian Ocean region.



In January 2022, the Philippines signed a \$375 million agreement of 3 batteries of shore-based anti-ship missile Brahmos missile

Realistically speaking, the Philippines is just like a developing country like India, and therefore the two countries are still finding synergies in their trade and economic vertical of cooperation. Data from the Philippine Statistics Authority showed Philippine exports to India reached \$547.98 million, while the country's imports from India amounted to \$1.51 billion in 2020. The reasons for the trade deficit need to be acted upon soon. Presently, India is the largest supplier of beef products and the second-largest supplier of dairy products to the Philippines. In turn, India is a favored nation by the Filipinos for medical treatments for its relatively inexpensive world-class quality medical infrastructure.

The 13th India Philippines Joint Working Group on Trade and Investments (JWGTI) Meeting, decided to work towards a Preferential Trade Agreement (PTA). The said agreement when realized would reduce or even end the tariffs to increase trade in terms of both value and volume. Currently, the focus is on sectors like pharmaceuticals, IT, and financial technology- areas where India is strongly placed and the two countries are working on the conclusion of the Preferential Trade Agreement. During a virtual meeting with the Philippines foreign minister, India was invited to join the International Solar Alliance Disaster Resilient Infrastructure in addition to offering higher educational opportunities to scholars and students. Tourism as a cross section of economy, people to people and cultural exchange, is another area that where Manila seeks India needs to consider.

From the vantage point of security, India has a larger vision for the region whereas the Philippines is still facing immediate internal security concerns in terms of radicalization and terrorism, and slow economic development. The external security environment has been threatened by China.

Brahmos sale needs to be seen as a part of the relationship. In January 2022, the Philippines signed a \$375 million agreement of 3 batteries of shore-based anti-ship missile Brahmos missile for upgrading Manila's coastal defence capabilities. As the Philippines is facing maritime

aggression from China towards its maritime claims (Mischief Reef, Scarborough Shoal in the South China Sea) but also a continuous threat to its fishermen by PLA Navy within its own EEZ. The current Brahmos missile with its reportedly 290kms range acts as a maritime defence buffer within its 200nautical mile (or 370km) Exclusive Economic Zone.

However, only a few missiles remain insufficient for its security. The Philippines needs a complete strengthening of its military infrastructure to be able to defend its territorial and maritime interests against aggression. India has already offered to provide a coastal surveillance radar system to the Philippines to help bolster its maritime domain awareness. The current level of military engagements includes naval ship port visits, joint training, and exercise. Countries need to figure out the other areas where military training and cooperation can be carried out. In this regard, the appointment of an Indian naval attache to Manila needs to be realized as a progressive step.

India on the other hand has been aiming at increasing defence exports to boost its defence manufacturing and production. It aims to become a bigger arms exporter to generate revenue of \$5 billion by 2025. According to March 2021 SIPRI report, India is among the top five arms importers but the 24th largest defence exporter. The Philippines, on the other hand, is seeking defence suppliers in addition to the United States and South Korea.

At the regional level, India has been expanding its cooperation with ASEAN in the areas of drug and human trafficking cyber and critical technology, countering disinformation, counterterrorism, maritime security, humanitarian and disaster response (HADR), and climate change. New Delhi has repeatedly expressed its support to ASEAN centrality and its vision for Indo-Pacific. The maritime domain presents both challenges and opportunities, it has emerged as a significant vertical for cooperation in the region in the recent India- ASEAN meetings. To deal with challenges and opportunities, India aims to work with individual ASEAN countries for capacity-building and technical assistance, to strengthen maritime domain awareness, uphold regional peace and security consistent with international laws, and strengthen regional security architecture.

Within the larger global focus on the Indo-Pacific region, India has its regional dynamics of political relationships. Just as the US, EU views India as its regional partner in its Free Open, prosperous and resilient Indo-Pacific strategy; New Delhi is finding new avenues of cooperation given the geopolitical realities, aligning its regional aspirations with other like-minded countries within its economic and resource limitations that have exacerbated by the pandemic since 2020. The synergies between the two countries are known but EAM Jaishankar's visit to the Philippines has to concretise them.

(The author is a Maritime Security Expert and has a Ph.D. in Disarmament Studies from Jawaharlal Nehru University. Views expressed are personal and do not reflect the official position or policy of Financial Express Online. Reproducing this content without permission is prohibited).

<https://www.financialexpress.com/defence/jaishankars-visit-to-the-philippines-what-does-it-mean-for-india/2432671/>



Mon, 14 Feb 2022

Malaysia and India eye Sukhoi Fighter upgrades

By Vladimir Karnozov

Commencement of shipments of the improved Sukhoi Su-30SM2 multirole fighters to the Russian Air and Space Force (VKS) might prompt Malaysia and India to upgrade their aging fleets of the Su-30MKM and Su-30MKI, respectively.

The Su-30SM2 is the latest variant of the initial twin-seat Su-30, which started operating 30 years ago. On January 20 the Russian defense ministry publicly acknowledged having taken delivery of four of Su-30SM2s of 21 on order from United Aircraft Corporation's factory in Irkutsk, produced to a new factory standard that has replaced the previous Su-30SM, first flown 10

years ago. Since then, the Russian Armed Forces has taken delivery of 110 examples, including 22 for the Naval Aviation and 88 for VKS, nine of which fly with the Russian Knights air display group. Twenty vastly different Su-30M2s—with different aerodynamics, radar sets, and avionics—also are in inventory.

The Su-30SM2 differs in its use of more powerful AL-41F1 turbofans in place of the AL-31FPs on the SM/MKI/MKM. Apart from delivering 16 percent more thrust (32,000 pounds versus 27,560 pounds), the engine comes with a swivel nozzle against the previous two-dimensional design, improving the M2's "super maneuverability" achieved through vectored thrust. Since 1996, Sukhoi fighters have starred at air shows with their ability to perform "Bell" (tail slide), "Pugachov's Cobra" (pitch-up), "Hook" (similar to Cobra but performed in the horizontal plane rather than vertical), and other maneuvers. More importantly, the model can outmaneuver an enemy fighter and evade radar-guided missiles, Sukhoi claims.



The Royal Malaysian Air Force (RMAF) Su-30MKM performs at the biennial air show in Langkawi, Malaysia, in 2017. (Photo: Vladimir Karnozov)

The needed enlargement of air intakes for the AL-41F1 requires a 20 percent higher airflow. Meanwhile, the SM2 version differs in its reshaped nosecone to house a larger radar: a special edition of the N-035 Irbis in place of the N-011M Bars. The Su-35S single-engine fighter also uses the SM2's avionics package for cross-type commonality. When needed, the Su-30SM2 will serve advanced training roles for novice Su-35S pilots because the latter type does not have a trainer version, while the Su-30SM's front cockpit features a different layout.

While Irkut has completed Su-30SM shipments to the Russian armed forces, deliveries to foreign clients continue. Armenia has so far received only four out of 12 on order, Belarus four of 12 and Kazakhstan 24 of 40. It remains unclear whether some of those customers, as well as Myanmar—which signed a preliminary agreement on six airplanes—will shift to the more advanced SM2 version.

The recent induction of the Su-30SM2 may prompt users of earlier-version Su-30s to conduct upgrades on their fleets to improve performance. Malaysia, which ordered 18 Su-30MKMs in 2003, has long sought ways to improve their lethality and reliability. The fleet now averages 10 years of age. Russia and Malaysia have tried to resolve issues with engines due to a shortage of prepaid spare parts through a better functioning logistics system and handing over some work on the Su-30MKM fleet to local companies such as Aerospace Technology Systems Corporation (ATSC). The latter handed back the first upgraded aircraft to the Malaysian air force in 2019. Reportedly, Malaysia wants to keep its Sukhois in service through to 2040.

India has ordered a total of 284 Su-30MKIs, of which 240 remain operational, including a recent batch of 12 last year. Although generally considered one of the best radar systems in the world at its introduction in 1997, the N-011M Bars and its passive phase array technology has become increasingly outdated. India's Defense Research and Development Organization (DRDO) has been working on an active antenna array unit (AAAU) radar with an active electronically scanned array (AESA) that might replace the Bars. Russia offered an alternative in the form of the Super-30 upgrade package that includes the replacement of the Su-30MKI's original radar with an AESA version employing transceivers developed for the radar of the fifth-generation Su-57 fighter.

<https://www.ainonline.com/aviation-news/defense/2022-02-13/malaysia-and-india-eye-sukhoi-fighter-upgrades>

Indian Army gets latest SiG Sauer rifles, ATVs along China border in Sikkim

The addition of ATVs will enhance capacity and will enable soldiers, especially those posted in harsh and challenging terrain to undertake their operational tasks with ease.

Edited By Surabhi Pathak

Highlights

ATVs and 7.62 mm SiG Sauers are inducted for soldiers deployed at high altitude areas

North Sikkim: Enhancing the capabilities of its troops deployed along the border with China, the Indian Army has provided the latest assault rifles and all-terrain vehicles (ATVs) to soldiers deployed in the North Sikkim area which has seen clashes between the two sides in recent times.

The aim is to enhance capacity and enable soldiers, especially those posted in harsh and challenging terrain to undertake their operational tasks with ease. The Indian Army inducted sophisticated weapon platforms and modern equipment in the last couple of years, said the Army.



Image credit: ANI

Mentioning its rapid capability enhancement drive, the Indian Army said ATVs and 7.62 mm SiG Sauers are inducted for soldiers deployed at high altitude areas.

Soldiers deployed in Muguthang Sub Sector in North Sikkim at an altitude of more than 15,500 feet, a super high altitude area, with ATVs and 7.62 mm SiG Sauers could be seen operating in that area.

"Indian Army is in stride with the future and ever ready to defend the Nation's territorial integrity and sovereignty," emphasized the Force.

<https://zeenews.india.com/india/indian-army-gets-latest-sig-sauer-rifles-atvs-along-china-border-in-sikkim-2435586.html>

THE ECONOMIC TIMES

MoD signs up Bengaluru startup for pseudo satellite deal

By Manu Pubby

Synopsis

Mentored under the ministry's Innovations for Defence Excellence (iDEX) initiative, the programme has been supported by the armed forces and will see Hindustan Aeronautics Limited (HAL) as the lead prototype development partner. NewSpace Research & Technologies signed the contract with defence ministry on Thursday, with plans in place to develop the first prototype for tests within the next four years.

The ministry of defence has signed up a design and development contract with a Bengaluru-based company to develop a High Altitude Pseudo Satellite (HAPS) which will be able to conduct surveillance operations and support communications by staying airborne for months at a stretch.

Mentored under the ministry's Innovations for Defence Excellence (iDEX) initiative, the programme has been supported by the armed forces and will see Hindustan Aeronautics Limited (HAL) as the lead prototype development partner. NewSpace Research & Technologies signed the contract with defence ministry on Thursday, with plans in place to develop the first prototype for tests within the next four years. "Major UAV-related tech development was initiated under iDEX for High Altitude Platform System HAPS. HAPS UAV will fly in stratosphere for months. Huge step towards cutting edge aerospace development by startups," Defence Secretary Ajay Kumar said. The first phase of the programme will be undertaken by the startup with the seed funding by defence ministry and the prototype development is likely to see HAL as the lead partner. The estimated budget to develop the system is upwards of Rs.700 crore and it will be part of HALs Combat Air Teaming System (CATS) that seeks to integrated manned airborne platforms with swarm drones and a high altitude surveillance network.



The UAV is being designed to fly at 70,000 feet, which would be out of range for most air defence systems and would rely on solar energy to power itself for months to a stretch.

Similar efforts to develop a pseudo satellite are being undertaken in Europe and the US but no such system has been deployed yet, giving the technology a cutting edge status. The HAPS is being designed to undertake surveillance and communication duties for months and will also have applications in the civilian domain in the future. The UAV is being designed to fly at 70,000 feet, which would be out of range for most air defence systems and would rely on solar energy to power itself for months to a stretch.

<https://economictimes.indiatimes.com/news/science/mod-signs-up-bengaluru-startup-for-pseudo-satellite-deal/articleshow/89516933.cms>



Sat, 12 Feb 2022

Opinion: India needs a comprehensive space strategy

It will not only bolster inter-organisation coordination in India's space sector, but also help in building investor confidence and projecting the country as a responsible space power

By Aditya Pareek and Megha Pardhi

India's growth and prosperity in the present era is due to its ability to secure its use of outer space. With the advent of the second space age, private NewSpace companies such as SpaceX are leading the charge, and not governmental civilian space agencies or militaries. However, as outlined in the Outer Space Treaty (OST), the existing international laws hold nation-states responsible for the actions and consequences of their private space companies, citizens, and functionaries.



Space has overarching applications and dependencies across almost all aspects of civilian life and military operations. (Isro)

So it is prudent for countries and even alliances of nations to formulate strategic publications detailing the broad direction of their space programmes. Unfortunately, India has not yet published a comprehensive space strategy. It will bolster inter-organisation coordination in India's space sector and help build investor confidence and project the nation as a responsible space power.

The United Kingdom (UK), China and North Atlantic Treaty Organization (NATO) have published the latest iterations of their strategic publications focused on the use of space. It may be wise for New Delhi to bring out its own strategic documents, outlining achievements, prospects and its broad approach to space.

Space is part of a wider strategic context

Space has overarching applications and dependencies across almost all aspects of civilian life and military operations. Therefore, India needs to avoid hyper-fixation on selected outer space projects. Instead, there is a need for a balanced approach to address in-orbit, Earth-to-space, and space-to-Earth applications. The NATO strategy's reference to space being of relevance "across the spectrum of conflict" is a correct articulation of the idea. India has recently set up its Defence Space Agency (DSA) and Defence Space Research Organisation (DSRO), but no strategic publication or detailed charter about their mandate, goals and direction has been put out.

However, some media reports suggest that DSA is looking to acquire technologies that can "evaluate threats" and "maximise the effectiveness of Indian operations in space, land, sea and air domains." As a tri-service agency, if indeed true, this is the correct approach for DSA. However, a more credible declaration in an overarching national strategic publication would reassure private NewSpace companies willing to supply these technologies and improve their ability to secure investor funding.

Engagement with international fora and international partners

The international community and the United Nations General Assembly (UNGA) are figuring out norms for responsible behaviour in outer space. New Delhi's strategy should indicate that it will not only be a participant but also a key stakeholder. Therefore, it is imperative to put forward India's concerns around ensuring unrestricted access to use of space by all nations.

Push for greater Space Situational Awareness (SSA)

Space Situational Awareness (SSA) is the awareness of which space object is where doing what and what impact it can have. Transparent SSA should also be a priority for India's strategic publication, as it augments India's capabilities across the spectrum for defence and deterrence.

New Delhi should express its resolve to hold its adversaries accountable with publicly available SSA data. Transparent SSA should also be a priority for India's strategic publication, as it augments India's capabilities across the spectrum for defence and deterrence.

China factor

India's progress in space exploration has gained a lot of momentum in the last few years, but it is still behind China in ambition and execution. China is the strategic adversary of India, and even though the Chinese space programme's budget six times higher compared to India's, the latter has to compete with China in space.

Space debris mitigation as a priority

India faced international criticism for its 2019 Mission Shakti, Direct Ascent Anti-Satellite test. China also faced similar criticisms when debris from the wreckage of its Fengyun-1C satellite threatened the International Space Station (ISS). China's recent white paper on space, aimed to mitigate international concerns and project China as a responsible player, includes cleaning space debris as an area of focus.

India can also use a prospective strategic publication on its use of space to declare that mitigating space debris is a newfound focus. Outgoing ISRO chairman K. Sivan has already confirmed that "technologies like self-eating rockets, self-vanishing satellites and robotic arms to catch space debris" are an area of push for ISRO.

Risk Estimation and Hostile Actions

Strategic publications are also crucial for projecting the stakes involved to communicate the risks better. India should acknowledge the threats to its economy and space assets vis adversarial, mainly Chinese counter-space capabilities. Like the UK, India should include a back-of-the-envelope estimate for potential damage any hostile action can inflict on the nation's economy.

Permanent presence, deep space exploration, and planetary defence

Indian Space Research Organisation (ISRO) has undertaken manned space flight as a key focus area, beginning with the upcoming Gaganyaan mission. It is of strategic and scientific significance for India to highlight the value of not just human space flight missions but also sustained human

presence in orbit and deep space exploration. Another area of relevance India should accelerate research on is defence from near-earth objects.

Without international cooperation, India is unlikely to catch up to China, which already has its “Tiangong” space station’s first module in orbit. China is also planning to build a near-earth object defence system in the next five years. Although details of the proposed defence systems are not known as of now, some Chinese researchers have simulated that China’s Long March 5 rockets could be used to deflect an asteroid from its trajectory.

The latest white paper on space also highlights Beijing’s willingness for international cooperation in monitoring and responding to near-earth objects. India does not have any plans for planetary defence on the horizon. Considering the importance of this subject, New Delhi should take the initiative to cooperate with international actors in the short term and plan for a planetary defence program in the long term.

(Aditya Pareek and Megha Pardhi are research analysts at Takshashila Institution. The views expressed are personal)

<https://www.hindustantimes.com/opinion/india-needs-a-comprehensive-space-strategy-101644571361711.html>



Mon, 14 Feb 2022

Defence Budget 2022-23: No end to paucity of funds

By Amit Cowshish

The year-on-year growth of 9.82 per cent in the defence budget for the financial year 2022-23 (FY23) is better than the corresponding growth of 1.45 per cent in the preceding year, but its share in the total central government expenditure has slid from 13.73% to 13.31%. As a percentage of the gross domestic product (GDP) also, it has dropped from 2.15% to 2.04%, much to the chagrin of those who want the defence budget pegged at 3% of the GDP.

India’s defence budget has been hovering around this level for quite some time. Consequently, there has been little change in the public discourse which remains centred on the inadequacy of resource allocation for defence and the possible ways of addressing this problem, overlooking some other aspects of budget management. It isn’t any different this year.

First, let us look at the paucity of funds and the much-awaited non-lapsable fund which is expected to mitigate this problem. Of the total defence budget of INR 5, 25,166.15 crore, the services have been allocated INR 3, 85,370.15 crore -INR 1, 52,369.61 crore for capital expenditure and INR 2, 33,000.54 crore for revenue expenditure- during the FY 23. A sum of INR 1, 19,696 crore has been allocated for defence pensions and INR 20,100 for the MoD’s secretariat and other organisations like the Borders Roads and Coast Guard.



The outlay for the services forms the core of the defence budget. Going by the past data, it can be said with reasonable certainty that the allocated amount of INR 3, 80,370.15 crore falls short of the requirement projected by the services. The gap has been widening for several years, jumping from approx INR 23,000 crore in 2010-11 to more than INR 1,25,000 crore in the FY22, of which INR 77,182 crore was under the capital segment of the budget.

If the estimates projected by the services to the fifteenth Finance Commission are any indication, the shortfall in the FY23 could be in the region of INR 2,81,000 crore, with the shortfall under the capital segment accounting for a little less than INR 1,62,000 crore. The finance minister could not possibly have bridged this gap in the union budget.

It was widely expected that the finance minister will announce the setting up of a non-lapsable Defence Modernisation Fund from which additional sums could be allocated for meeting the expenditure on modernisation of the armed forces if required during the year. Recommended by the fifteenth Finance Commission, virtually at the behest of the government, this fund has been in the works for almost a year.

Although it is somewhat surprising that the finance minister made no mention of it in her budget speech, there is little doubt that the said fund will be set up sooner or later. What is in doubt is whether it can help in meeting the annual shortfall in allocation vis-à-vis the estimated requirement.

According to the details disclosed by the MoD to the Standing Committee on Defence in March last year, the bulk of the capital for this fund will have to come from the Consolidated Fund of India, which is also the source of regular budgetary allocations and it will be possible to transfer sums out of the fund only through the regular budgetary process.

Additionally, the money transferred to the fund will lapse if not utilised within three years of the transfer, and appropriation from the fund for modernisation (and some other purposes) will be permitted only after the regular budgetary allocation has been exhausted by the MoD. These are tough conditions.

More importantly, the size of the fund is proposed to be INR 2, 38,354 crore for the period 2021-22 to 2025-26, including INR 50,000 crore for internal security, with a maximum of INR 51,000 crore being transferred to it every year. Keeping all these features in view, it is unclear how, and to what extent, the non-lapsable fund will be of help in bridging the estimated shortfall of INR 8,45,136 crore in allocation for capital expenditure during the aforesaid period. As for the shortfall of INR 6, 78,964 crore, it cannot anyway be met from the non-lapsable fund.

The focus on the shortfall in allocation and impending setting up of the non-lapsable fund for modernisation to address the problem should also not blind us to the fact that utilisation of the allocated budget itself is often a challenge. The revised estimates for FY22 show a reduction of INR 11,104.81 crore in the Army's capital budget and INR 1,383.84 in the Air Force's. This is an indication of the unlikelihood of these amounts being spent by them.

But for the fact that the Navy has mopped up these utilised funds, the underutilised amount would have lapsed at the end of the current financial year. There is a lesson to be learnt from this, especially because the unutilised amounts at the end of the year cannot be transferred to the proposed non-lapsable fund and the amount available in the latter can only be dipped into after the regular allocation has been exhausted each year. The services, especially Army which often struggles to utilise the allocated fund, will have to improve their performance in utilising the regular budgetary allocation.

A mention must be made of 68% of the capital procurement budget being earmarked for procurement from the domestic industry in the FY23. It is not known how much of this will go towards meeting committed liabilities arising from the ongoing contracts and what amount will be available for new purchases. While this may be music to the ears of the Indian industry, it sends some confusing signals to the foreign vendors, besides being of little help in dealing with the chronic paucity of funds.

The finance minister also announced that R&D will be opened for the industry, start-ups and academia and 25% per cent of the defence R&D budget will be earmarked to encourage them to take up design and development of military platforms and equipment in collaboration with the Defence Research & Development Organisation and other organizations. It is a desirable objective, but, like reservation of a portion of the capital budget for domestic purchases, it can be of little help in overcoming the challenge of funding defence modernisation.

Coming to the revenue budget of the services, it too is marked by inadequate budgetary allocation but throws up different challenges, the biggest of them being the growing expenditure on salaries. The proportion of salaries in the total revenue budget has risen from 61.98% in FY22 to 64.12% in FY23. A decade back in 2010-11, it accounted for 55.3% of the services' total revenue budget.

In the case of Army, salaries account for an even higher share in the revenue budget. Between the current and coming fiscals it has gone up from 69.16% to 70.78%, while a decade back in 2010-11, it was 60.92%. To some extent it is understandable, as Army is a manpower intensive service which is mandated to physically defend the vast stretches of the disputed borders with two of the most hostile nations.

Despite this operational compulsion, then Chief of Army Staff General VP Malik (Retd), had announced in 1998 that the manpower will be reduced by 1.5 lakh in three years. The Kargil conflict very next year put paid to that intent. Another half-hearted attempt made in May 2020 when approximately 9,300 posts, probably lying vacant in the Military Engineer Service, were surrendered, ostensibly to 'rationalise' the manpower. Such measures cannot make much of a dent on the requirement of funds.

The high percentage of expenditure on salaries is important as it impacts the availability of funds for procurement of ordnance stores, including various types of ammunition, maintenance of equipment, and upkeep of infrastructure, training, and other related activities. What is left after providing for the obligatory expenses on ration and clothing, is inadequate for operational expenses, impacting serviceability of the equipment and state of repair of the military infrastructure. This has been the case for more than fifteen years, with no practical solution in sight.

This problem is best illustrated by the 'stores' budget head which caters for expenditure on ration, clothing, fuel, and other ordnance, medical, veterinary, engineer, aviation, and information technology stores, some of which are required for repair and maintenance. At INR 6,053.93 crore, the Navy's allocation for FY 23 is the same as for FY22, while Army's is INR 51 crore and Air Force's INR 249.99 crore more than FY22's budget allocation. Under the navy's 'Repair and Refit' budget head, the allocation of INR 1,555.95 for the coming fiscal is the same as this year. The revenue budget for FY23 offers no respite on this count.

Lastly, a word about defence pensions and the budget outlay for other organisations like the Border Roads and Coast Guard. At INR 1, 19,696 crore, defence pensions account for 22.79 per cent of the defence budget for the coming fiscal. Although the growth in pensions budget has slowed down a little bit, it could be because the second up-gradation under the one-rank-one-pension is held up since 2019. Once the orders are issued, the expenditure is bound to rise.

Expenditure on pensions has grown significantly since 2000-01 when it was INR 12,000 crore and, therefore, it cannot be brushed aside as an insignificant component of the defence budget. As a matter of fact, the fifteenth FC had recommended that due to overall fiscal constraints, MoD should take immediate measures to 'innovatively' bring down the salaries and pensions liability. The finance minister made no mention of this in her budget speech which, for good reasons, was focused on increasing capital expenditure in infrastructure and other sectors which have the potential of spurring growth.

This leaves us with the Demand for Grant for MoD (Civil), the highlight of which is the enhanced allocation for the Border Roads and Coast Guard Organisations, which are integral to the defence architecture of the country. The gross budgetary support of INR 3,500 crore to the Border Roads for the FY23 is 40% higher than the current year's allocation, while the Coast Guard's capital budget for FY 23 has been increased by 60%, going up from INR 2,650 crore to INR 4,246.37 crore. This seems to indicate the government's focus on developing road infrastructure along the northern borders and beefing up coastal security.

To sum up, while FY23's defence budget is slightly better than the current year's in terms of the growth in the outlay, it is likely to fall short of the requirement projected by the services, which has

been the main problem for decades. The proposed non-lapsable fund cannot address the problem in its entirety. Consequently, the modernisation drive is unlikely to gather faster pace during the coming fiscal. The shortfall in the allocation for revenue expenditure remains unbridged, and unbridgeable in the coming fiscal and indeed in near future.

There has, however, been a reasonable increase in the allocation for the Border Roads and Coast Guard Organisations in a clear indication of the government's priorities. The decision to earmark 25% of the R&D budget for promoting collaboration with the private industry will help in indigenous design and development of military capabilities, but ultimately substantially higher sums will be required for the armed forces to reap the benefit of such measures.

(Amit Cowshish is a former Financial Advisor (Acquisition), Ministry of Defence. He was associated as a Distinguished Fellow with the Institute for Defence Studies and Analyses, New Delhi, and as a Partner with Dua Associates, Advocates and Solicitors. A post-graduate in Political Science, he also holds an M Phil and LL B degrees.)

<https://bharatshakti.in/defence-budget-2022-23-no-end-to-paucity-of-funds/>



Mon, 14 Feb 2022

Commander of Oman Navy Al Rahbi on India visit from Monday

By Sidhant Siba

Story highlights

The visit comes days after the visit of the Secretary-General of Omani Defence ministry, Mohammed Nasser Al Zaabi to India

New Delhi: The Commander of Royal Navy of Oman (CRNO) Rear Admiral Saif Al Rahbi will be on India visit from 14 to 18 February even as both sides increase military engagement.

The visit comes days after the visit of the Secretary-General of Omani Defence ministry, Mohammed Nasser Al Zaabi to India. Rear Admiral Saif's visit, who assumed charge last January is significant in terms of New Delhi's outreach to the new military leadership which was appointed under the new Sultan of Oman.

This is the first India visit by CRNO RAdm Saif Al Rahbi during which he will meet all the two services Chiefs', members of the National Security Council, Foreign Secretary Harsh Shringla and senior officers from the Armed forces at Delhi. He will also visit operational facilities, ship building and repair facilities at Mumbai and Western Naval Command which deals with deployment of ships in the gulf.

The key focus during India visit will be India-Oman Navy to Navy Staff Talks that will take place from 15 to 18 February. CRNO will be visiting the IFC-IOR or Information Fusion Centre for the Indian Ocean Region with emphasis on early operationalization of Information Exchange. Information Fusion Centre Indian Ocean Region is Gurugram based Indian Navy's eye in the region.

The Centre has linkages with more than 50 nations and multinational/ maritime security centers. It hosts International Liaison Officers (ILOs) from 10 partner nations - Australia, France, Japan, Maldives, Mauritius, Myanmar, Seychelles Singapore, United Kingdom, United States of America. More ILOs are expected to join it in near future.

Training and naval equipment procurement from India will dominate the talks between Indian side and CRNO, who is also the Chairman Maritime Security Committee of Oman.



File photo: Rear Admiral Saif bin Nasser bin Mohsen Al-Rahbi, Commander of Royal Navy of Oman (CRNO) and Admiral Karambir Singh, Chief of the Naval Staff (CNS), Indian Navy Photograph:(Twitter)

Both countries already have a White Shipping Exchange Agreement. The then Indian Navy Chief Karambir Singh had visited Oman last September. Last Visit by Oman Navy Chief to India was undertaken in September 2017. The west Asian country also provides critical operational support to Indian naval deployments in the Arabian sea for anti-piracy missions and actively participates in the Indian Ocean Naval Symposium (IONS).

More high-level engagements are seen between Indian, Omani military leadership. Chief of Oman's Air force will also visit India soon even as Jodhpur will see Air exercises between the two countries later this month. The annual bilateral air exercise this year will see the participation of over 150 personnel from Oman.

Oman is the only country in the Gulf region with which all 3 services of the Indian armed forces conduct regular bilateral exercises and staff talks. Oman is India's closest defence partner in the Gulf region and Defence exchanges are a part of a framework MOU which was renewed in 2021.

<https://www.wionews.com/india-news/commander-of-oman-navy-al-rahbi-on-india-visit-from-monday-453053>

The Indian EXPRESS

Sat, 12 Feb 2022

US Navy delegation visits Western Naval Command HQ in Mumbai

The visit is linked to the Basic Exchange and Cooperation Agreement (BECA) talks held in 2020 wherein a consensus was reached to explore cooperation in Underwater Domain Awareness.

Mumbai: A ten-member US Navy delegation led by Rear Admiral Leonard C 'Butch' Dollaga, Commander Submarine Group 7, visited the Headquarters of the Western Naval Command in Mumbai on Wednesday.

During the visit, Rear Admiral Dollaga called on Vice Admiral Ajendra Bahadur Singh of the Western Naval command and discussed matters of relevance to the maritime domain with special emphasis on the growing cooperation between the two navies. The delegation was accompanied by US Consul General (Mumbai) David J Ranz.

The visit of the US Navy (USN) delegation was part of follow-up activities linked to the Basic Exchange and Cooperation Agreement (BECA) discussions held in October 2020 wherein a consensus was reached to explore cooperation in the field of Underwater Domain Awareness (UDA) with a formal agreement between the two sides.

The delegation presented various avenues to progress cooperation in the niche field of UDA and further strengthen Indo-US comprehensive global strategic partnership. On the Indian side, the discussion was led by Vice Admiral Krishna Swaminathan, Chief of Staff of Western Naval Command, wherein various facets of mutual cooperation in the field of UDA were deliberated.

India was accorded 'Major Defence Partner Status' by the USA during Prime Minister Narendra Modi's visit to the USA in June 2016 which institutionalised defence trade and technology sharing with India, at par with closest allies and partners of the USA.

Major agreements signed between India and the USA since 2014 include the Defence Framework Agreement (DFA), BECA, General Security of Military Information Agreement (GSOMIA), Communication Compatibility and Security Arrangements (COMCASA) and the Logistics Exchange Memorandum of Agreement (LEMOA).

<https://indianexpress.com/article/cities/mumbai/us-navy-delegation-wnc-indian-navy-mumbai-7767395/>



During the visit, Rear Admiral Dollaga called on Vice Admiral Ajendra Bahadur Singh of the Western Naval command and discussed matters of relevance to the maritime domain with special emphasis on the growing cooperation between the two navies. (Representational)

Black Hawk helicopter takes to the skies without pilots for the first time

Black Hawk helicopter, a US military icon, flew without a pilot on board for the first time in Kentucky earlier this week.

New Delhi: In a major step ahead for autonomous flight, a Black Hawk helicopter flew without a pilot on board in the US state of Kentucky earlier this week.

The specially equipped chopper flew for 30 minutes through a simulated cityscape, avoiding imagined buildings before performing a perfect landing, reported Reuters.

In the first test flight on February 5, the unmanned Black Hawk flew at around 4,000 feet of altitude and at speeds of about 115 to 125 miles per hour. Another simulated autonomous flight was conducted on Monday with the same chopper, according to report by Popular Science.

The wholly computer-operated aircraft was being tested as part of a US defence research program called Alias, and the tests took place out of Fort Campbell in Kentucky.

Stuart Young, the program manager for Alias, told Popular Science this kind of autonomous flight technology has three main goals. The first is safety, to avert disasters like crashing into terrain. The second is in-flight assistance, while the third is cost reduction.

The Alias program aims to put “removable kits” into existing military aircrafts to “promote the addition of high-level automation”, reported The Next Web.

This will give the Army operational flexibility, as it would essentially enable them to operate aircraft at all times of the day or night, with and without pilots, and in a variety of difficult conditions, such as degraded visual environments.

<https://www.indiatoday.in/world/story/black-hawk-helicopter-flies-without-pilot-for-first-time-video-1912112-2022-02-12>



The specially equipped Black Hawk helicopter flew without a pilot on board (Photo courtesy: Reuters)



Mon, 14 Feb 2022

7 Times the speed of sound, China claims breakthrough with ‘Hypersonic Gun’ that can shoot-down missiles, fighter jets

By Ashish Dangwal

The emergence of hypersonic weapons has forced nations to look for countermeasures. Japan has reportedly decided to develop “railguns” in the face of emerging hypersonic threats and it is not the only country to do so.

A railgun is an electromagnetic weapon capable of firing projectiles at Mach 7 — seven times the speed of sound — and is said to be capable of destroying ships, missiles, and planes. But on the flip side, the fast-moving projectile and its high-voltage electric current could produce irreversible wear on the rail or inner wall, lowering the gun’s lifespan and accuracy.

Now, China appears to have found answers to some of the issues plaguing railguns. Wang Xiaohe, a researcher at the China Huayin Ordnance Test Centre in the northwestern province of Shaanxi, claims that the country's researchers have come up with some viable solutions in recent years, reported SCMP.

China's railgun program has to go through a number of certification processes before it can be used in future battles. Wang and his colleagues emphasized that the volume and intensity of these tests would considerably exceed any previous tests, stating that a significant number of shots would have to be fired "nonstop at top energy levels" to uncover and address issues.

China's railgun program is not new. In 2018, some images emerged on social media showing a large, previously unknown weapon placed on the Type 072III-class landing ship, Haiyang Shan.



China's Type 072III-class landing ship Haiyang Shan is outfitted with a large weapon that has been identified by some analysts as a railgun. (via Twitter)

The possibility of a ship-mounted railgun was mentioned by a verified Weibo account belonging to a retired Chinese navy officer. He said that a project to build a ship-mounted railgun had been authorized years ago, possibly with the help of the Beijing Institute of Technology and a China Aerospace Science and Industry Corporation institute.

Does US Have Railguns?

Last July, the Pentagon declared that it had put a halt to its railgun program in order to free up resources for hypersonic weapon research. Aside from financial limitations, one of the main reasons was the need to replace a gun barrel after 20 shots due to wear and other problems.

The United States has been a pioneer in the development of railguns. It is said an American inventor had suggested the use of rail cannon to shell Havana from the coast of Florida during the Spanish-American War in the late nineteenth century. The Pentagon initiated the modern US railgun program during the Cold War period.

After decades of development and more than 1,000 rounds of tests, US researchers accomplished a variety of technological and engineering advancements that expanded the weapon's operational range to over 100 nautical miles with bullets soaring at seven times the speed of sound.

However, the issue with the weapon is that its range would still expose American warships to enemy fire. This might be fatal in the face of an opponent (China) capable of deploying sophisticated missiles.

Wang claimed that research in the United States and other nations had benefited Chinese researchers a lot. China is using liquid metal in the rail to reduce wear. Chinese scientists also employed some of the models used by American railgun experts to simulate and analyze the occurrence of damage.

However, Chinese railgun had some unique designs that had never been seen before, Wang added. The Chinese design, unlike most railguns, would not have an additional mechanism attached to the muzzle to suppress an electric flash. To attain more consistent performance with minimal damage, it would employ a special coating technology.

In 2018, China undertook the world's first live open-sea test with a railgun placed on a warship. A 25kg (55lbs) projectile was reportedly propelled to Mach 7.3 and hit a target 250 kilometers away with the prototype weapon. Chinese scientists are also working on hypersonic missiles that could be launched from a railgun and could search for targets, the report said.

China claims to have developed heat-seeking hypersonic missiles ahead of the United States, which could be used to attack aircraft carriers and moving vehicles. However, hypersonic weapons are expensive to operate. Railguns, according to the Chinese navy, might help defend the country's shore due to its unrivaled firing range.

Japan's Foray into Railgun Domain

Last Month, it was reported that Japan has decided to develop an electromagnetic weapon system to intercept enemy hypersonic missiles. The decision to develop "railguns" came as Tokyo considers how to deal with the threat posed by hypersonic weapons from its neighbors such as China, North Korea, and Russia.

The plan is to add railgun interceptors to the existing missile defense system. Japan is also considering long-range missiles that would allow it to fire projectiles from afar. The three mechanisms would combine to provide a three-tier deterrent.

A total of 6.5 billion yen (\$56 million) has been set out in the fiscal 2022 budget for the development of prototypes of military-use railgun technology. The system ought to be operational in the second part of the 2020s.

Moreover, the Japanese Defense Ministry will begin full-scale research and development of high-power microwave (HPM) weapons in the fiscal year 2022, which begins in April, according to Japan's *Yomiuri Shimbun* newspaper. The news comes days after Chinese media reported that the country is working on laser weaponry for the J-20 Mighty Dragon stealth aircraft.

"The ministry plans to work on a prototype over the next five years and has earmarked 7.2 billion yen [US\$62.5 million] in next year's budget plan for that purpose," officials told Japanese newspaper, *Yomiuri Shimbun*.

<https://eurasianimes.com/china-claims-breakthrough-with-hypersonic-gun/>

Science & Technology News

THE TIMES OF INDIA

Mon, 14 Feb 2022

PSLV-C52/ EOS-03 mission successful; ISRO places three satellites in orbits

By U Tejonmayam

Chennai: The Indian Space Research Organisation opened its 2022 account with the successful launch of radar imaging satellite EOS-04 and two others onboard PSLV-C52 on Monday morning.

The launch comes nearly six months after the failed GSLV-F10/EOS-03 mission. According to Isro, the cryogenic upper stage ignition did not happen due to a technical anomaly during the GSLV-F10/EOS-03 launch on August 12, 2021.

At 5.59am on Monday, PSLV-C52 lifted off from the first launch pad at Satish Dhawan Space Centre in Sriharikota with three satellites, including its primary payload EOS-04 radar imaging satellite. Around 17 minutes after lift-off, EOS-04 satellite was placed in a sun synchronous orbit. A minute later, the rocket injected the two other satellites -- INS-2TD and Inspiresat-1.



PSLV C52 takes off from Sriharikota on Monday.

Around four minutes later -- that is 22 minutes after lift-off -- the fourth stage was passivated to remove remaining propellants, with mixed oxides of nitrogen (MON) passivation followed by mono methyl hydrazine (MMH) passivation, two propellants that power PSLV's upper stage. The passivation lasted for 10 minutes. Passivation is the removal of any leftover fuel in the rocket to prevent the explosion of rocket upper stages. The upper stage either performs an idle burn or vent the remaining propellants.

The mission was PSLV's 54th flight and 23rd mission using PSLV-XL configuration with six PSOM-XLs.

Congratulating the team, Isro chairman S Somanath said, "The primary satellite, EOS-04, has been put in a very precise orbit by PSLV-C52. Co-passenger satellites INS-2TD and INSPIRESat-1 have also been placed in the right orbits. This spacecraft is going to be one of the biggest assets to serve the country. We will be back again with another launch of PSLV very soon."

Satellite director Srikanth said, "Let me first congratulate the PSLV team on precise inject of EOS-04. The launch has rejuvenated Isro team once again. The most awaited spacecraft, EOS-04, is an earth observation mission, all weather, day and night imaging SAR mission with indigenously developed state-of-the-art technology SAR and will serve the country in the sectors of agriculture, soil moisture, disaster management, disaster assessment, carbon inventory, forest and plantation management and many more sectors."

"The health of EOS-04 is perfectly fine after separation. I am happy to share that the solar panels are deployed autonomously and started generating the designed power.... In a couple of days after calibration and braking for outgassing, the satellite will be ready to deliver the glimpse of images. The services will be an integral part of many governmental services. EOS-04 has taken a small step in the nation's dream of opening the space sector with the industry participation in the form of build to print and also assemble and test. We have fairly succeeded in our effort."

Satellites

EOS-04, a radar imaging satellite with a mission life of 10 years, is designed to provide high quality images under all weather conditions for applications like agriculture, forestry and plantations, flood mapping, soil moisture and hydrology. Collecting earth observation data in C-band, it complements/supplements the data from Resourcesat, Cartosat series and RISAT-2B series.

INS-2TD is a technology demonstrator from Isro with a mission life of six months, which is a precursor to the India-Bhutan joint satellite (INS-2B). Having a thermal imaging camera as its payload, the satellite benefits from the assessment of land surface temperature, water surface temperature of wetlands/lakes, delineation of vegetation (crops and forest) and thermal inertia (day/night).

Inspiresat-1 is a student satellite with a mission life of one year developed by Indian Institute of Space Science and Technology (IIST), in association with University of Colorado in the US. Other contributions are NTU, Singapore and NCU, Taiwan. Two scientific payloads improve the understanding of ionosphere dynamics and the sun's orbital heating processes.

<https://timesofindia.indiatimes.com/india/pslv-c52/-eos-03-mission-successful-isro-places-three-satellites-in-orbits/articleshow/89554668.cms>



Mon, 14 Feb 2022

ISRO का PSLV-C52 सफलतापूर्वक लॉन्च, दो छोटे उपग्रह भी लेकर गया साथ; जानिए क्या काम करेगा यह उपग्रह

By Sanjeev Tiwari

नई दिल्ली: भारतीय अंतरिक्ष अनुसंधान संगठन (ISRO) ने सोमवार सुबह 5.59 बजे पीएसएलवी-सी 52 (PSLV-C52) को सफलतापूर्वक लॉन्च कर दिया। यह 2022 का पहला प्रक्षेपण अभियान है। पीएसएलवी-सी 52 के जरिए धरती पर नजर रखने वाले उपग्रह ईओएस-04 को कक्षा में भेजने के लिए 25 घंटे की उलटी गिनती रविवार सुबह शुरू हो गई थी। ध्रुवीय उपग्रह प्रक्षेपण यान (पीएसएलवी) अपने साथ दो छोटे

उपग्रहों को भी लेकर गया। इसका प्रक्षेपण आंध्र प्रदेश के श्रीहरिकोटा स्थित सतीश धवन अंतरिक्ष केंद्र के पहले लॉन्च पैड से सोमवार को सुबह 05:59 बजे निर्धारित है।

ईओएस-04 एक 'रडार इमेजिंग सैटेलाइट' है जिसे कृषि, वानिकी और वृक्षारोपण, मिट्टी की नमी और जल विज्ञान व बाढ़ मानचित्रण जैसे अनुप्रयोगों एवं सभी मौसम स्थितियों में उच्च गुणवत्ता वाली तस्वीरें प्रदान करने के लिए डिजाइन किया गया है।

इसरो के मुताबिक पृथ्वी अवलोकन सैटेलाइट EOS-04 के साथ ही दो छोटे सैटेलाइट को भी PSLV-C52 रॉकेट से सफलतापूर्वक लॉन्च किया गया है। ये सैटेलाइट अपनी कक्षा में स्थापित हो गए हैं। इसरो इस साल के शुरुआती तीन महीनों के अंदर पांच लॉन्चिंग की तैयारी में है। पहली तो EOS-4 होगी। इसके बाद PSLV-C53 पर OCEANSAT-3 और INS-2B मार्च में लॉन्च किया जाएगा। अप्रैल में SSLV-D1 माइक्रोसैट की लॉन्चिंग होगी। हालांकि किसी भी लॉन्चिंग की तय तारीख आखिरी वक्त तक बदली जा सकती है। क्योंकि किसी भी लॉन्च से पहले कई तरह के मानकों को देखना होता है।

दो छोटे उपग्रह भी साथ ले गया

पीएसएलवी अपने साथ में दो छोटे उपग्रहों को भी ले गया, जिनमें कोलोराडो विश्वविद्यालय, बोल्डर की वायुमंडलीय और अंतरिक्ष भौतिकी प्रयोगशाला के सहयोग से तैयार किया गया भारतीय अंतरिक्ष विज्ञान और प्रौद्योगिकी संस्थान (आईआईएसटी) का उपग्रह इन्सपायरसैट-1 भी शामिल है। इसमें एनटीयू, सिंगापुर और एनसीयू, ताइवान का भी योगदान रहा है। इस उपग्रह का उद्देश्य आयनमंडल के गति विज्ञान और सूर्य की कोरोनल ऊष्मीय प्रक्रियाओं की समझ में सुधार करना है।

वहीं, दूसरा उपग्रह इसरो का एक प्रौद्योगिकी प्रदर्शक उपग्रह (आईएनएस-2टीडी) है। इसके उपकरण के रूप में एक थर्मल इमेजिंग कैमरा होने से उपग्रह भूमि की सतह के तापमान, आर्द्रभूमि या झीलों के पानी की सतह के तापमान, वनस्पतियों (फसलों और जंगल) और तापीय जड़त्व (दिन और रात) के आकलन में सहायता प्रदान करेगा।

<https://www.jagran.com/news/national-isro-successfully-launches-earth-observation-satellite-two-other-co-passengers-on-pslv-c52-2246521.html>



Sun, 13 Feb 2022

IIST has a role in ISRO's first launch of the year

INSPIRESat-1 one of the three satellites to be launched aboard PSLV C-52 tomorrow

By Tiki Rajwi

Thiruvananthapuram: The Indian Space Research Organisation's (ISRO) first launch of the year, scheduled for a Valentine's Day lift-off from Sriharikota, will be a thrilling moment for the Indian Institute of Space Science and Technology (IIST) at Valiamala here.

The Polar Satellite Launch Vehicle C-52 (PSLV C-52/EOS-04) mission will have on board three satellites, and one of them is a small student satellite weighing just 8.1 kg.

INSPIRESat-1, as the cubesat is named, is a joint effort by the IIST, the Laboratory of Atmospheric Science and Physics (LASP) at the University of Colorado Boulder, US, the Nanyang Technological University (NTU), Singapore, and the National Central University (NCU), Taiwan.

INSPIRE - short for the INternational Space Program in Research and Education which kicked off in 2017 - envisions a constellation of earth and space weather observation satellites.

The main payload

Aboard the PSLV C-52, INSPIRESat-1 will be one of two 'co-passengers' sharing space with the main payload, the 1,710-kg radar imaging satellite EOS-04. The other small satellite is the 17.5 kg INS-TD, a technology demonstrator from ISRO.

The Indian space agency has scheduled the launch for 5.59 a.m. on Monday from the first launch pad of the Satish Dhawan Space Centre, Sriharikota.

IIST contribution

To be placed in a low earth orbit, INSPIRESat-1 has a mission life of one year. It consists of two scientific payloads designed to improve our knowledge of ionosphere dynamics and the sun's coronal heating processes, according to ISRO and IIST. Design and development of the onboard computer and the electrical power supply for the satellite were carried out by the IIST team.

The satellite was ready last year, but the COVID-19 pandemic which played havoc with the ISRO launch calendar delayed its launch. Although it bears the serial number '1,' INSPIRESat-1 is in reality the third satellite in the constellation to be launched, but it will be the first by ISRO. INSPIRESat-2 and 5 were launched by SpaceX.

Benefiting students

The INSPIRE programme has been a rewarding experience both for the students and faculty of IIST, the institute's registrar Y.V.N. Krishna Murthy said. Not only has it given the students insights into spacecraft design and development, but it has also equipped them for handling collaborative projects, he said.

The PSLV C-52/EOS-04 mission will mark the 54th flight of the PSLV, often dubbed the 'reliable workhorse' of ISRO. It aims to place the main payload, the EOS-04 satellite, in a sun synchronous orbit. This satellite will have a mission life of 10 years.

<https://www.thehindu.com/news/national/kerala/iist-has-a-role-in-isros-first-launch-of-the-year/article38418892.ece>



Sat, 12 Feb 2022

Explained: The importance of the EOS-04 launch, ISRO's first of 2022

As many as 19 launches are planned this year, including a few big-ticket ones like the Chandrayaan-3 and the uncrewed Gaganyaan mission

By Amitabh Sinha

Pune: After a disappointing 2021 which saw just one successful launch, ISRO is getting back to business on Monday with the EOS-04, an earth observation satellite, that is supposed to be the beginning of a busy year for the Indian space agency.

As many as 19 launches are planned this year, including a few big-ticket ones like the Chandrayaan-3 and the uncrewed Gaganyaan mission. This makes 2022 the busiest calendar for ISRO since its inception. Hit by the Covid-19 pandemic, ISRO had made only three successful launches in the last two years, and all its major missions have been delayed by several months.

What is the EOS-04 all about?

The showpiece of Monday is the EOS-04 — the fourth in a series of earth observation satellites that are being launched under a new generic name. Two years ago, ISRO had moved to a new naming system for its earth observation satellites which till then had been named thematically, according to the purpose they were meant for.

The Cartosat series of satellites were meant to provide data for land topography and mapping, while the Oceansat satellites were meant for observations over sea. Some INSAT-series, Resourcesat series, GISAT, Scatsat, and a few other earth observation satellites were named differently for the specific jobs they were assigned to do, or the different instruments that they. All these would now become part of the new EOS series of satellites. Land and forest mapping and monitoring, mapping of resources like water or minerals or fishes, weather and climate observations, soil assessment, and geospatial contour mapping are done through these satellites.

However, only the first of these newly named satellites, EOS-01, launched in November 2020, is in orbit right now. EOS-02, a micro-satellite to be flown on a new launch vehicle called SSLV (Small Satellite Launch Vehicle) is yet to be launched, while launch of EOS-03 had ended in a failure in August last year.



Technicians work on the EOS-04 satellite. (Photo: Department of Science and Technology)

Like EOS-01, the 1,710-kg EOS-04, which will be placed in a sun synchronous polar orbit of 529 km, is a radar-imaging satellite which would have made it a part of the RISAT series earlier. In fact, it would replace the RISAT-1 which was launched in 2012 but has been non-functional for the last few years. RISATs use synthetic aperture radars to produce high-resolution images of the land. One big advantage that radar imaging has over optical instruments is that it is unaffected by weather, cloud or fog, or the lack of sunlight. It can produce high-quality images in all conditions and at all times, making it suitable for surveillance.

ISRO said that the EOS-04 was designed to provide high-quality images for applications such as agriculture, forestry and plantations, flood mapping, soil moisture and hydrology. It will complement the data from Resourcesat, Cartosat and RISAT-2B series of satellites that are already in orbit.

What other satellites are being launched on Monday?

Besides EOS-04, two other small satellites —INSPIRESat-1 and INS-2TD — will ride on the heaviest version of the PSLV rocket in the early hours from the Sriharikota launch range.

INSPIRESat-1 is a student satellite developed by the Thiruvananthapuram-based Indian Institute of Space Science and Technology in collaboration with the University of Colorado in the United States where it was assembled and tested. Students from Nanyang Technological University in Singapore and National Central University of Taiwan have also contributed. This satellite will study the dynamics of the upper atmosphere and carries an X-ray spectrometer for studying solar flares.

The other co-passenger, INS-2TD, is a technology demonstrator for the first India-Bhutan joint satellite that is scheduled to be launched next month. The two countries had signed a space agreement last year, and its first outcome would be the launch of BhutanSat, or INS-2B, on a PSLV rocket in March. The INS-2TD that will fly on Monday has a thermal imaging camera meant for earth observation purposes, like assessment of land and water surface temperature, and identification of forest and tree cover.

How many satellites does India have in space?

India currently has 53 operational satellites, of which 21 are earth observation ones and another 21 are communication-based. Eight are navigation satellites, while the remaining three are science satellites, according to information provided by the government in Parliament.

Monday's launch would be the 54th flight of the PSLV rocket, and the 23rd of its most powerful XL-version that has six strap-on boosters. The EOS-04 would be the first satellite to detach from the rocket, 18 minutes after the lift-off. The two other satellites would be released about a minute later.

<https://indianexpress.com/article/explained/explained-isro-eos-04-monday-launch-2022-first-7770178/>

