



# CONTENTS

S. No.	TITLE	Page No.
	<b>DRDO News</b>	<b>1-2</b>
	<b>DRDO Technology News</b>	<b>1-2</b>
1.	DRDO to Test Niche Tech for Submarines Next Year <i>The New Indian Express</i>	1
	<b>Defence News</b>	<b>2-10</b>
	<b>Defence Strategic: National/International</b>	<b>2-10</b>
2.	Army Issues Tender to Lease 20 Light Helicopters <i>The Hindu</i>	2
3.	Indian Army Adds New Toyota Hilux, Mahindra Scorpio Classic to its Fleet: Details <i>Financial Express</i>	3
4.	HAL and Argentina Defence Ministry Sign LoI for Light and Medium Utility Helicopters <i>The Hindu</i>	4
5.	US Working with India on Co-producing Extended-Range Artillery & Infantry Vehicles to Address Threats Posed by China: Senior Pentagon Official <i>Financial Express</i>	4
6.	Indian, Indonesian Naval Ships to Conduct Maritime Partnership Exercise in Jakarta: Know all about the Defence Exercise <i>News Nine</i>	5
7.	India-Philippines to Strengthen Defence Cooperation; to Sign Enhanced Maritime Cooperation Pact <i>Financial Express</i>	6
8.	India's Desperate Struggle to get into a First-World Exporter Club <i>The Economic Times</i>	7
9.	UK Steps up Efforts to Deliver Integrated Air and Missile Defence Approach <i>Janes</i>	9
	<b>Science &amp; Technology News</b>	<b>10-11</b>
10.	ISRO Successfully Tests Gaganyaan Service Module Propulsion System <i>The Hindu</i>	10
11.	Chandrayaan-3 Finishes Fourth Orbit-Raising Manoeuvre <i>The Hindu</i>	11



*Fri, 21 Jul 2023*

## **DRDO to Test Niche Tech for Submarines Next Year**

The Defence Research and Development Organisation is working to conduct the first underwater trial of its fuel cell-based Air Independent Propulsion (AIP) system in Mumbai. The niche technology is being developed that will enhance the submerged endurance of the submarine severalfold.

An AIP system gives a submarine the ability to remain submerged underwater, away from enemy sensors, for a long time without surfacing. As per DRDO, the AIP has a “force multiplier effect on lethality of a diesel-electric submarine.”

Sources in the defence and security establishment said the underwater testing of AIP will be conducted next year. The shore-based prototype testing was done in 2021. Once developed, the home-grown AIP system will be fitted into three Scorpene submarines that India is in the process to purchase from France.

The plan, sources said, is to equip all new submarines with the indigenous AIP system.

The fuel cell-based AIP has merits in performance compared to other technologies. The DRDO may get ample time to take the project to its maturity, said the sources, if the contract to purchase the additional three submarines is signed at the end of this year. It will take 6-7 years to be commissioned in the Indian Navy. A source cautioned, “The project is taking time. By the time it is ready to be integrated with the three additional Scorpene submarines to be manufactured in India, better technologies might come in vogue.”

The Defence Acquisition Council recently approved the construction of additional submarines. In the process to take the project forward, DRDO’s Naval Materials Research Laboratory (NMRL) and Naval Group France had in January this year signed an agreement wherein the French major will help in the detailed design phase for integration of indigenous AIP in the Kalvari class submarines. As part of the agreement, Naval Group France will certify the AIP design for integration in the submarines.

Internationally, there are different types of AIP systems, but the fuel cell-based AIP is considered unique as hydrogen is generated onboard. It will obviate the need for carrying hydrogen onboard which is a major safety concern for a submarine. With its integration into the submarines, India will join an elite club of nations who have indigenously developed fuel cell-based submarine AIP technology. This technology is a green one since the by-product of the reaction is non-polluted water that can be released into the oceans.

**In the elite club**

With its integration into the submarines, India will join an elite club of nations that have indigenously developed fuel cell-based submarine Air Independent Propulsion technology. This technology is a green one since the by-product of the reaction is non-polluted water which can be released into the oceans.

<https://www.newindianexpress.com/nation/2023/jul/21/drdo-to-test-niche-tech-for-submarines-next-year-2597008.html>

## Defence News

### Defence Strategic: National/International

THE  HINDU

*Fri, 21 Jul 2023*

## Army Issues Tender to Lease 20 Light Helicopters

In the latest effort to procure utility helicopters amid huge increase in operational commitments on the northern borders and delays in various procurement programmes, Indian Army has floated a tender for leasing 20 Light Helicopters, for reconnaissance and surveillance, for a period of five years. These are in the category of the ageing Cheetah and Chetaks, the replacement of which has been repeatedly delayed.

“The Ministry of Defence (MoD), Government of India (Lessee), intends to lease 20 Helicopters (Reconnaissance & Surveillance Helicopters) with ground support equipment for five years. This lease will also include all maintenance support including Performance Based Logistics (PBL) and training of aircrew and maintenance crew during the term of the lease,” the Request For Information (RFI) issued on Wednesday said. The MoD seeks information from helicopter Original Equipment Manufacturers (OEMs) or authorised Indian Leasing Firms for participation in the lease project in accordance with Chapter IX of Defence Acquisition Procedure (DAP) 2020, it stated.

The Acceptance of Necessity (AoN) for the leasing contract will be processed within six months after the RFI is issued and contract conclusion in accordance with the timelines mentioned in DAP 2020, the RFI stated. The Request For Proposal is expected by mid-October, a defence source said adding they are also trying to speed up the delivery timeline sooner than the two years mentioned in the RFI. While the lease period stated is five years, it is likely to go up to 10 years, officials said.

While the Army Aviation Corps is in the process of a major augmentation of its firepower with the induction of the indigenous Light Combat Helicopter (LCH) underway and Apache attack helicopters from 2024 onwards, its light helicopter fleet has been in dire need of replacement. The Army Aviation currently operates around 190 Cheetah, Chetak and Cheetal helicopters, with five of them, the oldest, being over 50 years old. Of the 190 Cheetahs and Chetaks in service, around 134 helicopters or over 70% of them are over 30 years old, as reported by The Hindu earlier. Of the 246 Cheetahs we now have 190 flying and at any time around 25 of them are at Hindustan Aeronautics Limited (HAL) for maintenance, one official said. “So there is a deficiency of 37% in this segment.” The proposed Ka-226T procurement from Russia has been stuck for several years now and is unlikely to materialise. “The indigenous Light Utility Helicopter (LUH) developed by HAL

and cleared for induction is yet to qualify the auto-pilot without which it cannot be inducted”, the source cited above said adding it will also take time for sufficient numbers to come in.

There is a requirement of leasing 20 helicopters including ground-support equipment to operate from two bases, the RFI said. “Lessor shall also indicate the possibility of delivering all 20 helicopters within two years from the contract signing date.”

The Army also operates around 145 indigenous Advanced Light Helicopters (ALH), 75 of which are the Rudra weaponised variants and another 25 ALH Mk-III are on order. The light helicopter fleet is the lifeline in transporting supplies and for evacuations in the high-altitude areas including the Siachen glacier and the commitments on the Northern borders have significantly gone up since the 2020 stand-off. In addition to the Army, the Navy and IAF too operate these helicopters. For instance, the IAF has around 120 Cheetah and Chetak and around 18 of the more recent Cheetals.

<https://www.thehindu.com/news/national/army-issues-to-lease-20-light-helicopters/article67102836.ece>



*Thu, 20 Jul 2023*

## **Indian Army Adds New Toyota Hilux, Mahindra Scorpio Classic to its Fleet: Details**

The Indian Army is updating its fleet with the induction of modern utility vehicles such as the Toyota Hilux and the Mahindra Scorpio Classic. Toyota Kirloskar Motor has delivered the first batch of the Hilux to the Northern Command of the Indian Army. Recently, Mahindra & Mahindra also bagged an order of 1,850 units of the Scorpio Classic from the armed forces.

### **Toyota Hilux, Mahindra Scorpio Classic in Army’s fleet:**

The latest addition to the Indian Army’s fleet is the Toyota Hilux Mountain Off-Road Vehicles (MRVs). The Hilux has been selected post a rigorous two-month-long selection process amongst other potential vehicles by the Army’s Technical Evaluation Committee. It was put through tests in rough terrain and extreme weather – ranging from an altitude of 13,000ft to sub-zero temperatures.

Talking about the Mahindra Scorpio, the Indian Army has placed an order for 3,320 units of this SUV in 2023 so far. This includes 1,470 units of the old Scorpio 4WD in January this year and 1,850 units of the Scorpio Classic in July 2023. The new Mahindra Scorpio will replace the old Maruti Gypsy of the Indian Army and even the Classic model will be available with 4WD for the armed forces.

### **Indian Army’s Vehicle Fleet:**

The Indian Army has multiple utility vehicles in its fleet but its all-time favourite SUV remains the Maruti Suzuki Gypsy which has served the armed forces for almost two decades. Some other UVs in the Army’s portfolio include the Tata Xenon pick-ups, Mahindra Scorpio, Toyota Hilux and the mighty Tata Safari Storme (GS800) which was specially curated for the military.

Stay tuned with Express Drives for more updates and also, do subscribe to our YouTube channel for the latest auto news and reviews.

<https://www.financialexpress.com/auto/car-news/indian-army-adds-new-toyota-hilux-mahindra-scorpio-classic-to-its-fleet-details/3179082/>

## **HAL and Argentina Defence Ministry Sign LoI for Light and Medium Utility Helicopters**

Hindustan Aeronautics Ltd. (HAL) and the Ministry of Defence of Argentina on Thursday signed a letter of intent (LoI) on productive cooperation and acquisition of light and medium utility helicopters for the armed forces of the Argentine Republic.

The LoI was signed by Argentinian Defence Minister Jorge Taiana and C.B. Ananthkrishnan, CMD, HAL, in the presence of Francisco Cafiero, secretary of International Affairs, ambassador Hugo Javier Gobbi, and ambassador Dinesh Bhatia.

Mr. Taiana said the day was interesting and a step on the road to an evergrowing and strong collaboration with HAL.

### **Second South American country**

This is the second time a South American country has expressed interest in HAL-manufactured helicopters. It can be recalled that Ecuador had procured seven advanced light helicopters (ALH) Dhruv in two batches — five in 2009 and two in 2011 — in a deal worth \$45.2 million. However, following four crashes, Ecuador terminated the contract with HAL in October 2015. Apart from Ecuador, HAL has also exported ALH Dhruv to Mauritius and Maldives.

During the daylong programme, Mr. Taiana and his team viewed the flying display of various HAL products at HAL Airport. The defence PSU said that the Argentine team also paid a visit to Light Combat Aircraft (LCA) Tejas, Helicopter Division, and evinced keen interest in HAL products.

### **LCA Tejas**

Argentina is said to have evinced interest in LCA Tejas.

During Aero India earlier this year, Mr. Ananthkrishnan said that the PSU had made proposals for the sale of 15 Tejas aircraft to Argentina.

<https://www.thehindu.com/news/national/hal-and-argentine-defence-ministry-sign-loi-for-light-and-medium-utility-helicopters/article67101592.ece>



## **US Working with India on Co-producing Extended-Range Artillery & Infantry Vehicles to Address Threats Posed by China: Senior Pentagon Official**

The US is working with India on proposals to co-produce extended-range artillery and infantry vehicles to meet its operational requirements along its border with China and address its “coercion and harassment”, a top Pentagon official said on Thursday. The Indian and Chinese troops are locked in an over-three-year confrontation in certain friction points in eastern Ladakh.

This is part of the unprecedented steps being undertaken by the Biden administration to enable its allies and partners to contribute to deterrence in the Indo-Pacific region, said Ely Ratner, Assistant Secretary of Defence for Indo-Pacific Security Affairs, in prepared opening remarks for his Congressional hearing on China.

The hearing is taking place at a time when relations between the US and China have been hit badly amid disputes over human rights, access to technology, China's territorial claims in the South China and East China seas and threats against self-governing Taiwan. Pentagon, he said, is supporting Japan's efforts to acquire counter-strike capabilities, working with Australia as it develops an indigenous capacity to manufacture guided weapons and explosive ordnance, implementing a new inaugural technology initiative with India focused on co-development and co-production of major defence platforms and working with Southeast Asian countries to acquire asymmetric capabilities suited to combatting China's coercion and harassment, and more.

"Most recently with India, we concretised our commitment to co-produce jet engines and strengthen cutting-edge technology and defence industrial cooperation during Prime Minister (Narendra) Modi's state visit," Ratner said. "We are also working with Indian counterparts on proposals to co-produce extended-range artillery and infantry vehicles to address India's operational requirements along its border with the People's Republic of China," Ratner said before the House Select Committee on China.

The Indian and Chinese troops are locked in an over-three-year confrontation in certain friction points in eastern Ladakh even as the two sides completed disengagement from several areas following extensive diplomatic and military talks.

The ties between the two countries nosedived significantly following the fierce clash in the Galwan Valley in June 2020 that marked the most serious military conflict between the two sides in decades. India has made it very clear to China that until there is peace and tranquillity in border areas, the relationship between the two countries cannot progress.

<https://www.financialexpress.com/business/defence-us-working-with-india-on-co-producing-extended-range-artillery-infantry-vehicles-to-address-threats-posed-by-china-senior-pentagon-official-3179986/>



*Fri, 21 Jul 2023*

## **Indian, Indonesian Naval Ships to Conduct Maritime Partnership Exercise in Jakarta: Know all about the Defence Exercise**

In a bid to bolster with other nations, all three wings of the Indian defence force participate in various bilateral or multilateral exercises conducted throughout the year. While some of these exercises are hosted by India, others are organised by various nations. In a recent development, the Indian Navy and Indonesian Navy are gearing up to participate in a bilateral exercise to exchange their war experience and learn more about the equipment used by both nations.

**Wide range of professional interaction**

During the port call, the naval warriors from both nations will engage in a wide range of professional interactions, including sports fixtures, joint yoga sessions, and cross-decks visits to boost mutual understanding and cooperation between the two navies.

In order to further strengthen the high level of interoperability that already exists between the two navies, the two ships will take part in an MPX at sea with the Indonesian Navy after the completion of the operational turnaround.

### **Indian ships to participate in MPX**

During the Maritime Partnership Exercise (MPX), India will be represented by two frontline Indian Naval ships, INS Sahyadri and INS Kolkata. Both ships received a warm welcome by the Indonesian Navy upon their arrival in Jakarta on Monday. The ships were deployed on a mission in South Eastern IOR.

### **About the ships**

While INS Kolkata is the first indigenously designed and built stealth destroyer of the Project-15A class, INS Sahyadri, a Shivalik-class stealth multi-role frigate, is the third indigenously designed and built Project-17 class stealth frigate. Notably, both frigates have been developed at Mazagon Dock Shipbuilders Ltd., Mumbai. While INS Kolkata can achieve a maximum speed of 30 knots, INS Sahyadri can be operated at a maximum speed of 32 knots.

### **Defence relations between India and Indonesia**

Soon after the independence of India and Indonesia, both countries embarked on cooperative relations in the field of defence and security. Over the years, the defence relations between the two nations have become stronger. Recently, both countries concluded bilateral Exercise Samudra Shakti-23 in the South China Sea.

<https://www.news9live.com/knowledge/indian-indonesian-naval-ships-to-conduct-maritime-partnership-exercise-in-jakarta-know-all-about-the-defence-exercise-2220693>



*Thu, 20 Jul 2023*

## **India-Philippines to Strengthen Defence Cooperation; to Sign Enhanced Maritime Cooperation Pact**

Indian ambassador to the Philippines, Shambhu Kumaran, has discussed maritime preparation with the Philippine Coast Guard (PCG) in Manila.

Indian ambassador and PCG Commandant Admiral Artemio M Abu discussed ways to strengthen maritime cooperation.

India and the Philippines are exploring various avenues to enhance their defence cooperation, with a particular emphasis on maritime security.

Building on the strategic partnership, PCG Commandant Admiral Abu and Ambassador Kumaran established priorities, capabilities, authority, limitations, and procedures relating to marine domain awareness and law enforcement operations.

During the discussion, India and the Philippines outlined various procedures when exchanging data on threat evaluations and particular targets of interest.



Highlighting the cooperation in the broader realm of Indo-pacific, Ambassador Kumaran tweeted, “Thank you Admiral Abu for the warmth of your welcome and substantive discussions. Look forward to working with you and the entire @coastguardph team to implement the next steps in our partnership towards a safe and secure Indo-Pacific.”

Earlier, Secretary for Foreign Affairs of the Philippines (SFA), Enrique A Manalo, was in India from June 27 to 30 where he and External Affairs Minister S Jaishankar expressed keen interest to continue to work together in this sector. Both sides agreed to hold regular official level interaction among defence agencies. India also announced the opening of the resident defence attaché office in Manila.

India has also offered Philippines a concessional Line of Credit (LoC) for defence cooperation. According to the reports, India has extended the concessional LOC for the acquisition of naval assets, and expansion of training and joint exercises on maritime security and disaster response, among others.

On maritime cooperation, both ministers acknowledged the growing importance of the maritime sector and pledged to continue the bilateral Maritime Dialogue on hydrography.

India and Philippines agreed on the utility of maritime domain awareness. They called for early operationalization of the Standard Operating Procedure (SOP) for the White Shipping Agreement between the Indian Navy (IN) and the Philippines Coast Guard (PCG).

Both leaders looked forward to the signing of the MoU on Enhanced Maritime Cooperation between the Indian Coast Guard (ICG) and Philippines Coast Guard (PCG).

<https://www.financialexpress.com/business/defence-india-philippines-to-strengthen-defence-cooperation-to-sign-enhanced-maritime-cooperation-pact-3180090/>

# THE ECONOMIC TIMES

*Thu, 20 Jul 2023*

## **India's Desperate Struggle to get into a First-World Exporter Club**

A definite mark of a developed country is its ability to build fighter jets and export them to other countries. A select few countries, including China, have this capability. The only developing country among them is Brazil. Now India is in a hurry to barge into this exclusive club of countries, determined as it is to grow into a world power.

Exporting fighter aircraft is not just business: it, of course, brings a lot of money to the exporting country, being a big-ticket item, but it also prepares the ground for developing strategic ties with the buyer countries. Big defence deals are often part of overall strategic ties. India has been in overdrive to sell its indigenously built light-combat aircraft Tejas, manufactured by state-owned Hindustan Aeronautics Limited (HAL), but has failed to find a customer so far. Yet, the frantic search for Tejas customers continues as India tries to boost its defence exports and build relations with many countries in order to consolidate the Global South.

India has been one of the world's biggest importers of defence equipment for decades, but it has punched below its weight in the global arms export market. Prime Minister Narendra Modi has set ambitions to more than triple the value of annual defence exports to \$5 billion over the next two years and his government has been making diplomatic efforts to export the Tejas. The latest is

discussions with visiting Argentinian defence minister Jorge Enrique Taiana by Defence Minister Rajnath Singh on Tuesday possibly for purchase of Tejas fighter jets. In June, India's ambassador to Argentina, Dinesh Bhatia, and the chief of Argentine Air Force, Brigadier General Xavier Isaac, discussed the export of the Tejas.

### **The business so far**

Tejas zoomed into news last year when it was short-listed by Malaysia as it planned to replace its ageing fleet of fighter jets. Malaysia had narrowed down on the Indian aircraft notwithstanding the stiff competition from China's JF-17 jet and Russia's Mig-35 as well as Yak-130. But ultimately, the Tejas lost out to South Korea's FA-50 which was picked by Malaysia.

The Chinese JF-17 was cheaper but could not match the technical parameters of the Tejas. To sweeten the deal, India had offered to set up an MRO (Maintenance, Repair and Overhaul) facility in Malaysia for its Russian-origin Su-30 fighter fleet as it was facing difficulties in procuring spares for the aircraft from Russia in view of western sanctions against Moscow.

Unshaken by the setback, India is trying to pitch the Tejas to other countries. Recently, Defence Minister Rajnath Singh inaugurated the regional office of HAL in Kuala Lumpur to facilitate close defence industrial collaboration between India and Malaysia and, more importantly, to serve as a hub for the HAL's engagement with the wider South-East Asian region.

HAL CMD CB Ananthkrishnan told TOI in February that HAL had some very good leads for the aircraft from many other countries. "Argentina and Egypt have definitely shown interest. Argentina also has seen two teams visit us and they are quite convinced about the product and quite happy about the product details. Their airforce team has come and flown the aircraft also. So, we are pursuing Argentina and want to start some sort of a relationship building. A contract is likely to get signed," he said. In February, HAL inked an agreement with Argentina to supply spares and provide engine repair services to Argentinian Air Force's two-tonne class helicopters.

Ananthkrishnan said while Argentina was in discussion for around 15 LCAs, Egypt had been given a proposal for around 20 aircraft. "We are yet to hear from them, but further discussions will take place and we are also interested in setting up an ecosystem with them," he said. PM Modi made a special visit to Egypt on his way back from his state visit to the US last month. Tejas was said to be on top of his agenda for his talks with President Abdel Fattah El-Sisi.

### **Why fighter jet exports are important**

Export of fighter jets is not any other defence export. Such an export deal is a veritable strategic partnership. Often, fighter jet deals are marked by a characteristic secrecy since these aircraft are customised according to the buyer's special needs. The secrecy helps the buying country maintain an element of surprise in its warcraft. That's why all the specifications of Rafale, which India imported from France a few years ago, were not revealed publically.

India's hurry to export fighter jets can be seen in the light of its hectic efforts to forge strategic relationships with countries in the Indo-Pacific as well as Africa and Latin America to emerge as a leader of the Global South. More importantly, India needs to counter the influence of China in these parts.

China has been selling fighter jets for decades but it has failed to emerge as a big exporter as it evokes little trust among other countries, especially the developing ones.

China has hankered to become a major fighter jet exporter for some time but has failed, according to an article in Foreign Policy. Between 2000 and 2020, China exported just \$7.2 billion worth of military aircraft, according to the Stockholm International Peace Research Institute arms transfers database. Meanwhile, the US stayed safely on top, exporting \$99.6 billion, and Russia stayed in the

second slot at \$61.5 billion. Even France's aircraft exports doubled China's, at \$14.7 billion. And there were few signs of upward momentum for China.

China's lack of progress on this front creates an opportunity for India to emerge as a fighter jet exporter. While India eyes countries such as the Philippines and Indonesia in the Indo-Pacific which have border disputes with China and thus a natural inclination to rely on India in strategic matters, it also tries to woo countries such as Egypt and Argentina which could have trust issues with China. India's fighter jet deals with such countries will also give India some sort of strategic footholds in these regions where China has been increasing its influence for years.

### **Tejas will be a boost for defence exports**

For long, India has been the largest defence importer in the world, which means utter dependence on other countries. But things have changed dramatically in the past few years when India fast emerged as a defence exporter.

India's defence exports reached an all-time high of Rs 15,920 crore in 2022-2023. The country's defence exports in 2021-22 were Rs 12,814 crore, Rs 8,434 crore in 2020-21, Rs 9,115 crore in 2019-20, Rs 10,745 crore in 2018-19, Rs 4,682 crore in 2017-18 and just Rs 1,521 crore in 2016-17, according to government data. The spurt in defence exports is the result of the Modi government's resolve to become 'Atmanirbhar' (self-reliant) in military supplies. The government has set the target of manufacturing defence hardware worth Rs 1,75,000 crore and take defence exports to Rs 35,000 crore by 2024-25.

The spurt in India's exports was partly helped by BrahMos missiles. Last year, India inked an export deal with the Philippines, signing a \$375 million contract for the BrahMos shore-based anti-ship missile system. Now Indonesia and Vietnam are also interested in the BrahMos. The Tejas could be a similar big-ticket export item, and thus a big boost to India's exports so they reach the ambitious target. Since a fighter jet is a highly technical product, it builds confidence in the buyer and the deal often opens the doors for export of other expensive defence hardware.

Selling fighter jets is a business, military, strategic and diplomatic enterprise and yields benefits on all these counts. That's why India is so keen to export the Tejas which can serve as an important part of its strategy to emerge as a world power.

<https://economictimes.indiatimes.com/news/defence/indias-desperate-struggle-to-get-into-a-first-world-exporter-club/articleshow/101982564.cms>



*Thu, 20 Jul 2023*

## **UK Steps up Efforts to Deliver Integrated Air and Missile Defence Approach**

The UK is stepping up efforts to deliver an integrated air and missile defence approach to protect itself “against attack from the skies, both overseas and at home”, according to the Defence Command Paper 2023 (DCP23) refresh published on 18 July. The DCP23 described these threats as “at its most acute for over 30 years – as evidenced in the war in Ukraine”.

The UK Royal Air Force will take the lead in this effort, promoting the use of airborne, ground-, sea-, and space-based sensors, and air and missile capabilities, including counter-unmanned aircraft systems (UASs), “to detect, protect and defend the UK”, according to the DCP23.

In addition to the UK's maritime Sea Viper Evolution ballistic missile defence (BMD) and London's commitment of a BMD radar to protect NATO, the UK is exploring air and missile defence co-operation with allies. During the parliamentary debate on the DCP23 on 18 July, UK Secretary of State for Defence Ben Wallace explained, "We are doing that across NATO, integrated with NATO, and working with the Germans and the French ... Last month, we started to examine what Europe and NATO need to have the right integrated air defence to protect its territory."

He outlined UK investments in air defence, "We have started investing in the extended-range missile for the Type 45 [destroyer], we have started increasing the number of batteries of our GBAD [ground-based air defence], and we have managed to export our GBAD to Poland in a GBP2 billion (USD2.6 billion) export deal."

<https://www.janes.com/defence-news/news-detail/uk-steps-up-efforts-to-deliver-integrated-air-and-missile-defence-approach>

## Science & Technology News



*Thu, 20 Jul 2023*

### **ISRO Successfully Tests Gaganyaan Service Module Propulsion System**

Indian Space Research Organisation (ISRO) successfully tested the Gaganyaan Service Module Propulsion System (SMPS) at ISRO Propulsion Complex in Mahendragiri, Tamil Nadu, on July 19.

This test involved five liquid apogee motor (LAM) engines with a thrust of 440 N, and 16 reaction control system (RCS) thrusters with a thrust of 100 N. The service module of Gaganyaan is a regulated bi-propellant based propulsion system that caters to the requirements of the Orbital Module, performing orbit injection, circularisation, on-orbit control, de-boost manoeuvring, and SM-based abort (if any) during the ascent phase.

The 440 N thrust LAM engines provide the main propulsive force during the ascending phase, while the RCS thrusters ensure precise altitude correction.

The hot test of the System Demonstration Model (SDM) emulated the fluid circuit of the Service Module Propulsion System, encompassing the propellant tank feed system, helium pressurisation system, flight-qualified thrusters, and control components.

The first hot test of the Phase-2 test series demonstrated the integrated performance of the Gaganyaan Service Module Propulsion System. The test, conducted for a duration of 250 seconds, involved LAM engines firing in continuous mode, along with RCS thrusters, adhering to the test profile.

As part of the Phase-1 test series of service module SDM, ISRO had carried out five hot tests, totalling a duration of 2,750 seconds.

Phase-1 involved five 440 N LAM engines, and eight 100 N RCS thrusters. Phase-2 test series involved the full configuration of five 440 N LAM engines, and 16 100 N RCS thrusters.

With the successful completion of the hot test, the SMPS demonstrated its performance in the full configuration. Moving forward, ISRO has scheduled five additional tests to demonstrate both nominal and off-nominal mission scenarios, reinforcing the rigour of testing.

The Gaganyaan project envisages demonstration of human spaceflight capability by launching a crew of three members to an orbit of 400 km for a three-day mission, and bringing them back safely to Earth, by landing in Indian sea waters. ISRO plans to carry out Gaganyaan's first abort test in August.

<https://www.thehindu.com/sci-tech/science/isro-successfully-tests-gaganyaan-service-module-propulsion-system/article67101045.ece>



*Thu, 20 Jul 2023*

## **Chandrayaan-3 Finishes Fourth Orbit-Raising Manoeuvre**

The Indian Space Research Organisation (ISRO) on Thursday successfully completed the fourth orbit-raising manoeuvre (earth-bound perigee firing) of the Chandrayaan-3 mission.

The space agency said, "India celebrates International Moon Day 2023 by propelling Chandrayaan-3 step closer to the Moon. The fourth orbit-raising manoeuvre (earth-bound perigee firing) is performed successfully from ISTRAC/ISRO, Bengaluru."

ISRO said Chandrayaan-3 had attained an orbit of 71351 km x 233 km orbit, as intended.

This means that Chandrayaan-3 is now in an orbit, which when closest to earth is at 233 km and farthest at 71,351 km.

Chandrayaan-3 was successfully launched by the Launch Vehicle Mark-3 (LVM-3) when it took off from the second launch pad of the Satish Dhawan Space Centre in Sriharikota at 2.35 p.m. on July 14 and placed at an elliptic parking orbit of 36,500 km x 170 km.

Four orbit-raising manoeuvres have now been completed and the next firing is planned for July 25 between 2 and 3 p.m. IST.

### **Chandrayaan-3 Mission update:**

The spacecraft's health is normal.

The first orbit-raising maneuver (Earthbound firing-1) is successfully performed at ISTRAC/ISRO, Bengaluru.

Spacecraft is now in 41762 km x 173 km orbit. [pic.twitter.com/4gCcRfmYb4](https://pic.twitter.com/4gCcRfmYb4)

— ISRO (@isro) July 15, 2023

After the launch on July 14, ISRO Chairman S. Somnath said all earth-bound manoeuvres would be conducted till July 31. Thereafter, the trans lunar insertion would take place on August 1. The lander of the mission is planned to soft-land on the surface of the moon on August 23 at 5.47 p.m.

<https://www.thehindu.com/sci-tech/science/isro-completes-4th-orbit-raising-manoevre-of-chandrayaan-3/article67101240.ece>

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