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# समाचार पत्रों से चयित अंश Newspapers Clippings

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

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# ThePrint

Thu, 30 Dec 2021

## India's plans to export BrahMos get a boost as Philippines sets aside funds for missiles

*Negotiations between India and Philippines regarding BrahMos had been going on for years, but hit a roadblock in 2020, with Manila citing budgetary limitations caused by Covid.*

*By Snehash Alex Philip, Edited by Gitanjali Das*

New Delhi: India's plans to export BrahMos supersonic cruise missiles may soon be a reality, with the Philippines setting aside funds for the planned acquisition of the shore-based, anti-ship missile system.

The Philippines' budget department has released initial funding for the acquisition, the *Inquirer*, a media portal based in the country, reported. Two special allotment release orders (SARO) — worth ₱1.3 billion (Rs 190 crore) and ₱1.535 billion (Rs 224 crore) — were issued by the Philippines' Department of Budget Management (DBM) on 27 December. The SARO allows the country's Department of National Defense to finalise contracts for military hardware.

According to the *Inquirer* report, the Philippines is expected to acquire BrahMos missiles under a "government-to-government deal".

The move comes at a time when Philippines President Rodrigo Duterte is on a military hardware shopping spree, with only six months left in his term. On 28 December, Manila had also signed a ₱28 billion contract with South Korea's Hyundai Heavy Industries for building two corvettes for the Philippine Navy.

Sources in the defence and security establishment said while India is working on an extended range of the BrahMos missile, the variant that will be exported will be the one with a "normal range" of 290 kilometres.

### A key pact after Covid stalled negotiations

The BrahMos — which is a joint venture between India and Russia — is the only supersonic cruise missile in the world that flies at three times the speed of sound (2.8 Mach). It is capable of both coastal defence and ground attack roles. India had offered a \$100 million line of credit for the purchase of the weapon. The Philippines has been eyeing BrahMos missiles to beef up its defence. Negotiations between India and the Philippines regarding the BrahMos missiles had been going on for years, but hit a roadblock in December 2020, with Manila citing budgetary limitations caused by the Covid-19 pandemic.

In March this year, India signed a key enabling pact with the Philippines — which is in a territorial dispute with China over the South China Sea — that had paved the way for government-to-government deals on defence equipment including BrahMos.

<https://theprint.in/defence/indias-plans-to-export-brahmos-get-a-boost-as-philippines-sets-aside-funds-for-missiles/790913/>



File photo of the BrahMos Supersonic Cruise Missile, as it is successfully test-fired from Indian Navy's Stealth Destroyer, INS Chennai | ANI

## India, Philippines close to finalising BrahMos missile deal

*India is likely to bag more orders for the missile system from friendly countries as it is negotiating at an advanced stage with some other nations too.*

New Delhi: In what could be a major success for the Narendra Modi government's defence export push, India is expected to soon get export order from Philippines for BrahMos supersonic cruise missiles. "India and Philippines are in an advanced stage of negotiations over the sale of BrahMos supersonic cruise missile. Export order likely to be placed soon," government sources told ANI.

"DRDO and BrahMos Aerospace together have been pushing hard for exports of this missile to friendly foreign countries: for the last few months," sources said. The Indian government's defence export push is coming from the DRDO stable as it bagged orders for a 'made-in-India' weapon locating radars from the Armenian government recently.



The BrahMos supersonic cruise missile  
(Credit: ANI)

India is likely to bag more orders for the missile system from friendly countries as it is negotiating at an advanced stage with some other nations too. The missile is also getting more capable due to added range and other modern technologies getting incorporated into it.

Senior scientist Atul Dinkar Rane has been appointed as the new head of the BrahMos Aerospace Limited and he has worked with the firm since its inception days.

<https://www.dtnext.in/News/National/2021/12/29223451/1336350/India-Philippines-close-to-finalising-BrahMos-missile-vpf>

## अमर उजाला

### ब्रह्मोस मिसाइल सौदे को अंतिम रूप देने के करीब भारत और फिलीपींस, जल्द मिल सकता है निर्यात का ऑर्डर

सार

ब्रह्मोस सुपरसोनिक क्रूज मिसाइल की खरीद के लिए फिलीपींस भारत के साथ बातचीत के लिए अंतिम चरण है। आसार हैं कि इस मिसाइल की खरीद के लिए फिलीपींस जल्द ही ऑर्डर जारी कर सकता है।

विस्तार

नई दिल्ली: रक्षा निर्यात को बढ़ाने की प्रधानमंत्री नरेंद्र मोदी की सरकार की पहल में जल्द ही देश को एक बड़ी सफलता मिल सकती है। भारत सरकार और फिलीपींस के बीच ब्रह्मोस सुपरसोनिक क्रूज मिसाइलों के निर्यात सौदे पर जल्दी ही अंतिम मुहर लगने की उम्मीद है।



समाचार एजेंसी एएनआई की एक रिपोर्ट के अनुसार सरकारी सूत्रों ने बताया कि ब्रह्मोस मिसाइलों की बिक्री को लेकर भारत और फिलीपींस सौदेबादी के अंतिम चरण में हैं। सूत्रों के अनुसार फिलीपींस जल्द ही इन मिसाइलों की खरीद के लिए ऑर्डर दे सकता है।

## और देशों से भी जल्द मिल सकते हैं खरीद के ऑर्डर

सूत्रों का कहना है कि डीआरडीओ (रक्षा अनुसंधान एवं विकास संगठन) और ब्रह्मोस एयरोस्पेस इस मिसाइल का मित्र देशों को निर्यात करने के लिए पूरा जोर लगा रहे हैं। डीआरडीओ ने हाल ही में अमेरिका के साथ मेड इन इंडिया रडार का सौदा भी किया था।

भारत को अन्य मित्र देशों से भी मिसाइल प्रणाली के ऑर्डर जल्द मिलने की उम्मीद है क्योंकि कुछ और देशों के साथ भी इसे लेकर सौदेबाजी अपने अंतिम दौर में है। इस मिसाइल की क्षमताओं में वृद्धि हुई है और कई आधुनिक विशेषताओं से लैस किया गया है।

<https://www.amarujala.com/india-news/india-philippines-close-to-finalizing-brahmos-supersonic-cruise-missile-deal-news-in-hindi>

# Business Standard

Thu, 30 Dec 2021

## Here's how Tejas Mark 2 is evolving into a bigger, powerful fighter

*The Tejas Mark 2's increased payload capacity will enable it to integrate significantly more weapons and sensors than the Mark 1 fighter*

*By Ajai Shukla*

New Delhi: With the Indian Air Force (IAF) having ordered 123 Tejas fighters (six squadrons) and foreign air forces evaluating India's homegrown light combat aircraft (LCA) for acquisition, the Tejas Mark 1 is evolving from a light fighter to a bigger and more powerful medium fighter that could be a clear notch above its possible adversaries in South Asia.

On November 15, the IAF signed off on a comprehensive design review (CDR) of the Tejas Mark 2, clearing the construction of a new prototype of the LCA for construction and testing.

A CDR is a critical step in designing and developing a new aircraft. It allows the customer air force to examine the proposed blueprints in detail to be sure the aircraft design is viable, ready for fabrication and testing and that it would achieve its stipulated performance within the laid down cost, schedule and risk.

The IAF's acceptance of the CDR allows Hindustan Aeronautics Ltd (HAL) to start releasing drawings of the Mark 2's first prototype and producing them.

The Tejas Mark 2 is no longer an LCA, but a significantly larger and more capable Medium Combat Aircraft (MCA), with a higher thrust engine and a 1.5-metre increase in length. While there is no change in the size of the wings, they have been pushed outwards, effectively increasing the fighter's wingspan by 300 mm.



Replacing the 1980s appearance of the Tejas Mark 1, the Mark 2 has a 21<sup>st</sup> century look. Ahead of the wings, a canard has been added, creating a resemblance with contemporary fighters such as the Rafale, Eurofighter or the Sukhoi-30MKI. The canard provides an additional control surface that creates a vortex, increasing the lifting capability and agility of the aircraft.

The key change in the Tejas Mark 2 is its significantly more powerful General Electric (GE) F-414 engine, which will replace the current GE F-404 power pack. For close-in dog fighting against enemy fighters, which involves sudden acceleration, sharp climbing and sustained turning, the F-404 engines' peak thrust of 83 KiloNewtons (kN) is considered inadequate. For that reason, the Aeronautical Development Agency (ADA) has decided to power the Mark 2 with a GE F-414 engine that will deliver 98 kN of peak power.

The new engine will enable the Mark 2 to take off with a maximum all-up weight of 16.5 tonnes, which will include the 10-tonne weight of the fighter and 6.5 tonnes of external payload.

The increased carriage creates a wealth of options for mission planners. The Tejas Mark 2 can carry 3.5 tonnes of fuel in external drop tanks, in addition to 3.3 tonnes in its internal fuel tanks, while still carrying three tonnes of weapons and sensors.

### **Weapons carriage**

The Tejas Mark 2's increased payload capacity will enable it to integrate significantly more weapons and sensors than the Mark 1 fighter. For air-to-air combat, the Mark 2 will carry the indigenous Astra Mark 1 and Mark 2 missiles. It would also carry Rudram anti-radiation missiles, developed by the DRDO's Defence R&D Laboratory (DRDL) Hyderabad, and tested on October 9.

Meanwhile, the DRDO's Armament Research & Development Establishment is developing a range of bombs for the Tejas Mark 2, such as the Tara (high speed, low drag) bomb that is mounted on the pylons. It will also have the option of carrying laser guided bombs (LGBs), fitted with laser-guidance kits. While there are no plans to integrate the game-changing Meteor beyond visual range (BVR) air-to-air missile, the Tejas Mark 2 may be integrated with the SCALP missile that has been procured along with the Rafale fighters.

To carry this payload, the Tejas Mark 2 will have 11 hard points, including one on each wingtip for the ASRAAM air-to-air missile. There will be three under-wing pylons on each side, one wet station on each side for fuel drop tanks, while the other three hard points are for long-range missiles such as the Astra and Rudram.

Besides a new engine, the Tejas Mark 2 would have its internals rearranged, to make them more accessible and maintenance friendly. While building the Mark 1, these "line replacement units" (LRUs) were positioned randomly, as the need arose. Their optimal rearrangement would improve space utilisation, accessibility, and make maintenance easier and quicker, reducing turn-around time between operational missions.

Furthermore, the Tejas Mark 1 is burdened with 300 kilos of ballast --- dead weight inserted incrementally while designing the fighter, to correct its centre of gravity. If the internal LRUs are re-arranged and the ballast removed, the Tejas Mark 2 could instead carry 300 kg more of useful payload.

[https://www.business-standard.com/article/current-affairs/here-s-how-tejas-mark-2-is-evolving-into-a-bigger-powerful-fighter-121122901540\\_1.html](https://www.business-standard.com/article/current-affairs/here-s-how-tejas-mark-2-is-evolving-into-a-bigger-powerful-fighter-121122901540_1.html)



Thu, 30 Dec 2021

## **रक्षा मंत्रालय और DRDO ने मिलकर तैयार की सफेद दाग की दवा, पूर्व राष्ट्रपति कलाम के एक सुझाव से बदली लाखों की जिंदगी**

*रक्षा मंत्रालय के उपक्रम रक्षा कृषि अनुसंधान और प्रयोगशाला डीआरडीओ पिथौरागढ़ ने सफेद दाग की दवाई तैयारी की है। खास बात ये है कि पूर्व राष्ट्रपति एपीजे अब्दुल कलाम की भी इसमें भूमिका रही है।*

रक्षा मंत्रालय के उपक्रम रक्षा कृषि अनुसंधान और प्रयोगशाला डीआरडीओ पिथौरागढ़ ने सफेद दाग 'ल्यूकोडर्मा' की अचूक दवाई तैयार की है। इस दवाई का अभी तक लगभग एक लाख लोग लाभ उठा चुके हैं। दवाई को तैयार करवाने में पूर्व राष्ट्रपति ए.पी.जे. अब्दुल कलाम की महत्वपूर्ण भूमिका रही है। उन्हीं की प्रेरणा मार्गदर्शन में संस्थान के वैज्ञानिकों ने दवाई तैयार करने में सफलता हासिल की है।

केंद्रीय रक्षा राज्य मंत्री अजय भट्ट ने बताया कि 1962 के युद्ध के बाद पहाड़ी क्षेत्रों में कई लैब बनाई गईं, जिसमें पण्डा फार्म पिथौरागढ़ की भी लैब है। उस समय हम अपने फौजी भाईयों को रसद नहीं भेज

सकते थे, सब्जियां नहीं भेज सकते थे। कई किस्म की अन्य चीजें नहीं भेज सकते थे। ये अपने उद्देश्य में सफल हुए हैं। सबसे बड़ी बात ये है कि भारत के पूर्व राष्ट्रपति अब्दुल कलाम भी यहां आए। उन्होंने कहा कि कुछ ऐसा काम करिये, कुछ ऐसी दवा बनाएं जो किसी ने नहीं बनाई। ल्यूकोडर्मा सफेद दाग की जो दवा यहां बनाई गई।



अजय भट्ट, केंद्रीय रक्षा राज्य मंत्री

### केंद्रीय रक्षा राज्य मंत्री ने दी ये जानकारी

अजय भट्ट ने बताया कि सफेद दाग से कई लोगों का जीवन बरबाद हो रहा था। किसी के माता-पिता को भी सफेद दाग हो जाता था तो उनके बच्चों की भी शादी नहीं हो पाती थी। उसे कोढ़ बुला जाता था। पर वो कोढ़ नहीं हैं। कई चीजों की डिफेंसी हो जाती है शरीर में। उसके कारण सफेद दाग हो जाते हैं और एक मात्र अच्छी दवा बनाई तो वो पण्डा फार्म में बनी अभी तक एक लाख लोगों ने अभी तक दवा से फायदा लिया है।

रक्षा मंत्रालय के उपक्रम रक्षा कृषि अनुसंधान और प्रयोगशाला डीआरडीओ पिथौरागढ़ ने सफेद दाग 'ल्यूकोडर्मा' की अचूक दवाई तैयार की है। इस दवाई का अभी तक लगभग एक लाख लोग लाभ उठा चुके हैं। दवाई को तैयार करवाने में पूर्व राष्ट्रपति ए.पी.जे.अब्दुल कलाम की महत्वपूर्ण भूमिका रही है। उन्हीं की प्रेरणा मार्गदर्शन में संस्थान के वैज्ञानिकों ने दवाई तैयार करने में सफलता हासिल की है।

केंद्रीय रक्षा राज्य मंत्री अजय भट्ट ने बताया कि 1962 के युद्ध के बाद पहाड़ी क्षेत्रों में कई लैब बनाई गई, जिसमें पण्डा फार्म पिथौरागढ़ की भी लैब है। उस समय हम अपने फौजी भाईयों को रसद नहीं भेज सकते थे, सब्जियां नहीं भेज सकते थे। कई किस्म की अन्य चीजें नहीं भेज सकते थे। ये अपने उद्देश्य में सफल हुए हैं। सबसे बड़ी बात ये है कि भारत के पूर्व राष्ट्रपति अब्दुल कलाम भी यहां आए। उन्होंने कहा कि कुछ ऐसा काम करिये, कुछ ऐसी दवा बनाएं जो किसी ने नहीं बनाई। ल्यूकोडर्मा सफेद दाग की जो दवा यहां बनाई गई।

### केंद्रीय रक्षा राज्य मंत्री ने दी ये जानकारी

अजय भट्ट ने बताया कि सफेद दाग से कई लोगों का जीवन बरबाद हो रहा था। किसी के माता-पिता को भी सफेद दाग हो जाता था तो उनके बच्चों की भी शादी नहीं हो पाती थी। उसे कोढ़ बुला जाता था। पर वो कोढ़ नहीं हैं। कई चीजों की डिफेंसी हो जाती है शरीर में। उसके कारण सफेद दाग हो जाते हैं और एक मात्र अच्छी दवा बनाई तो वो पण्डा फार्म में बनी अभी तक एक लाख लोगों ने अभी तक दवा से फायदा लिया है।

<https://www.abplive.com/states/up-uk/uttarakhand-ministry-of-defense-and-drdo-together-prepared-medicine-for-white-spots-abdul-kalam-changed-the-lives-of-millions-ann-2027769>

# COVID 19: DRDO's Contribution



Thu, 30 Dec 2021

## Haryana governor inaugurates oxygen plant at Karnal's KCGMC

*Haryana governor Bandaru Dattatraya on Wednesday said all hospitals in state should make arrangements for online registration of patients in OPDs so that they do not face unnecessary delays and hardship*

Karnal: Haryana governor Bandaru Dattatraya on Wednesday said all hospitals in state should make arrangements for online registration of patients in OPDs so that they do not face unnecessary delays and hardship.

The governor urged people in state to take advantage of the technology by making online registration if the facility is available in their hospital instead of spending hours in queues.

He said it is the first priority of the government to provide best healthcare facilities in state-run hospitals and the government is keen to develop the infrastructure where it is feeling shortage.

The governor also inaugurated a 1,000 LMP PAS oxygen plant at KCGMC in Karnal. As per the district health authorities, the oxygen plant has been built by the Defence Research and Development Organisation (DRDO) under the PM CARES Fund.

The governor said setting up of the oxygen plant is to further improve supply of medical oxygen. Earlier, he had interacted with patients and medical students of the hospital.

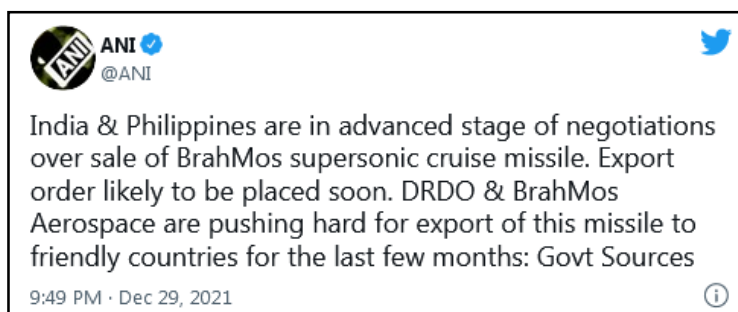
Responding to questions from students, the governor said they are the future of the country and should strive to fulfil the expectations of people. He urged medical students to maintain cleanliness on hospital premises and classrooms.

<https://www.hindustantimes.com/cities/chandigarh-news/haryana-governor-inaugurates-oxygen-plant-at-karnal-s-kcgmc-101640806947115.html>



Haryana governor Bandaru Dattatraya inaugurating a 1,000 LMP PSA oxygen plant at Kalpana Chawla Government Medical College and Hospital in Karnal on Wednesday. (HT Photo)

## DRDO on Twitter







Press Information Bureau

Government of India

Ministry of Defence

Wed, 29 Dec 2021 1:11PM

### **MoD notifies positive indigenisation list of sub-systems/assemblies/ sub-assemblies/components to achieve self-reliance in defence & minimise imports by DPSUs**

A positive indigenisation list of sub-systems/assemblies/sub-assemblies/components has been notified by Department of Defence Production, Ministry of Defence, as part of the efforts to achieve self-reliance in defence manufacturing and minimise imports by Defence Public Sector Undertakings (DPSUs). The list contains 2,500 imported items which have already been indigenised and 351 imported items which will be indigenised in next three years. This Aatmanirbhar initiative will save foreign exchange approximately equivalent to Rs. 3,000 cr every year. Details of these items are available on Srijan portal (<https://srijandefence.gov.in/DPSU%20Indigenization%20List.pdf>). They will only be procured from Indian Industry after the timelines indicated in the list.

Two positive indigenisation lists of weapons/platforms/ systems/ammunitions etc have already been notified by the Department of Military Affairs, in order to provide impetus to self-reliance in defence manufacturing, as part of 'Aatmanirbhar Bharat Abhiyan'.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1786022>



पत्र सूचना कार्यालय

भारत सरकार

रक्षा मंत्रालय

Wed, 29 Dec 2021 1:11PM

### **रक्षा मंत्रालय ने रक्षा क्षेत्र में आत्मनिर्भरता हासिल करने और डीपीएसयू द्वारा आयात में कमी लाने के लिए उप-प्रणालियों/संयोजनों/उप-संयोजनों/घटकों की निर्णायक स्वदेशीकरण सूची अधिसूचित की**

रक्षा निर्माण क्षेत्र में आत्मनिर्भरता हासिल करने तथा रक्षा सार्वजनिक क्षेत्र के उपक्रमों-(डीपीएसयू) द्वारा आयात में कमी लाने के प्रयासों के हिस्से के रूप में रक्षा मंत्रालय के रक्षा उत्पादन विभाग ने उप-प्रणालियों/संयोजनों/उप-संयोजनों/घटकों की निर्णायक स्वदेशीकरण सूची अधिसूचित कर दी है। इस सूची में 2,500 आयातित उपकरण शामिल हैं, जिन्हें पहले ही स्वदेशी बनाया जा चुका है और 351 ऐसी आयातित वस्तुएं हैं, जिन्हें अगले तीन वर्षों में स्वदेशी बनाया जाएगा। इस आत्मनिर्भर पहल से हर साल लगभग

3,000 करोड़ रुपये के बराबर विदेशी मुद्रा की बचत होगी। इन मर्दों का विवरण सृजन पोर्टल (<https://srijandefence.gov.in/DPSU%20Indigenization%20List.pdf>) पर उपलब्ध करा दिया गया है। सूची में दर्शाई गई समय-सीमा के बाद ही इन्हें भारतीय उद्योगों से खरीदा जाएगा।

'आत्मनिर्भर भारत अभियान' के हिस्से के रूप में रक्षा निर्माण में आत्मनिर्भरता को प्रोत्साहन देने के लिए सैन्य मामलों के विभाग द्वारा हथियारों / प्लेटफार्मों / प्रणालियों / गोला-बारूद आदि की दो निर्णायक स्वदेशीकरण सूचियां पहले ही अधिसूचित की जा चुकी हैं।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1786075>



**Press Information Bureau**  
**Government of India**

**Ministry of Defence**

*Wed, 29 Dec 2021 12:18PM*

## **Indian Army Establishes Quantum Laboratory at Mhow (MP)**

The Indian Army is making steady, yet significant strides in the field of emerging technology domains. The Army, with support from the National Security Council Secretariat (NSCS) has recently established the Quantum Lab at Military College of Telecommunication Engineering, Mhow (MP) MCTE to spearhead research and training in this key developing field. Gen MM Naravane, the Chief of Army Staff was briefed on the facility during his recent visit to Mhow.

Indian Army has also established an Artificial Intelligence (AI) Centre at the same institution with over 140 deployments in forward areas and active support of industry and academia. Training on cyber warfare is being imparted through a state of art cyber range, and cyber security labs. Ideation for Army's involvement in Electromagnetic Spectrum Operations was done in a seminar on Electromagnetic Spectrum and National Security organised in October last year. Since then, an impetus has been given to Indian Army's Technology Institutions for investing in AI, Quantum and Cyber.

Research undertaken by Indian Army in the field of Quantum Technology will help leapfrog into next generation communication and transform the current system of cryptography in the Indian Armed Forces to Post Quantum Cryptography (PQC). Key thrust areas are Quantum Key Distribution, Quantum Communication, Quantum Computing and Post Quantum Cryptography

By undertaking a multi-stakeholder approach incorporating Academia (such as IITs), DRDO organisations, Research Institutes, Corporate firms, Startups and Industry players, this initiative is an apt example of Civil Military fusion with Atmanirbhar Bharat a key driving factor. Requisite timelines based objectives with adequate funding have been worked out for projects and progressive fielding of solutions in Indian Army is expected on a fast track basis.



<https://pib.gov.in/PressReleasePage.aspx?PRID=1786012>



## पत्र सूचना कार्यालय भारत सरकार

### रक्षा मंत्रालय

Wed, 29 Dec 2021 12:18PM

## भारतीय सेना ने महू (मध्य प्रदेश) में क्वांटम प्रयोगशाला की स्थापना की

भारतीय सेना उभरते हुए प्रौद्योगिकी डोमेन के क्षेत्र में स्थिर और महत्वपूर्ण प्रगति कर रही है। राष्ट्रीय सुरक्षा परिषद सचिवालय (एनएससीएस) के सहयोग से सेना ने हाल ही में प्रौद्योगिकी के प्रमुख विकासशील क्षेत्र में अनुसंधान एवं प्रशिक्षण के लिए महू (मध्य प्रदेश) के मिलिट्री कॉलेज ऑफ टेलीकम्युनिकेशन इंजीनियरिंग- एमसीटीई में क्वांटम प्रयोगशाला की स्थापना की है। थल सेनाध्यक्ष जनरल एम एम नरवणे को उनकी हाल की महू यात्रा के दौरान इसके बारे में सूचना दी गई थी।

भारतीय सेना ने इसी संस्थान में एक आर्टिफिशियल इंटेलिजेंस (एआई) केंद्र भी स्थापित किया है, जिससे प्रमुख क्षेत्रों में 140 से अधिक नियुक्तियों की गई हैं और इसे उद्योग एवं शिक्षाविदों का सक्रिय सहयोग प्राप्त है। यहां पर अत्याधुनिक साइबर रेंज तथा साइबर सुरक्षा प्रयोगशालाओं के माध्यम से साइबर संघर्ष पर प्रशिक्षण दिया जा रहा है। पिछले वर्ष अक्टूबर में विद्युत चुंबकीय स्पेक्ट्रम एवं राष्ट्रीय सुरक्षा पर आयोजित एक संगोष्ठी में विद्युत चुंबकीय स्पेक्ट्रम संचालन में सेना की भागीदारी के लिए विचार किया गया था। तब से ही भारतीय सेना के प्रौद्योगिकी संस्थानों को एआई, क्वांटम और साइबर में निवेश करने के लिए प्रोत्साहन दिया जा रहा है।

क्वांटम प्रौद्योगिकी के क्षेत्र में भारतीय सेना द्वारा किए गए शोध अगली पीढ़ी की संचार व्यवस्था तक तेजी से पहुंचने में मदद करेंगे और भारतीय सशस्त्र बलों में क्रिप्टोग्राफी की वर्तमान प्रणाली को पोस्ट क्वांटम क्रिप्टोग्राफी (पीक्यूसी) में परिवर्तित कर देंगे। क्वांटम की डिस्ट्रिब्यूशन, क्वांटम संचार, क्वांटम कंप्यूटिंग और पोस्ट क्वांटम क्रिप्टोग्राफी भविष्य के प्रमुख क्षेत्र हैं।

अकादमिक संस्थानों (जैसे आईआईटी), डीआरडीओ संगठनों, अनुसंधान संस्थानों, कॉरपोरेट फर्मों, स्टार्टअप्स और उद्योग के प्रमुख व्यक्तियों को शामिल करते हुए एक बहु-हितधारक दृष्टिकोण अपनाकर, यह पहल आत्मनिर्भर भारत के अतिरिक्त एक प्रमुख संचालन कारक के साथ नागरिक सैन्य संलयन का उपयुक्त उदाहरण है। परियोजनाओं के लिए पर्याप्त धन के साथ-साथ आवश्यक समयसीमा आधारित उद्देश्यों पर कार्य किया गया है और भारतीय सेना में समाधान के प्रगतिशील क्षेत्ररक्षण के तेजी से आधार पर अपेक्षित है।



<https://pib.gov.in/PressReleasePage.aspx?PRID=1786039>

## Russia offers India its cutting-edge T-14 Armata tank technology | What we know

*The negotiations to create exclusive equipment based on the Indian military's specifications took place during the meeting of the Inter-Governmental Commission on Military and Military-Technical Cooperation held in New Delhi on December 6.*

### Highlights

- *Negotiations took place on December 6 when Russian President Putin was in New Delhi*
- *Defence Minister Rajnath Singh, Russian counterpart Sergey Shoygu co-chaired discussions*
- *Armata uses unprecedented design solutions, in particular, the T-14 tower is uninhabited*

New Delhi: Taking the Military-Technical Cooperation (MTC) between the two countries to a new high, Russia has offered India "new areas of work", including developing together new armoured vehicles based on the T-14 Armata tank platform.

The negotiations to create exclusive equipment based on the Indian military's specifications took place during the meeting of the Inter-Governmental Commission on Military and Military-Technical Cooperation held in New Delhi on December 6.

Defence Minister Rajnath Singh and his Russian counterpart Sergey Shoygu had co-chaired the discussions which were held just a few hours before the 21st India-Russia Annual Summit between Prime Minister Narendra Modi and Russian President Vladimir Putin.



"The Indian partners were offered new areas of work, including the creation of armoured vehicles based on the customer's specifications on the Armata platform, especially given that the Indian military is planning to expand work on the creation of a new main battle tank," Valeria Reshetnikova, the Press Secretary of Russia's Military-Technical Cooperation (FSMTC), told Russian state-owned domestic news agency RIA Novosti in an interview on Tuesday.

Reshetnikova said that the Russian weapons, including new models, are of great interest among buyers of military products which is confirmed by the volume of contracts being concluded with several partner countries, amounting to billions of US dollars.

Russia's newest and state-of-the-art T-14 Armata battle tank has been showcased at various international military and technical forums since its first public viewing at the Victory Day parade in Moscow on May 9, 2015.

The Armata uses unprecedented design solutions, in particular, the T-14 tower is uninhabited. The crew is placed in an armoured capsule, separated from the ammunition. The original silhouette, combined with the use of a special coating, significantly reduces the visibility of the vehicle in the thermal and radar spectra of observation.

It is capable of withstanding any existing anti-tank weapon hit. The tank is equipped with active and dynamic protection, equipped with a remotely controlled combat module with a powerful cannon and an automatic reloading system. Optical-electronic devices for observation, aiming and threat detection are installed along the perimeter of the tower and the hull.

The Russian Defence Ministry says that the main combat characteristics of the Armata T-14 tank are a high degree of passive and active armour protection, which is superior to any other types of armoured vehicles; as well as high cross-country mobility and great firepower.

It is armed with a 125-mm new generation tank gun with a prospective ammunition load and a digital fire control system.

Also, the T-14 is equipped with the most modern on-board complexes. The crew members' workplaces are equipped with video devices with touch-sensitive controls.

As the full cycle of tests of the T-14 Armata tank neared completion, Russia had planned to supply about 20 of them to its troops by the end of this month.

In a briefing for the military attaches of foreign states earlier this month, Russian military chief General Valery Gerasimov said that new samples of armoured vehicles on the Armata, Kurganets and Boomerang platforms would increase the strike capabilities of the Russian ground forces, especially taking into account the new areas of instability around the country's borders.

As reported by IndiaNarrative.com, India, along with China, Algeria, Egypt, Vietnam and Myanmar, remained amongst Russia's main partners in the field of military-technical cooperation during 2021 - a year which has been labeled as "extraordinary" for the country's defence capability by Putin.

As both countries signed an agreement on a programme of military-technical cooperation until 2030 on December 6, both PM Modi and Putin had expressed satisfaction at the "sustained progress" in the Special and Privileged Strategic Partnership despite the challenges posed by the Covid pandemic.

Just before the Summit, the government had informed Parliament that delivery of the S-400 missile system from Russia, which will significantly enhance the air defence capability of the nation, remains as per the contractual timelines.

"Government is aware of all developments that may impact procurement of defence equipment. Government takes sovereign decisions based on threat perception, operational and technological aspects to keep the Armed Forces in a state of readiness to meet the entire spectrum of security challenges," Minister of State for Defence Ajay Bhatt had said in a written reply in Lok Sabha on December 3.

A contract for procurement of 6,01,427 AK-203 assault rifles was also signed on December 6 between both the countries, the production for which will be done in Uttar Pradesh's Korwa.

New Delhi and Moscow are also working on having joint manufacturing of military equipment in Central Asia.

"The unprecedented level of trust between our countries is evidenced by the intensity and depth of military-technical cooperation, which is reaching a new qualitative level every year," Russian Defence Minister Sergei Shoigu had said in Delhi, a few weeks ago.

<https://www.indiatvnews.com/news/india/russia-offers-india-t14-armata-tank-technology-pm-modi-putin-talks-751797>

**TIMESNOWNEWS.COM**

*Thu, 30 Dec 2021*

## **Exclusive: Pakistan Navy buys Chinese air-launched anti-ship missiles**

*CM-501GA anti-ship missiles are manufactured by the China Aerospace Science and Industry Corporation have a range of about 40 km.*

*By Srinjoy Chowdhury*

New Delhi: The warship-- a 054 A/P frigate-- is Chinese-made. So is the Z-9 helicopter on the frigate and now, Pakistan is buying Chinese CM-501GA anti-ship missiles to fire from the choppers. The target, of course, are Indian warships.

The CM-501GA is a lighter version of the original missile, which is land attack and also, anti-ship. These missiles, manufactured by the China Aerospace Science and Industry Corporation have a range of about 40 km. Being a lighter version, it can be launched from the Harbin Z-9 helicopters that the Pakistan Navy has. And these choppers are also from China.

The choppers are to be on the 054 A/P frigates that China is giving Pakistan. One, the PNS Tughril, was delivered last month. Three more are due soon

The missiles, sources said, are to target Indian warships like the Kolkata and Vizag class destroyers and the stealth frigates.

Besides, Pakistan is negotiating with China for the LY-70 air-defence missile system for its warships. It has already asked ALIT, the manufacturer, for a technical and budget proposal. The Pakistan Navy had purchased the earlier version, the LY-60N two decades ago for its Tariq-class frigates.

<https://www.timesnownews.com/international/article/exclusive-pakistan-navy-buys-chinese-air-launched-anti-ship-missiles/844689>

# The Washington Times

Thu, 30 Dec 2021

## Chinese ‘brain control’ warfare work revealed

By Bill Gertz

### News and analysis:

The Commerce Department imposed sanctions on Chinese technology companies and announced last week revealed that China’s military is engaged in dangerous work related to “brain control” warfare research.

The announcement of the sanctions provided limited specific details of the work by China’s Academy of Military Medical Sciences and 11 related Chinese research institutes. Commerce’s Bureau of Industry and Security said only that the academy and its affiliates are using “biotechnology processes to support Chinese military end-uses and end-users, to include purported brain-control weaponry.”

However, three reports by the People’s Liberation Army obtained by Inside the Ring shed light on the depths of China’s brain warfare research and show that it has been underway for several years.

The translated 2019 reports discuss developing brain control weaponry as part of what Chinese officials call the “intelligentization” of warfare.

According to one of the reports, advances in science and technology are leading to upgrades in methods and the ability to subdue enemies. “War has started to shift from the pursuit of destroying bodies to paralyzing and controlling the opponent,” said the report headlined, “The Future of the Concept of Military Supremacy.”

“The focus is to attack the enemy’s will to resist, not physical destruction,” it stated.

Brain science is being used to extend warfare in the sphere of human consciousness “causing the brain to become the main target of offense and defense of new concept weapons,” the report added.

“To win without fighting is no longer far-fetched,” it stated, quoting ancient strategist Sun Tzu’s maxim.

The report, which was published in the official military newspaper PLA Daily, also asserted that China is merging four major technology fields for military purposes: nano, bio, information and cognition.



Photo by: Mark Schiefelbein, Spectators wave Chinese flags as military vehicles carrying DF-41 ballistic missiles roll during a parade to commemorate the 70th anniversary of the founding of Communist China in Beijing, Oct. 1, 2019. China’s military buildup has triggered unease across Asia and was the driving factor behind the recent formation of a three-way U.S., Britain and Australia security pact focused on the region, according to President Biden’s top national security adviser for the Indo-Pacific. (AP Photo/Mark Schiefelbein) \*\* FILE \*\*

The intended result will be enhanced individual capabilities. “Future human-machine merging will revolve around the contest for the brain,” the report said. “The two combatant sides will use various kinds of brain control technologies and effective designs to focus on taking over the enemy’s way of thinking and his awareness, and even directly intervene in the thinking of the enemy leaders and staff, and with that produce war to control awareness and thinking,” the report said.

A second Chinese report, also from 2019, disclosed that brain-machine interface is part of Beijing’s plan for the development of intelligentized warfare. The second report said “interactive intelligentization” will involve “direct control of machines using thoughts through mature brain-machine interface.”

Fused intelligentization is also being studied and involves integrating humans and machines toward the goal of creating enhanced human physiological and cognitive capacities.

A third report published by the PLA revealed that the China Electronic Technology Group is working on “brain confrontation” technology for warfare.

Among its various research focuses are “brain control technologies, such as measuring neuronal activity in the brain and translating neuro-signals into computer signals, establishing uni-directional or bi-directional signal transmission between the brain and external equipment,” the third report said.

Research also is being conducted on “neuro-defense” technology such as “leveraging electromagnetic, biophysical, and material technologies to enhance human brain’s defense towards brain-control attacks,” it said.

One brain enhancement technology involves wearable equipment that stimulates or manipulates brain electrical activities. Another is the use of brain-implanted microchips or other computer interfaces that enhance brain functions.

In sanctioning the Chinese institutes, the Commerce Department said the research activities are “contrary to U.S. national security and foreign policy.”

The other institutes hit with sanctions include China’s Institute of Health Service and Medical Information; the Institute of Radiation and Radiation Medicine; the Institute of Basic Medicine; the Institute of Hygiene and Environmental Medicine; the Institute of Microbiology and Epidemiology; the Institute of Toxicology and Pharmacology; the Institute of Medical Equipment; the Institute of Bioengineering; the Field Blood Transfusion Institute; the Institute of Disease Control and Prevention; and the Military Veterinary Research Institute.

The 11 institutes have been added to the Commerce blacklist called the Entity List.

Japanese and U.S. military officials have drawn up plans for a joint defense of Taiwan in the event of an attack by China, Japan’s Kyodo news agency reported last week.

Japanese government officials told the Chinese-language edition of Kyodo on Dec. 23 that the Japan Self-Defense Forces and the Pentagon developed a new draft of a joint operations plan for “emergencies” in Taiwan.

The plan calls for U.S. Marines to set up temporary bases for offensive operations on the islands near Okinawa.

The Japan-U.S. Security Consultative Committee, known as the 2 plus 2 forum of foreign and defense ministers is expected to hammer out the military contingency plan early next year.

Initial operations will involve joint deployment of U.S. and Japanese troops to existing bases, according to the Kyodo report, which noted that it is unlikely new bases will be set up.

After holding a summit meeting together in April, President Biden and Japanese then-Prime Minister Yoshihide Suga issued a joint statement that referred for the first time to the “importance of peace and stability in the Taiwan Strait.”

Beijing has been putting increased military pressure on the Chinese-claimed, self-ruled island.

Last summer, Japanese officials let it be known through the press that a Chinese attack on Taiwan poses a threat to Japan and that Japan’s military would join a U.S. defense of the island.

Then in November, Australia's Defense Minister Peter Dutton joined in, telling a news outlet that it would be "inconceivable that we wouldn't support the U.S. in an action [in support of Taiwan] if the U.S. chose to take that action."

Both nations' position put the U.S. government on the spot as the Pentagon and State Department for decades have avoided directly stating the U.S. military would intervene militarily to defend Taiwan from a mainland attack.

U.S. policy toward the defense of Taiwan has remained unclear over concerns about upsetting U.S.-China relations.

China has been increasing military pressure against the island state that broke from the mainland in the 1940s during a civil war that saw Nationalist Chinese forces flee to the island.

Since then, Taiwan has evolved into a vibrant democracy that Beijing regards as a threat to its authoritarian communist system.

Chinese warplanes regularly intrude into Taiwan's air defense zone around the island and Chinese warships conducted frequent war games that state media has described as preparation for attacks.

### **Defense law hits contractors on China**

The fiscal 2022 National Defense Authorization Act signed into law by President Biden requires greater transparency for defense contractors and other companies doing business with the Pentagon in revealing work conducted in and for China.

The measure is aimed at preventing China from obtaining the fruits of Pentagon contracts through espionage or trade secrets theft.

Section 855 of the new law says Defense Secretary Lloyd Austin has until July to report to Congress on contractors that employ people who work for the Chinese government. The reporting must include numbers and locations of the world.

The disclosures are now required from all companies that submit bids or proposals for defense contracts.

The requirement will be in force through the end of 2024 and covers all contracts worth \$5 million or more for commercial products and services. Those covered by the law include corporations or companies that conduct work on contracts in China.

<https://www.washingtontimes.com/news/2021/dec/29/pla-brain-control-warfare-work-revealed/>

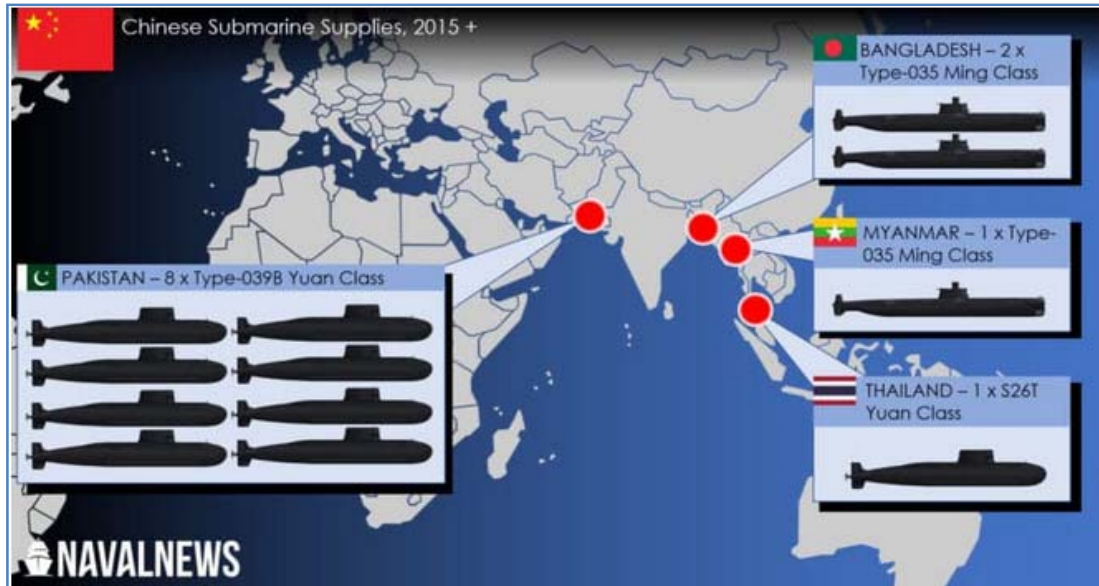


## China's surprise submarine move shows its growing power

*Submarine sales are a powerful weapon in the game of international power and influence. China is increasingly combining it with the Belt and Road Initiative in ways which shape the geopolitical landscape. The latest surprise submarine supply illustrates this.*

*By H I Sutton*

When a Chinese submarine entered the Malacca Strait on December 20, heading towards the Indian Ocean, there was speculation about where it was going. This was answered when it pulled into the Yangon River, Myanmar, on December 23. Literally the next day it was commissioned into the Myanmar Navy as UMS Minye Kyaw Htin.



Myanmar is the latest country to acquire a submarine capability from China.

The sale, or transfer, had not been announced in advance. It highlights the growing influence of China in the region and the role submarine sales play in the geopolitical arena.

And China's impact on the world submarine market. China is now supplying 4 countries with submarines. More may follow.

### Submarine Diplomacy

Buying submarines is not like cars, where you select a model, and pick from a catalogue of features. They are not bought off the shelf, instead each aspect has to be defined. The location where they are to be built, the degree of customization, crew training, and ongoing maintenance are all part of a typical deal. And there is always a geopolitical aspect, and often government-to-government negotiations.



And it is not simply commercial. Governments can supply submarines to help create, or reinforce, alliances. Or at least expect favorable future relations going forward. This is especially true if the submarines are provided free, or at a major discount. One way to do this is by supplying older submarines from their own inventory. It can be a win-win and limits the risk if politics change in the future.

The Chinese submarine for Myanmar is more complex than most in a few ways. Although China has been Myanmar's main defense supplier for many years, it had not been in the frame for submarines. Instead, India and Russia had. Externally, it might be seen as a stab in the back to Indian efforts.

Myanmar has been trying to establish a submarine capability for about two decades. Exactly a year earlier on December 24 2020 the Myanmar Navy commissioned its first submarine, the UMS Min Ye Theinkhathu. Significantly, that submarine had been transferred by India, China's immediate rival in the Indian Ocean region.

Both submarines are relatively old types, and both are second-hand. The Chinese one is a Type-035 Ming Class, and the Indian one is a Russian-built KILO class boat. Despite arriving second, the Chinese boat is hardly an upgrade over the Indian supplied one. In fact, the KILO is generally considered the more capable platform, although the exact details of their equipment fit are naturally harder to pin down.

So the sudden acquisition of an older Chinese boat is not about modernizing Myanmar's capabilities. It is instead part of a bigger picture. China is presumably expecting to bag the follow-on order or more modern boats. And solidify its geopolitical position in the Bay of Bengal in the process.

China has done something very similar in the past. In 2017 it supplied two ex-PLAN (Chinese Navy) Type-035 Ming Class submarines to Bangladesh.

### **Market Warfare**

For the past few decades, the submarine export market has been dominated by France and Germany. These big players are already being challenged. These include new entrants South Korea, Spain and Japan, and reemerging established players like Sweden. And of course Russia has a stake in submarine exports. Now China is joining the club and rapidly rising towards the top.

China is already supplying four nations with a total of 12 submarines. The largest, and likely most sophisticated, deal is for Pakistan. The Pakistan Navy is getting eight Type-039B Yuan Class submarines, with four being built locally. These missile-capable submarines come with AIP (Air Independent Power).

Thailand is getting another Yuan, designated S26T. Meanwhile ex-PLAN Type-035 Min Class boats, which are less capable than the Yuans, have been supplied to Bangladesh (2) and now Myanmar (1). China is known to be courting other countries with submarines, notably Nigeria.

Like Russia, China is willing to supply submarines to countries which western governments may not. But unlike Russia its new-build submarines come with AIP. Thrown together with the classic Belt-and-Road incentives this may make them particularly appealing to internationally isolated governments.

Western leaning submarine builders will also be watching Chinese developments. On the one hand, there are many prospective customers who would not consider Chinese submarines. But equally, the markets undoubtedly overlap with many countries being open to both China and the West. Chinese submarine designs will increasingly be competing directly against Western types.

### **Belt and Submarine**

The game will not only be about money, but strategic influence and position. For China there is the added dimension of the Belt and Road Initiative. This is a Chinese government strategy to invest in key infrastructure developments around the world. Countries brought into this in a big way include Myanmar.

While the Belt and Road projects are infrastructure, many will see a very blurred line between them and the submarine sales. Said another way, the submarines are part of an influence game and strategic positioning. They can be leveraged in a similar way to port or shipyard projects.

In the case of Myanmar, it will be interesting to see the sales conditions. Not just the price, which is surely cheap or free, but the future restrictions it places on Myanmar.

<https://www.navalnews.com/naval-news/2021/12/chinas-surprise-submarine-move-shows-its-growing-power/>



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## Chandrayaan-3, Gaganyaan-1 and more—here's what ISRO has on the launchpad for 2022

*India's space agency has around 11 launches planned during the year but the most-watched would be its preparations for the country's maiden human space mission Gaganyaan now scheduled for 2023*

The year 2022 will be a busy one for the Indian Space Research Organisation (Isro), as it gears up for new missions and also clear the backlog forced by the coronavirus pandemic.

At the beginning of 2021, Chairman K Sivan said Isro would launch 14 missions during the year, including the space agency's first unmanned mission. However, only two launches —PSLV-DL in February and EOS 03 satellite in August, which was unsuccessful—materialised.

During the recent winter session of Parliament, Minister of State for Atomic Energy and Space Jitendra Singh said that India's maiden human space mission Gaganyaan will now be launched in 2023. The earlier plan was for 2022.

Singh said COVID restrictions delayed the plan but preparations were on to achieve the target by 2023.

The minister later said the test vehicle flight for the validation of crew escape system performance and the first uncrewed mission of Gaganyaan (G1) was scheduled for 2022, which would be followed by a second uncrewed flight at the end of the year.

Indian Defence News report, citing ISRO sources, said 11 launch windows have been booked but more were possible during the year.

### **Here are some of the missions planned by Isro in 2022:**

**1 Small Satellite Launch Vehicle (SSLV):** On December 16, Jitendra Singh told the Rajya Sabha that the development of SSLV was in the final stages. Its first developmental flight was being planned for the first quarter of 2022.

SSLV will provide a payload capability of 500 kg to a 500 km planar orbit. SSLV was being primarily developed to realise a cost-effective launch vehicle with a high launch frequency and quick turnaround capability to cater to a growing global market.

**2 RISAT-1A:** Radar Imaging Satellite-1A, or RISAT-1A, is a remote sensing satellite. Developed by Isro, it will be sixth in the series of RISAT satellites, with a configuration similar to that of RISAT-1. It will be a land-based mission with primary application in terrain mapping and analysis of land, ocean and water surface for soil moisture.

**3 Aditya L1:** The year 2022 will also see some progress in the Aditya-L1 mission to study the sun. The launch is expected by the middle of 2022. It is India's first observatory class mission to study the solar corona using a solar coronagraph and also chromosphere using near UV instrument. X-ray spectroscopic instrument will provide flare spectra while in-situ payload observe the solar events during their passage from the sun to Earth.

**4 Chandrayaan-3:** Chandrayaan-3 will be India's third mission to Moon. The earlier mission Chandrayaan-2 failed following a last-minute glitch in the soft landing guidance software.

It has the same configuration as its predecessor but it will not have an orbiter and only include a lander and rover. The orbiter launched during Chandrayaan-2 will be used for Chandrayaan-3. The spacecraft is planned to be launched in the third quarter of 2022.

**5 Gaganyaan 1:** The test vehicle flight for the validation of crew escape system performance and the first uncrewed mission of Gaganyaan (G1) are scheduled at the beginning of the second half of 2022.

**6 Gaganyaan 2:** After Gaganyaan 1, the second uncrewed mission is expected to be launched at the end of 2022 carrying Vyommitra, a spacefaring human-robot developed by Isro. After that, the first crewed Gaganyaan mission is expected to be launched in 2023, which will make India the fourth nation in the world to launch a human spaceflight mission after the US, Russia and China.

The Gaganyaan programme will be different from other human missions as it will be more cost-effective and inclusive, Singh had told the Rajya Sabha.

Several research modules will accompany the Gaganyaan and it will involve start-ups and more than 500 industries. For the first time since the country's Independence, private industry will be involved in space technology. The objective of the Gaganyaan programme is to demonstrate the capability to send humans to low earth orbit (LEO) onboard on Indian Launch Vehicle and bring them back to Earth safely.

Isro is also expected to launch other satellites in 2022.

Public sector NewSpace India Ltd (NSIL) has decided to launch the communication satellite GSAT-24 through the Ariane-5 rocket belonging to Arianespace.

NSIL, incorporated in March 2019, is a Central Public Sector Enterprise (CPSE) under the Department of Space and is the commercial arm of Isro. The entire satellite capacity on-board GSAT-24 will be leased to its committed customer Tata Sky for meeting its DTH application needs. The launch is expected in the first quarter of 2022.

#### **Sharing the space with private players**

Small rocket makers Skyroot Aerospace Private Ltd and Agnikul Cosmos are expected to fly their vehicles by the end of 2022. Satellite-maker Syzygy Space Technologies Pvt Ltd, commonly known as Pixxel, is also expected to fly its satellite sometime next year.

"The year 2022 is an important year as we bring everything together for a launch of Vikram-1 rocket and join the elite of the world in providing launch solutions," Pawan Kumar Chandana, CEO and Chief Technology Officer, Skyroot Aerospace, told IANS news agency.

As a part of opening up the space sector, the Indian government constituted the Indian National Space Promotion and Authorization Centre (IN-SPACe) as the sectoral regulator for the private players.

Chandana said 2021 was a time when startups proved their capability with successful technology demonstrations and forward-looking policies drafted by the Department of Space.

"2021 is the year where a framework has been established for sharing the facilities and expertise of Isro with startups. This started with the landmark MoU signed between Isro and Skyroot Aerospace in September. This framework is going to benefit several startups to gain competitive advantage in the commercial space world," Chandana said.

With Omicron strain pushing up Covid cases again, delays can't be ruled out in 2022 as well but the new year is a time for new beginnings, new hope, and possibly new launches—plenty of them.

<https://www.moneycontrol.com/news/science/chandrayaan-3-gaganyaan-1-and-more-heres-what-isro-has-on-the-launchpad-for-2022-7864651.html>

