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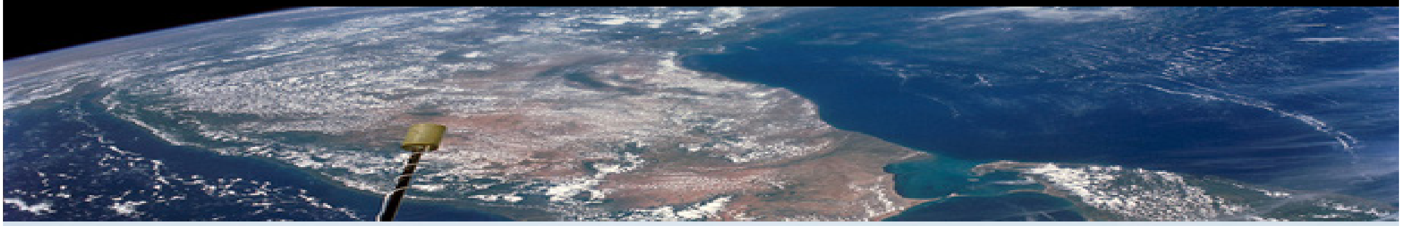

Exercise Garuda was one of the largest international air training engagements undertaken by the IAF on the year 2025; and enhances the IAF's war-fighting capabilities and strengthen jointmanship with friendly foreign air forces.

Source: https://www.newsonair.gov.in/indian-air-force-returns-after-8th-edition-of-exercise-garuda-in-france/

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> *"The successful LVM3-M6 launch, placing the heaviest satellite ever launched from Indian soil – the spacecraft of the USA, BlueBird Block-2 – nto its intended orbit, reinforces India's growing role in the global commercial launch market. This is also reflective of our efforts towards an Aatmanirbhar Bharat,"*
>
> *- Shri Narendra Modi*
> *Hon'ble Prime Minister*

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Opinions and Analysis

PLAAF: Soon to be the Largest and the first Air Force in the World to have a 6th-Generation Fighter

Ms Ritu Sharma | 23 December 2025

Source: CAPSS India | https://capssindia.org/plaaf-soon-to-be-the-largest-and-the-first-air-force-in-the-world-to-have-a-6th-generation-fighter/

USAF and RAAF showcasing F-22 and F-35

When the United States Air Force (USAF) Captain Charles E. "Chuck" Yeager flew his Bell X-1 Glamorous Glennis faster than the speed of sound (Mach 1) on October 14, 1947, it put the US ahead of the rest of the world in a race to the moon. Fifteen years later, it also opened a new frontier for rivalry between the US and the Union of Socialist Soviet Republic (USSR) during the Cold War. The countries tried to match fighter-for-fighter to upend others as the most superior air force in the world.

Slowly, Moscow lost the edge, and the USAF became the most dominating air power in the world. It became the first air force in the world to fly 5th-generation stealth aircraft and the only air force to fly two types of 5th-generation fighter jets – namely F-22 Raptors and F-35 Lightning II. The supremacy is now being challenged by the People's Liberation Army Air Force (PLAAF). Soon, the PLAAF is likely to beat the USAF to become the first air force in the world to fly 6th-generation fighter jet.

So far, the world has been concerned with the PLA Navy's feverish modernisation pace, and the advancement by the PLAAF has been dismissed as the force playing catchup with the US. But the watchers of the PLAAF did not expect the force to have a 6th-generation fighter before the USAF, as they underestimated China's capability to produce new aircraft designs. And Beijing has been churning out one new aircraft design every 10-15 years.

The 2024 edition of the Pentagon's annual report on Chinese military power underscored how the PLAAF has expanded the capabilities of its unmanned aerial systems (UAS). It conceded that they are now comparable to USAF systems. It also noted the strides that the Chinese have made with air-to-air missiles, electronic warfare, bombers, and fifth-generation fighters, but it said that the PLAAF was still playing catch-up with the USAF in terms of combat capabilities.

The complacency could prove detrimental to the USAF's air power dominance as Chinese 6th generation fighter jet development is flying ahead with alarming speed. Numerically, the Chinese Air Force, along with the Navy, fields the largest aviation force in the Indo-Pacific region and the third-largest in the world, with over 3,150 crewed aircraft—not including trainers or drones. More than 2,400 of these are combat aircraft, and the majority of them—around 1,300—are now fourth-generation, according the report.

The modernisation of PLAAF is driven by China's ambition to project power beyond the first chain of islands, including Taiwan, Okinawa, and the Philippines, which China sees as the first line of defence. The "second island chain" in the Western Pacific runs from south-eastern Japan to Guam and south to Indonesia. This would supplant the US as the dominating military power in the region.

In present times, the three major state threats faced by the US – the People's Republic of China (PRC), Russia and the Democratic People's Republic of Korea (DPRK) are in the US INDOPACOM's area of responsibility. Of these three countries, China is the only one with the will and wherewithal to disrupt the international order.

China is modernising its air force, keeping in mind the strategic role air power has played in recent conflicts. President Xi Jinping has set a target for the PLAAF to achieve modernisation as a strategic force by 2035.

F-47 Vs J-36 – The Flight to Induction

The concurrent emergence of the Chinese J-36 and the American F-47 reflects the heightened rivalry between China and the US to dominate the Indo-Pacific. Beijing is increasingly looking to project its power beyond the first island chain and challenge American influence in the Pacific. The J-36 is pivotal to this strategy.

After images of China's 6th-generation fighter jet , 2025 prototypes went viral, the US finally awarded the contract for the US Air Force's first 6th-generation fighter jet. Instead of going with Lockheed Martin, the US government announced on March 21, 2025 to go with Boeing. Recently, the outgoing US Air Force Chief of Staff General David W. Allvin announced that the first F-47 Next-Generation Air Dominance fighter will be ready to fly by 2028. The F-47 is key to the US maintaining its air dominance as F-22 Raptors near the end of their operational lifespan.

Keeping an eye on the rapid strides taken by the Chinese Air Force modernisation, the new timeline suggests urgency on the part of the USAF. During his keynote address at the annual Air, Space and Cyber Conference in National Harbor, Md. (south of Washington), Allin said: "We got to go fast." "I got to tell you, team, it's almost 2026. The team is committed to get the first one flying in 2028. … We're ready to go fast. We have to go fast," he added.

Despite moving up the timeline for the first airframe of the F-47, it is 3-4 years behind the Chinese 6th-generation fighter jet J-36 and the other prototype J-XDS (also referred to as J-50 sometimes). Both Chinese aircraft have been recently spotted at a secretive airbase with a massive runway in northwestern China. This suggests that the aircraft has entered its testing phase, and the massive infrastructure that Beijing is building up at the test base indicates its commitment to challenge US's air dominance.

The US has obliquely tried to debunk the advantage the Chinese 6th-generation aircraft development programme has over the American programme. A press release by the American Defense Advanced Research Projects Agency (DARPA) on March 21, 2025, revealed that Boeing and Lockheed Martin designed two X-planes as "risk reduction for the NGAD Platform. These aircraft first flew in 2019 and 2022, logging several hundred hours each."

Unlike the US, which has kept the prototypes under wraps, China has parked its two prototypes out in the open despite knowing that the site is regularly imaged by satellites. The new images of the J-36 point towards commendable design evolution of the aircraft. The second iteration of the J-36 suggests new structural changes over the first. The two new images from November 24, 2025, show new inlets, main landing gear and two-dimensional thrust vectoring across its bank of three engines.

The J-36 stealth fighter developed by Chengdu Aircraft Corporation has a tailless, twin-engine design and is a very large tactical aircraft comparable to US strategic bombers in terms of size.It has a unique side-by-side cockpit configuration, indicative of a two-crew mission management. This could help the aircraft play the role of an airborne command and control node for both manned and unmanned aircraft that can execute missions beyond the first island chain. The design of J-36 indicates a departure of fighter jets from the classic role of dogfighting to optimise air assets by coordinating manned and unmanned systems.

If the timeline of the 5th-generation J-20 'Mighty Dragon' from a technology demonstrator to induction into service is any indicator, the PLAAF will get J-36 years ahead of when the USAF will get the F-47.

Will PLAAF's technological leapfrogging with J-36 counter USAF's numerical advantage?

Based on International Institute for Strategic Studies (IISS) Military Balance reports for 2007 and 2025, the total number of PLAAF fighters, multirole fighters, and ground-attack aircraft shrank from 2,453 in 2007 to 2,065 in 2025. The air forces across the globe have experienced this decline as they move from less expensive second- and third-generation fighters to more expensive but more capable fourth-generation aircraft.

This development can be analysed from the framework presented by Phillip

C. Saunders and Erik Quam in 2007 after analysing PLAAF's modernisation. Instead of predicting the right size of the PLAAF's and its force structure, it gives five perspectives that will shape China's decisions about the PLAAF's future force structure. The authors contended that the perception of the international environment, including a crisis over Taiwan or a conflict with the US, and budget constraints will have a major influence on PLAAF's modernisation.

Their analytic framework focused on potential changes in PLAAF roles and missions, domestic versus foreign procurement, low-tech versus high-tech systems and combat versus support aircraft. A 2019 defence white paper published by China indicated the transition of the PLAAF's missions from territorial air defense to "offensive and defensive operations." The technological capability of the PLAAF is fast approaching the standards of the US Air Force.

The reduction in the number of fighter jets and the advent of futuristic and technologically advanced aircraft is driving the PLAAF's modernisation. And soon it will have the advantage of 6th-generation fighter jet. The modernisation of the fighter jet fleet is supported by the development of its bomber and air-to-air refueller aircraft fleet.

The J-36 can help China leapfrog as a technologically advanced air force. Soon, the PLAAF is going to be the largest air force in the world, and that too equipped with the world's first 6th-generation fighter jet. The critics often highlight that the development of the 6th-generation fighter jets should be evolutionary. But, China's J-36 development stems from the belief that deploying disruptive technology is necessary to neutralise the numerical advantage the US might possess aerially. It is investing in radical innovation that will reshape future conflicts.

At the same time, China is ramping up the production of J-20 fighters. As per reports, it has already built 300 units of the aircraft, and slowly it is switching to Chinese-made engines to power these fighters.

The production rate has increased from 30 to 100 aircraft annually, and conservative estimates suggest that the PLAAF's J-20 fleet could surpass 1000 aircraft by 2030. China intends to have nearly 1,500 by 2035. With five production lines, China is capable of producing a new aircraft every eight days. In comparison, USAF has over 180 F-22s and 630 F-35s. There are plans to acquire 1800 more. Despite entering production two decades before the J-20s, the American F-35 has a low production rate of 140 aircraft per year.

Implications of PLAAF's Capability Boost

China is boosting its anti-access/area-denial capabilities with stealth fighter jets, advanced long-range missiles, and a rapidly growing blue-water navy. Air dominance will help it offset the geographic constraints of the First Island Chain, thereby challenging the US military in the Western Pacific.

China's hegemony over Asia is one of the biggest threats to the US position in the international system. Supplanting the US military as the dominant force in the region will have implications for regional disputes and will also impact other regional actors such as India. The leapfrogging aerial technology will help China to project power beyond its borders and send signals to countries across the globe.

While J-35 has a carrier-based variant, most of the Chinese fighter jets are land-based. But with Beijing converting its Y-20 "Chubby Girl" transport aircraft to refuellers, the range of its fighter jets is bound to get doubled, threatening the US' military positions.

The Y-20, officially called "Kunpeng" after a mythical Chinese bird and nicknamed "Chubby Girl" for its appearance, has superior endurance and air-refueling capability that will increase the range of PLAAF fighter jets much beyond the first island chain, a string of islands encumbering the seas around China. Y-20 is the largest military aircraft currently in production after Boeing's C-17 Globemaster III stopped production in 2015.

In this scenario, the US has no other option but to rely on its allies helping the US to establish air superiority quickly. It can just hope that its 5th-generation US Navy fighter jets and aircraft of allied forces will be able to subdue the PLA Navy and the Air Force in the air..

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How Kaveri Engine's 39-Year Failure Exposes Deep Institutional Voids in DRDO and HAL, Paralyzing India's AMCA and TEDBF Programmes

Ronit Bisht | 14 December 2025

Source: Defence.in | https://defence.in/threads/how-kaveri-engines-39-year-failure-exposes-deep-institutional-voids-in-drdo-and-hal-paralyzing-indias-amca-and-tedbf-programmes.16242/

In a scathing The Print column published on 10 December 2025, Admiral Arun Prakash (Retd), the former Chief of Naval Staff and a distinguished strategic thinker, has delivered a stark indictment of India's aviation establishment.

His assessment is grim: despite ambitious rhetoric surrounding the fifth-generation Advanced Medium Combat Aircraft (AMCA) and the Twin-Engine Deck-Based Fighter (TEDBF), both programmes remain effectively grounded.

The cause is not a lack of funding or desire, but a 39-year-old failure that continues to haunt the Defence Research and Development Organisation (DRDO): the inability to produce a functional indigenous jet engine.

The Kaveri Stagnation: Four Decades of Missed Deadlines

The heart of the crisis lies with the GTX-35VS Kaveri programme. Initiated by the DRDO's Gas Turbine Research Establishment (GTRE) in 1986—and formally sanctioned in 1989—the project was intended to power India’s Light Combat Aircraft (Tejas). Instead, it has become a case study in institutional inertia.

Admiral Prakash points out that after nearly four decades and the expenditure of billions of rupees, the Kaveri remains unfit for combat application.

Although first bench-tested in 1996, the engine has suffered from persistent technical setbacks, including thrust deficits, overheating turbine blades, and unreliable digital control systems. Every technical failure has been met not with a solution, but with a revised timeline that quietly shifts targets into the next decade.

Consequently, the AMCA programme is now paralysed by indecision: forced to choose between waiting for an indigenous engine that may never materialise or opting for the American GE F414—precisely the sort of foreign dependency the project was designed to eliminate.

HAL: Manufacturing Without Mastery

The former Navy Chief extends his critique to Hindustan Aeronautics Limited (HAL), arguing that the organisation suffers from a deep-seated "assembler" mindset.

Since the 1950s, HAL has manufactured approximately 3,000 airframes and 5,000 aero-engines. However, virtually every unit was built under licence from foreign Original Equipment Manufacturers (OEMs) in Britain, France, or Russia.

Despite 75 years of experience in licensed production and overhaul, HAL’s engine divisions have failed to internalise the critical "black arts" of jet engine design.

Complex technologies such as single-crystal turbine blades, advanced thermal coatings, and precision metallurgy—which distinguish a reliable combat engine from an experimental prototype—remain foreign concepts.

The intellectual property and design expertise stayed in Bristol, Toulouse, and Moscow, leaving Indian engineers as skilled assemblers rather than true innovators.

A Failure of Political Will

Perhaps the sharpest criticism in the column is reserved for India’s political leadership across successive governments.

Admiral Prakash highlights a glaring strategic failure: while India has spent tens of billions of dollars on foreign defence acquisitions—saving Dassault with the Rafale deal, sustaining Sukhoi with massive

Su-30MKI orders, and bolstering Israel's defence sector—New Delhi has failed to leverage this buying power.

No Prime Minister or Defence Minister has successfully conditioned these mega-deals on the transfer of critical engine technology. There have been no offsets clauses mandating the sharing of "hot-section" know-how or the joint development of turbine blades.

As a result, while vast sums of money have flowed out of India, the core technologies required for independence have remained firmly abroad.

The Chinese Mirror: Persistence Pays Off

The column draws an inevitable and unflattering comparison with China.

In the 1950s, Beijing's aviation sector was, like India's, entirely dependent on Soviet technology. However, following the Sino-Soviet split in 1960, China embarked on a ruthless campaign of guochanhua (indigenisation).

While early Chinese copies were crude and accident-prone, the state persisted.

By the 1980s, the Chinese leadership prioritised aero-engine development with the WS-10 programme, which was derived from the core of the civilian CFM56 engine.

Despite decades of failures, China did not abandon the project. The WS-10 Taihang eventually entered service in 2009.

Today, advanced variants like the WS-10C and WS-15 power the People's Liberation Army Air Force's (PLAAF) entire fleet of fourth and fifth-generation fighters.

The column further notes reports that updated engines are now powering prototypes of China's next-generation J-36 and J-50 stealth fighters.

Conclusion: No Shortcuts to Power

Admiral Prakash concludes with a sobering reality check: no nation has ever achieved the status of a true aerospace power without mastering the design and production of both airframes and engines. The US, Russia, Britain, France, and China paid for this capability in "blood, treasure, and time."

India's desire for the prestige of a fifth-generation fighter, without enduring the painful process of developing its heart, is described as a fundamental strategic error.

Until the government summons the political will to force technology transfers and funds the GTRE with the same ruthlessness China applied to the WS-10, the Admiral warns that the AMCA and TEDBF are destined to remain "PowerPoint warriors"—impressive on screen, but absent from the skies.

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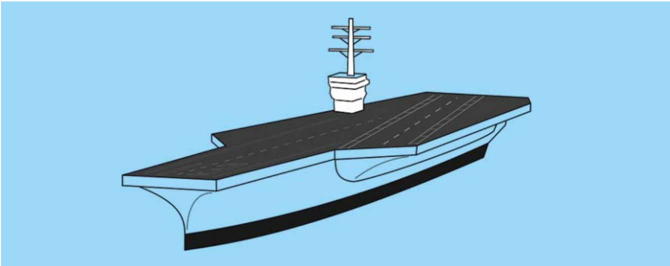
China's Fujian Aircraft Carrier: A Technological Leap in Shipbuilding

Abhishek Kumar Darbey | 17 December 2025

Source: IDSA | https://www.idsa.in/publisher/issuebrief/chinas-fujian-aircraft-carrier-a-technological-leap-in-shipbuilding



Introduction

In November 2025, China commissioned its third aircraft carrier, 'Fujian', which is more advanced with better combat capabilities than the previous two aircraft carriers, i.e., Liaoning and Shandong. The Fujian carrier, estimated to cost approximately US$ 8 billion, is China's first domestically designed aircraft carrier. It was officially launched in June 2022 and conducted its first sea trials in May 2024. It is now a part of the South Sea Fleet of the Southern Theatre Command Navy.

The 'Fujian' aircraft carrier is distinctive compared with the previous two because its commissioning marks a technological breakthrough that demonstrates China's capability to build an indigenous aircraft carrier. Unlike the Fujian, the last two aircraft carriers were based on Soviet technology. Moreover, the 'Fujian' aircraft carrier is China's first carrier equipped with an electromagnetic aircraft launch system (EMALS). The previous two aircraft carriers have ski-jump aircraft takeoff decks. Before Fujian, the United States was the only country to have an aircraft carrier with an electromagnetic catapult launch system, which was commissioned in 2017.

The commissioning of 'Fujian' surprised analysts as China has leapt from ski-jump technology to electromagnetic catapult technology, bypassing the steam catapult technology. For aircraft carrier-based takeoff and landing, most countries, including the United States, first developed ski-jump technology, then steam catapult technology, and finally electromagnetic catapult technology. However, China directly transitioned from ski-jump technology to electromagnetic catapult technology, which is the most advanced and provides an edge in combat capabilities. Second, the 'Fujian' carrier's electromagnetic catapult system is conventionally powered, unlike the United States' nuclear-powered USS Ford-class carrier. This makes the Fujian carrier the first of its kind, a conventionally powered aircraft carrier with electromagnetic catapults.

A Technological Leap in Shipbuilding

Before the commissioning of the Fujian aircraft carrier on 5 November 2025, the Chinese military released a video showing the take-off and landing of three types of carrier-based aircraft on the deck of the Fujian carrier, including J-15T multi-role fighter, J-35 stealth fighter, and KJ-600 early warning aircraft, using electromagnetic catapults. According to Lu Junyong, a member of Fujian Carrier's R&D team, the ship features three electromagnetic rails and a flat deck, with a water displacement of 80,000 tons. Sea trials of the Fujian carrier began in May 2024, and by August 2025, eight rounds had been completed. These trials primarily tested its power, electrical and catapult systems.

With the combination of an electromagnetic catapult, the Fujian aircraft carrier can carry various types of aircraft, including fighter jets, attack aircraft, early-warning aircraft, electromagnetic warfare aircraft and search-and-rescue aircraft. In addition, the Fujian carrier is equipped with a multifunctional integrated electronic mast that combines the functions of multiple antennas previously installed on the two preceding aircraft carriers. The mast provides three key functions. First, it includes air and sea search, tracking and guidance, as well as missile defence and fire control. Second, it supports the electronic reconnaissance function of collecting and analysing enemy electromagnetic signals. Third, it helps jam and deceive enemy electromagnetic signals. Furthermore, the Fujian carrier is equipped with 32 phased-array radars, including S-band and X-band fire-control radars. These are all active phased-array radars, meaning each radiator is fitted with an independent transmitting and receiving component that can generate and receive electromagnetic waves.

Why Electromagnetic Catapult Technology?

For several years, a team of Chinese engineers has been developing a steam catapult system based on the decommissioned Australian Navy aircraft carrier HMAS Melbourne, which China acquired in 1985. However, following the successful development of a mature electromagnetic catapult by Chinese academician Ma Weiming and his team, the Chinese leadership decided to forgo the steam catapult for their new Fujian aircraft carrier. Ma Weiming is better known as the 'Father of the Chinese Electromagnetic Catapult'. He is recognised for a series of breakthroughs in ship propulsion and electrical engineering, which are considered milestones in the development of modern naval equipment. He was awarded the 'August 1st Medal' by the Central Military Commission, one of the highest awards in the Chinese military.

With electromagnetic catapults, the Fujian carrier can have significant advantages over aircraft carriers with ski-jump or steam catapult technology, including a higher aircraft sortie rate, shorter take-off preparation time, the ability to use multiple catapults, and easier maintenance. In addition, in comparison to the steam catapult system, the Fujian carrier with electromagnetic catapult multiplies the combat radius and thereby enhances the carrier's overall combat capabilities. Secondly, unlike the steam catapult, the Fujian carrier's electromagnetic catapult does not require complex piping systems. Thirdly, the electromagnetic catapults in

Fujian enable the airline to flexibly select the launch force that prevents damage to the aircraft. Furthermore, unlike the ski-jump deck, the Fujian carrier has a flat deck that accommodates more aircraft.

The Electromagnetic Aircraft Launch System (EMALS), also known as the electromagnetic catapult system, is a shipborne takeoff device on aircraft carriers. It is a device that uses electromagnetic force to drive the launch object and accelerate it to ultra-high speed. Essentially, it is an energy-conversion technology that converts electromagnetic energy into kinetic energy with high efficiency. Unlike previously developed take-off devices such as ski-jump and steam catapults, the electromagnetic catapult can launch a wide range of manned and unmanned aircraft, from small drones to large fighter jets, with high precision. So far, only four countries—the United States, the United Kingdom, Russia and China—have researched the electromagnetic catapult system. Among them, only the United States and China have successfully built and commissioned it.

China Shipbuilding Corporation developed the electromagnetic catapult system mounted on the Fujian aircraft carrier under the supervision of Chinese academician Ma Weiming. The Chinese electromagnetic catapult system differs from the United States 'in that a DC power system drives it, whereas the United States' is driven by an AC power system. The technology was developed at the Shanghai Aerospace System Engineering Research Institute under the supervision of Ma Weiming. In fact, Ma Weiming is the first to propose and develop a medium-voltage DC integrated power system for all-electric propulsion systems and the electromagnetic catapult of aircraft carriers. Unlike the steam catapult, the electromagnetic catapult drives its piston with electricity rather than steam; therefore, it requires fewer service personnel than the steam catapult system, resulting in lower maintenance costs. One reason China avoids using steam catapults is that they cannot launch heavier early-warning fighters, which are crucial for information support in modern warfare.

It is worth noting that China has taken relatively less time to develop an electromagnetic catapult than the United States. The United States began researching electromagnetic catapult technology for its aircraft carriers in the 1930s, during World War II. The research was shelved due to the lack of available technology and the required magnetic material at that time. However, it was resumed in the 1980s, and it took more than three decades before they commissioned their first aircraft carrier equipped with an electromagnetic catapult system. In contrast, China's second aircraft carrier, Shandong, with a ski-jump, was commissioned in December 2019. At the same time, a team of Chinese engineers were working on a steam catapult system, probably for the Fujian aircraft carrier. However, Ma Weiming's team was ready with a mature electromagnetic catapult technology for the aircraft carrier. Therefore, Xi Jinping decided to shift to electromagnetic catapult technology and to forgo their nearly developed steam catapult technology.

Combat Capability of Fujian Carrier

Two weeks after the commissioning of the Fujian aircraft carrier, it was sent for its first live-fire training exercise at sea on 18 November 2025. The formation of the Fujian aircraft carrier group included Yan'an Type 055 guided-missile destroyer, Tongliao Type 054A guided-missile frigate. The training aimed to assess the compatibility between the ship and its aircraft by conducting multiple take-offs and landings. So far, the identified aircraft and equipment at the Fujian carrier include the KJ-600 early-warning aircraft, J-35 stealth fighter jet, J-15T fighter jet, J-15D electronic-warfare aircraft, GJ-21 UAV, Z-18F anti-submarine helicopter, and Z-20H multipurpose helicopter.

The electromagnetic catapult system in Fujian is capable of launching both a 30-ton heavy fighter and light drones weighing only a few tons. In addition, the sortie rate of the Fujian carrier is 2.5 times higher than that of the Shandong aircraft carrier, and is capable of launching 160-180 sorties per day. In comparison, the Shandong carrier has 54 sorties per day. With a water displacement of 80,000 tons, the Fujian far exceeds the previous two aircraft carriers, Liaoning and Shandong, enabling it to carry more carrier-based aircraft, ammunition, and fuel reserves, and ensuring longer endurance at sea.

Analysts note that the combination of the J-15D electronic-warfare aircraft, the J-35 stealth fighter, and the KJ-600 early-warning aircraft indicates a significant leap forward in Chinese aircraft-carrier capabilities relative to its previous two carriers. The Fujian carrier has the advantages of operational range, payload and awareness range. Fujian's operational radius can effectively control the airspace and waters hundreds of nautical miles. Fujian aircraft carrier's weapon systems are modern and comprehensive, with its core capabilities centred on air power and electronic warfare. Its design focuses on forming a powerful carrier strike group and coordinating multidimensional operations through information, electronic, air, and surface capabilities. It can also conduct land-attack, anti-submarine warfare, humanitarian-assistance, and other missions.

The Fujian carrier is expected to carry 50–60 aircraft of various types. Its ammunition primarily consists of various air-to-air, air-to-ground, and air-to-sea missiles, bombs, and anti-ship missiles for its carrier-based aircraft, namely the J-15T, J-15D, J-35, and KJ-600, as well as ammunition for the aircraft's own cannons. The electromagnetic catapult system enables the Fujian carrier to launch a variety of fully loaded aircraft with fuel and weapons, thereby enhancing their combat range and firepower. Key weapons include PL-10 and PL-15 air-to-air missiles, and YJ-12/18 air-to-ground missile.

Among the carrier-based aircraft on the Fujian carrier, the J-35 fighter jet primarily carries 4 to 6 folding-wing PL-15 medium-range air-to-air missiles, enabling beyond-visual-range strikes in stealth mode. Its secondary weapons bay can carry the short-range air-to-air missile PL-10. It operates in conjunction with early-warning and electronic-warfare aircraft to allow beyond-visual-range strikes. Second is the J-15T carrier-based fighter jet, which has powerful weapon-carrying capabilities and carries PL-15 long-range air-to-air missiles, PL-12 medium-range air-to-air missiles, PL-10 short-range air-to-air missiles, PLA-8 short-range infrared-guided air-to-air missiles, YJ-83K subsonic anti-ship missiles, and YJ-12 supersonic anti-ship missiles.

Third is the J-15D carrier-based electronic warfare aircraft, equipped with advanced electronic warfare pods and systems to conduct aerial electronic jamming, reconnaissance, and suppression of enemy air defence systems. This aircraft enhances the overall combat capability and survivability of the Chinese carrier strike group, especially in complex electromagnetic countermeasures environments. Fourth is the KJ-600 carrier-based fixed-wing early-warning aircraft, primarily deployed on the Fujian aircraft carrier, which utilises electromagnetic catapult launch and recovery systems, providing long-range early warning and command-and-control capabilities for carrier strike groups. The aircraft acts as a force multiplier by tracking numerous targets simultaneously.

The self-defence weapons in Fujian carrier include a close-in weapon system (CIWS) such as four Type 1130 CIWS to intercept supersonic anti-ship missiles and aircraft, four HQ-10 24-cell surface-to-air missile defence systems, anti-submarine weapons such as 12-cell anti-swimmer grenade launcher to counter underwater infiltration threats, 6-cell 324mm anti-torpedo launcher, and the 24/32-cell 122mm multi-purpose rocket launcher. Lastly, the overall combat capability of the Fujian carrier group also depends on the accompanying destroyers, frigates and submarines, which together form a multi-layered, comprehensive defence and attack system.

Conclusion

The commissioning of the Fujian aircraft carrier is the beginning of an era in China's aircraft carrier building. It indicates that the upcoming Chinese aircraft carriers, Type 004 and Type 005, may be able to match the United States in terms of water displacement and combat capabilities. Nonetheless, a critical gap remains between the United States and China in nuclear-powered aircraft carriers, which limits China's aircraft-carrier combat capabilities. With 11 nuclear-powered aircraft carriers, the United States is far ahead of China. However, the United States has only one nuclear-powered aircraft carrier, the USS Gerald R. Ford (CVN-78), with electromagnetic catapults. Although China doesn't have a nuclear-powered aircraft carrier, it has built an aircraft carrier equipped with electromagnetic catapults, which enhance its airpower capabilities and combat range. It is likely, however, that China will pursue the construction of nuclear-powered aircraft carriers equipped with electromagnetic catapults.

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AIR POWER

How HAL's Domestic SJ-100 Production Poised to End Western Monopoly in Indian Civil Aviation

Raghav Patel | 27 December 2025

Source: Defence.in | https://defence.in/threads/how-hals-domestic-sj-100-production-poised-to-end-western-monopoly-in-indian-civil-aviation.16396/

In a development that signals a pivotal transformation for the global aviation sector, Hindustan Aeronautics Limited (HAL) has entered into a significant Memorandum of Understanding (MoU) with Russia's United Aircraft Corporation (UAC).

The agreement, finalised in Moscow on October 27, 2025, authorises HAL to manufacture the Sukhoi Superjet 100—now redesignated as the SJ-100—within India.

This collaboration marks India's re-entry into comprehensive civil aircraft manufacturing after a gap of nearly 40 years. Under the terms of the pact, HAL has secured exclusive rights to produce this 75- to 100-seat regional jet specifically for Indian carriers.

The initiative aims to strengthen the government's UDAN regional connectivity scheme by providing a locally produced alternative to foreign imports.

A Strategic Push for Regional Connectivity

The momentum for indigenous aviation solutions accelerated further during the 23rd India-Russia Summit on December 5, 2025.

Following the initial jet agreement, discussions expanded to include the joint production of the Ilyushin Il-114-300. This rugged, 68-seat turboprop aircraft is specifically designed for short-haul routes and is capable of operating from the shorter runways found in India's hinterlands.

These consecutive developments represent a strategic manoeuvre by New Delhi, intended to send a firm signal to the prevailing duopoly of Airbus and Boeing.

While these Western aerospace giants have benefited immensely from the surge in Indian air travel, they have remained hesitant to establish Final Assembly Lines (FAL) within the country.

With Indian carriers like IndiGo and Air India operating the world's largest combined fleet of Airbus A320neo aircraft, the Ministry of Civil Aviation is leveraging domestic production to compel these manufacturers to commit to local assembly or risk losing market share to subsidised, home-grown alternatives.

The SJ-100: A "Russified" Alternative

The SJ-100 is an evolution of the original Sukhoi Superjet, re-engineered to overcome previous supply chain challenges caused by Western sanctions.

The updated aircraft is powered by twin PD-8 turbofan engines, developed by Russia to replace the earlier Franco-Russian powerplants.

Offering a flight range of 3,500 km and modern fly-by-wire controls, the SJ-100 is positioned as a cost-effective competitor to the Airbus A220 and Embraer E190.

HAL is set to undertake the full assembly of these jets at its Nashik facility, which currently produces military trainers. By utilising existing infrastructure, HAL aims to scale production rapidly.

Furthermore, under the "Atmanirbhar Bharat" initiative, government subsidies could cover up to 40% of development costs.

This financial support is projected to reduce the unit price to approximately $25–30 million, making the aircraft a financially attractive option for low-cost airlines operating on the 500-plus underserved routes identified under the UDAN scheme.

Overcoming Historical Challenges

While the original Superjet faced criticism regarding its safety record and maintenance issues since 2011, the 2025 "Russified" variant addresses these concerns by replacing the complex international supply chain with reliable, domestically sourced components, including Aviadvigatel engines. Certification for the new variant is scheduled for December.

Industry reports suggest that IndiGo, which holds a 60% share of the domestic market, is in early discussions for a pilot order of 50 units by mid-2026. Such a move would revitalise HAL's civil aviation division and potentially generate 5,000 specialised jobs in Bengaluru and surrounding regions.

Complementing the jet is the Il-114-300, a modernised version of a Soviet-era utility aircraft. Equipped with Klimov TV7-117SM engines and digital glass cockpits, it is tailored for unpaved airstrips in difficult terrains like the Northeast and the Andaman and Nicobar Islands.

During the recent summit, Rostec CEO Sergey Chemezov proposed local production at HAL facilities if India commits to a fleet of over 100 units, offering full technology transfer.

With a price point of $17–18 million—roughly half that of an ATR-72—this aircraft could capture a significant portion of the regional market, currently served by ageing fleets.

Breaking the Western Monopoly

The introduction of these aircraft targets a market in urgent need of affordable regional connectivity.

Although India's passenger traffic grew by 15% in 2025 to reach 150 million, many Tier-2 and Tier-3 airports remain underutilised due to a lack of suitable aircraft.

Viability gap funding and subsidies could support the induction of 200 such airframes by 2030, forcing airlines to reconsider their reliance on exclusively Airbus or Boeing fleets.

Despite securing nearly $200 billion in orders from India over the coming decade, Airbus and Boeing have resisted requests to establish civil manufacturing lines in India, citing the need for even larger order volumes or warning of overcapacity risks similar to China's C919 program.

However, India's strategy to fast-track Russian platforms aims to circumvent potential sanctions (such as CAATSA) while maintaining pressure on Western manufacturers.

Strategic Autonomy and Future Diversification

This shift towards domestic production is driven by lessons learned from geopolitical volatility.

When sanctions halted the supply of spare parts to Russia and Iran, fleets were grounded, highlighting the risks of relying solely on Western duopolies.

The SJ-100 program's focus on import substitution ensures that Indian airlines can maintain operational sovereignty.

Simultaneously, India is diversifying its partnerships, with ongoing discussions involving Brazil's Embraer.

Talks at Aero India 2025 indicated potential co-production of the E175 regional jet, blending Embraer's aerodynamic expertise with Indian composite manufacturing capabilities.

This multi-pronged approach underscores India's determination to secure its aviation independence and reduce the long-standing dominance of Western manufacturers in its skies.

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Rise of the PLA Air Force Shaping China's National Security Strategy

Air Marshal (Dr) Diptendu Choudhury | January-March 2026

Source: Medals and Ribbons | https://medalsandribbons.com/wp-content/uploads/2025/12/Consolidated-MR-Jan_Mar2026-1-1.pdf

A 'deterrent air power' mass produced MiG 19s and MiG 21s

The PLAAF assumes importance not only as a major air power, both in size and growing capability, but as an increasingly potent instrument of national power in the India-China perspective, in Beijing's Taiwan priority and in the Indo-Pacific security construct. Considering the background of the 1962 Sino-Indian war, the on and off border skirmishes due unsettled border disputes, the Chinese hand in Sindoor, and the larger context of India's position in Asia and globally, the rise of the PLAAF assumes a serious military and strategic significance.

Early Years

The birth of Chinese air power thought goes back to Sun Yat-Sen, who with his exposure to Western air power thinking of Douhet and the American Billy Mitchell, believed in its need for the nation's security. The Nationalist leadership according to Zhang, invested in an air force in 1930s in the firm belief of its ability to bring isolated provinces under control, and because of the Japanese occupation of China's North East. Considering the heavy losses suffered in the war against Japan, where the Air Force strength reduced from seven hundred to eighty combat aircraft, the Soviet Union supported China with 885 aircraft over the next five years, and the USA provided 1394 aircraft from 1942 till the war's end. But the Air Force was unable to keep the Nationalists from losing control of the mainland to the Communists in the Civil war in 1949, and they fled to Taiwan. The Communist air force was thereafter built up using all the assets and infrastructure left behind by the Nationalists. Mao Zedong and the communist leadership never gave serious consideration to air power until victory against the Nationalists seemed possible in 1947. Given the need to bring Tibet and Taiwan under it, and the necessity of defending China from internal and foreign enemies, Mao remarked - "We must be devoted to the construction of an air force"

Initially because the PLA leadership did not want an autonomous aviation force, no consideration was given to creating an independent Air Force. Consequently, the initial leadership was from the Army without any experience in aviation, and the PLAAF organisation was mainly administrative as the focus was on Air Defence (AD) of its cities from the bombings by the Nationalist Air Force. In October 1950, the Central Military Commission formally established the PLA Air Defence Headquarters (HQ) to oversee all AD forces. However, the vulnerability to the bombings spurred the leadership to build its own Air Force and a team was sent to the Soviet Union, which aided with 434 aircraft and helped establish their pilot training In its first development plan between 1950 and 1953, the PLAAF established about 100 aviation regiments, repaired 100 airfields, the number of aircraft repair factories were increased and eleven more aircraft repair factories were set up. The training capacity was also expanded. During this period the PLAAF also took part in air operations in Tibet. From April 1950 to November 1952, it opened 25 navigation routes, undertook 1282 sorties of air drops from Chengdu and dropped 51 tonnes of load. It also undertook offensive missions against the Tibetan bandits' in Gansu and Sichuan regions using TU-2 bombers and La-9 fighters to drop 72 bombs and fired 1300 rounds of ammunition.

The Korean War

In the Korean war, the rapid increase in its size prompted General Vandenberg, the USAF Chief of Staff to announce with concern in November 1951, that China had become one of the world's major air powers. The original employment philosophy of the

PLAAF was support of ground troops, who were disadvantaged due to the US. control of the air and its technological superiority. It therefore chose a strategy of accumulated strength and concentrated employment, first by providing aerial protection of its logistic lines under the coordination of the experienced Soviet Air Force, and second by building airfields in Korea to enable direct close air support to its troops and launch full-scale air-operations. This strategy failed because the USAF bombarded North Korean airfields which prevented all hopes of forward deployment, and thereby providing direct support to its ground troops. Forced to operate only from airfields inside China, the PLAAF limited their strategy to air superiority in North-western Korea. Also, the limited AD centred Soviet Air Force approach and the limited range of its fighters restricted the scope of PLAAF operations to protection of its key communication lines, military and industrial assets in Korea and indirect support to ground forces." 8

The area berween the Yalu and Chongchon rivers was to become a dangerous place for the UNC aircraft and earned it the famous name 'MiG Alley." In the war, the PLAAF daimed to have shot down 330 UNC aircraft against 231 of their own. In contrast the USAF claimed exchange ratios varying from 10:1 to 14:1 in their favour, which are an exaggeration. More recent researches indicate that it was probably closer to 2:1, and the kill ratio between USAF F-86 and the Soviet MiG-15 to be even, possibly 1.3:1" The Communist air forces included the Soviets, North Koreans and the Chinese, of which the Soviets were definitely most experienced, but the technological advantage enjoyed by the UNC air forces and training played a significant role in the outcome of the air war. The key takeaway for Mao from this war was that air bombardment caused lesser casualties to his forces when compared with ground fire." This coupled with the inability of the PLAAF to provide air support to the ground forces, led to the firm belief that ground forces would prevail against stronger forces and the continuing emphasis of the PLAAF on AD. The heavy ground casualties inflicted by the USAF also brought in the realisation that aside from being one of the largest air forces, it needed to become a strong one.

The Taiwan Crisis & Vietnam War

13 By 1955, the Soviets provided support for the build-up of the PLAAF with 4400 aircraft, as well as trained the pilots and technicians. The lack of prior aviation experience and the extensive Soviet assistance meant that the PLAAF organisation, initial doctrines, tactics and training were similar. The focus was on AD, and support to land forces, as the concept of independent air operations or strategic bombing did not form a part of the PLAAF orientation. Post Korea, a series of transformations took place beginning with

the merger of the PLA AD with the PLAAF in 1957. The six Military Region Air Forces (MRAF) were renamed and aligned with the PLA Military Regions (MR). In 1958, the PLAAF was involved in the operations in the Taiwan strait crisis against the Nationalists, from mid-July till the end of October, during which period it claims to have flown 3778 sorties, fought 13 air combats, shooting down 14 aircraft and damaging nine, and said to have lost five and suffered damage on five aircraft. The USAF claimed to have fought twenty- five air combats, shooting down between 32 and 35 aircraft, damaged ten and lost four. The main outcome was that PLAAF had a permanent presence across Taiwan, which could no longer dominate the Chinese air space in the region. " In 1961, 14 the CIA supplied the Republic of China Air Force (ROCAF) with the U-2 high spy planes essentially to monitor China's nuclear testing These missions were flown as high altitude flights in subsequent years, during which PLAAF claimed to have shot down five aircraft berween 1962 and 1967, using the Soviet supplied SA-2 missiles.

The split with the Soviet Union in 1960 had a serious adverse effect on the PLAAF development, and with no other external support had to rely on self-reliance. The aircraft produced in this period were unreliable with many failures and crashes, with pilot and maintenance training having almost stopped. With lack of engines and spares, flying reduced by 41% in 1960 which continued till 1963." In 1962, China also fought a war with India, where the Indian Air Force was not brought into operations due to the perceived threat of escalation and the consequent possibility of PLAAF bombing Indian cities. The reality of the weak operational status of the PLAAF indicates that this was highly unlikely, because apart from other low serviceability and maintenance issues, the service was also adversely impacted by shortage of fuel." The political upheavals accompanying the Cultural Revolution between 1966 and 1976 stymied the growth of an independent PLAAF strategy and doctrine, while in the same period its size grew to fifty air divisions of which two thirds were short range fighters. Even though the PLAAF took part in the Sino-Vietnam War in 1979, in the month-long operations between February and March, it did not see any combat. It flew 8500 sorties of air patrols but nil ground support or air combat, as Deng Xiaoping did not want the war to escalate due to the use of air power. In the end it maintained that its air operations deterred the Vietnamese Air Force from engaging the PLAAF. This misplaced 'deterrent' view was to continue in the years to follow, as was evident in the continued production of obsolete platforms to maintain its numerical size. It manufactured over 4000 J-6 (MiG 19 variant) between 1980 and 1986 to maintain what it considered a 'deterrent' air power, "large but of legacy technology, and limited operational capability.

The Gulf War: Winds of Change

To the Chinese leadership, the definitive role and performance of the US-led military coalition in the Gulf War of 1991, was a turning point. The PLAAF closely examined the coalition's capabilities, warfighting tactics, and strengths, particularly those of the US during the Gulf War. According to Colonels Qiao Liang and Wang Xiangsui -"Only "Desert Storm" can provide ready-made examples when we try to use previous wars to discuss what constitutes war in the age of technological integration-globalization. It is still, in some ways, not just the only [excample], but the classic [exxample), and thus the only apple worthy of our careful examination. Fully aware of the inherent shortcomings, Deng assessed that the wars in the future would be local and limited and air dominance would be a critical necessity." His views prioritised the military spending on the Air Force to increase, while PLA's share came down from 18.5% in 1979, to 8% by 1989. But he also ensured downsizing of the Air Force to one third of its size by early 1990. Deng also advised the PLAAF that active defence concept must also contain an offensive element."

This triggered the PLAAF's modernization and transformation drive and led to changes in its organisational, technological, warfighting, training and doctrinal concepts. It has made similar strides in key technological areas such as precision-guided weapons and missiles, as well as combat aircraft. There was a clear focus on modernising its fighter fleet, moving away from the mainstay Soviet-era legacy platforms toward an inventory with a higher proportion of fourth generation and higher aircraft. This was primarily to counter the air threat posed by the US Carrier Strike Group (CSG) in the region, as well as to maintain control over air and maritime domains of interest. After years of struggling with access to advance technology which it overcame with copying and reverse engineering Western weapons and platforms, the Chinese military aviation industry today has built up significant developmental and production capabilities and has remained committed to self-reliance.

25 China's military capabilities have grown at an impressive rate since 2009, thanks to consistent increases in defence spending. Rising defence expenditure over the years has made the People's Republic of China (PRC) the world's second-largest military spender after the United States. Because the PRC government has been inconsistent in its reported defence spending, the official military budget provides an incomplete picture. It reported a defence budget of just under $178 billion in 2019, while the Stockholm International Peace Research Institute (SIPRI) estimated it to be $261 billion, which has grown to reach $314 billion in 2024. Based on available economic data and growth projections, the PRC can continue

to increase its defence spending for at least the next five to ten years, according to official defence spending figures. Its aviation industry has already displayed its sixth generation aircraft development capability along with development of the new generation bomber H 20, while its fighter production rate is estimated to be a staggering 240 platforms a yearl

Despite the total number of PLAAF fighters, multirole fighters, and ground-attack aircraft shrinking from 2453 platforms in 2007 to 2065 in 2025, it is the third largest Air Force in the world. China did not engage in major military conflicts in the 2010s, allowing the PLAAF to accept a decline in strength while waiting for more capable aircraft to become available. Today it operates mostly fourth and fifth generation fighters, with a similar story evident in its bomber force which is smaller than it was in 2007 but is much more capable. The PLAAF has increased both the overall numbers and the capability of its support aircraft fleet. Its inventory of fighters capable of long-duration, all-weather, long-range offensive missions with significant combat persistence is steadily growing. In effect, the PLAAF inventory is adapting to its anticipated future missions, which include its Taiwan mission, maritime interests in the East China Sea, South China Sea, and the larger Indo-Pacific construct, and, more recently, the Tibet Autonomous Region (TAR).

A Strategic Air Force

Post the Gulf War, the Chinese adopted a long-term vision of air power capability development over the following decades through systematic strengthening of the PLAAF. It focused on organisational transformation in the first decade of this century, while the focus in the second decade was on modernization, self-sufficiency, capability and capacity development. Since 2004, the PLAAF has used a service-specific strategic concept for offensive and defensive operations that integrates air and space. The Chinese leadership and the official state media have since endorsed the PLAAF as a Strategic Air Force. During a visit to the PLAAF HQ in 2014, President Xi Jinping emphasized 'accelerate the construction of a powerful people's Air Force that integrates air and space,' according to the need. And referred to the PLAAF as a "strategic service" capable of "playing a decisive role" in "the overall situation of national security and military strategy".

The PLAAF which was already growing in strength and stature, took on a larger role in the PRC's national interests. It also succeeded in expanding its presence and influence in the maritime domain, which had previously been the PLA Navy's (PLAN) exclusive domain. This allowed PLAAF to expand from the tactical role of mainland China's AD, to assume a much larger strategic role in support of the country's increasingly coercive foreign policy. The PLAAF has emerged as a tool for political signalling, coercion and harassment in recent years, while simultaneously expanding its operational capabilities, thanks to its persistent and aggressive actions. With its aggressive foreign policy, the PRC's maritime and aerial actions in the region have consistently shown little respect for international norms and a rules-based order. A 2023 reorganization transferred most PLAN land-based aviation units (including fighters, bombers, radars, airfields, and AD units) to the PLAAF, consolidating maritime strike and AD capabilities within one service. Gaining full responsibility for the coastal AD and maritime strike missions (and control of the PLAN personnel and equipment associated with those missions) has expanded the PLAAF personnel and force structure. This change also limited the need for cross-service cooperation at the tactical level, which posed difficult command and control challenges. At the same time, it embraced jointness at the operational level by forcing the PLAN to rely on the PLAAF to execute critical maritime strike missions.

A recent study summarises several larger reasons for the PLAAF's unprecedented growth. Rising defence budgets were one of the most influential drivers of force structure by offsetting higher procurement, operations, and maintenance costs of advanced aircraft. The progress of China's defence industry emerged as an extremely significant factor that eased common force modernization trade-offs, allowing the PLAAF to forge a new path of a high-tech and domestically produced Air Force. The PLAAF has significantly reduced, but not eliminated, its dependence on foreign suppliers. It managed the difficult trade-offs by choosing to wait for the domestic aviation industry to overcome 32 technology constraints and catch up with foreign producers. Beijing's grand strategy of avoiding conflict allowed the PLAAF to exercise patience in its force modernization decisions instead of having to procure expensive foreign systems or enormous quantities of available but less capable domestic systems. According to Anthony Cordesman, USA and China are now competing superpowers, and that China's growing military forces are developing to the point where they will be able to challenge the USA. He claims that the region has become a focal point for major country competition, and that the United States' strengthening of its Asia-Pacific military alliances has complicated regional security.

Conclusion

China has succeeded in transforming a large but legacy Air Force with old airframes, limited tactical capabilities, and out-of-date training into a modern, dynamic, technologically advanced, and increasingly well-trained aerospace force. There is no doubt that the PLAAF has gained significant strategic influence and is already capable of defending its First Island Chain. The deployment of a PLAAF-assisted maritime force inside the First Island Chain has alarmed both the US and its neighbours. The issues are not just about freedom of navigation but also about sovereignty. The inevitable extension of this capability to the Second Island Chain soon will undoubtedly challenge US power projection and have an impact on the Indo-Pacific region. The Chinese Air Force has now become a key part of China's defensive-offensive strategy, helping to protect not only the country's economic lifelines of trade and energy, but also its sovereignty and geopolitical interests.

The PLAAF's future growth trajectory as a significant player of the PLA's military capability is a serious future threat in India's larger security matrix, especially in the continental domain where the vertical dimension will play a defining role. Similarly, in the regional maritime power competition, land-based air power will be necessary along with carrier-based maritime power to secure the vertical dimension for greater control over oceans. China has already jumped ahead of the pack in terms of coercively using air power as a tool of foreign policy in the region. There are clear lessons for India from the PLAAF's use of air power to advance its national interests. While it has naturally focused on its seaboard and maritime spaces, it will soon shift its attention to the West and South to counter India's continental threat and to support and bolster it's currently constrained CPEC and BRI outreach westwards. Air power will continue to play a critical role in any conflict in the mountains, and future PLAAF capacity development goals in the TAR region will reflect this.

Space

Successful Accomplishment of Drogue Parachute Deployment Tests for Gaganyaan

20 December 2025

Source: ISRO | https://www.isro.gov.in/Gaganyaan_Drogue_Parachute_Deployment_Tests.html

ISRO has successfully completed a series of qualification tests for Drogue Parachutes for the development of deceleration system of Gaganyaan Crew Module at the Rail Track Rocket Sled (RTRS) facility of the Terminal Ballistics Research Laboratory (TBRL), Chandigarh, during December 18-19, 2025.

The deceleration system of Gaganyaan Crew Module comprises of a total of 10 parachutes of 4 types. The descent sequence begins with two apex cover separation parachutes that remove the protective cover of the parachute compartment, followed by two drogue parachutes that stabilize and decelerate the module. Upon release of the drogues, three pilot parachutes are deployed to extract three main parachutes, which further slow down the Crew Module to ensure a safe touchdown.

A crucial component of this system is the deployment of drogue parachutes, which play a pivotal role in stabilizing the Crew Module and also reducing its velocity to a safe level during re-entry.

The objective of this specific test series was to rigorously evaluate the performance and reliability of the drogue parachutes under extreme conditions. Both the RTRS tests on drogue parachutes were successfully conducted on December 18 & 19, 2025 achieving all the test objectives and confirming their robustness even under the situation of significant variation in flight conditions.

The successful completion of these tests marks another significant step toward qualifying the parachute system for human spaceflight, with active support and participation from the Vikram Sarabhai Space Centre (VSSC), ISRO, Aerial Delivery Research and Development Establishment (ADRDE), DRDO and Terminal Ballistic Research Laboratory (TBRL), DRDO.

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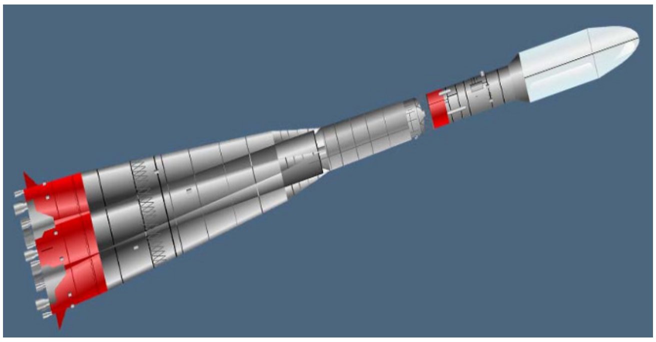
Shenzhou-22: China's First Crewed Spaceflight Emergency Response

Ajey Lele | 27 November 2025

Source: IDSA | https://www.idsa.in/publisher/comments/shenzhou-22-chinas-first-crewed-spaceflight-emergency-response



At present, two operational space stations host humans in orbit – the International Space Station (ISS) and China's Tiangong station. Both maintain a continuous human presence, with each group of astronauts usually staying for about six months. The spacecraft that transports them to the space station remains docked throughout their mission and later brings them back to Earth. Meanwhile, the incoming crew arrives (known as crew rotation) in a separate spacecraft, which then docks with the station, enabling a smooth crew handover.

For more than four years, the Tiangong space station has been operational and continuously occupied by humans. China has designed and developed a spacecraft, Shenzhou, to carry astronauts (taikonauts) to the space station. The first uncrewed flight of Shenzhou occurred in November 1999, while the first crewed mission (Shenzhou-5) launched on 15 October 2003.

During the 15th crewed Chinese spaceflight (Shenzhou-20) on 24 April 2025, three taikonauts were carried to the space station. About six months after Launch, on 31 October 2025, Shenzhou-21 delivered a replacement crew to the Tiangong space station. Shenzhou-20 was expected to return to Earth in early November 2025 in the Shenzhou-20 spacecraft. However, due to suspected damage to the Shenzhou-20 craft from space debris, the spacecraft's return was delayed. Finally, a decision was taken that Shenzhou-20 would not be used for the taikonauts' return journey. The recently launched Shenzhou-21 spacecraft carried the Shenzhou-20 crew back to Earth. They returned safely to the Earth on 14 November 2025. As a result, the Tiangong space station was left with three taikonauts on board and a damaged Shenzhou-20 spacecraft, with no rescue option available in the event of an emergency.

Usually, a spacecraft remains docked to a space station for two reasons: first, to return astronauts to Earth at the end of their mission (typically after 6 months); and second, to serve as a lifeboat in an emergency. Conditions such as fire, depressurisation, a potential collision with space debris or another satellite, or a critical system failure may require the crew to quickly board the docked spacecraft and undock to ensure a safe return to Earth. In some situations, astronauts may temporarily take shelter inside the spacecraft while the hazard is assessed. They may even conduct a spacewalk to repair damage and re-enter the station once it is deemed safe. A fully serviceable spacecraft docked to the space station, therefore, is a critical safety requirement for long-duration human spaceflight.

Since 14 November 2025, the crew aboard the Tiangong space station has been without a reliable safety net, as the docked Shenzhou-20 spacecraft has been damaged. This uncertainty lasted for about 12 to 14 days, until China launched the Shenzhou-22 spacecraft on an emergency mission. Shenzhou-22 successfully docked with Tiangong on 25 November 2025, and is expected to remain attached to the station until around April 2026 to bring the Shenzhou-21 crew safely back to Earth. Although launched without taikonauts, Shenzhou-22 carried medical supplies, spare parts, and equipment needed to repair the damaged Shenzhou-20 spacecraft.

Three years ago, a similar situation occurred with a Russian craft at the ISS. Russia had launched Soyuz MS-22 on 21 September 2022 to ISS with two Russian cosmonauts and one NASA astronaut. A micrometeoroid strike to this craft was detected on 14 December 2022, which is known to have damaged the spacecraft's external radiator and cooling system. Finally, after more than two months, Russia had launched Soyuz MS-23 as an uncrewed replacement on 24 February 2023. This was a more extended mission, and the crew, which had reached the ISS on board MS-

22, landed back on Earth on 27 September 2023. Incidentally, Soyuz MS-22 returned to Earth uncrewed on 28 March 2023 after some repairs.

NASA launched astronauts Sunita Williams and Butch Wilmore aboard Boeing's Starliner capsule to the ISS on 5 June 2024. The mission was initially planned to last for eight to nine days. However, after docking, the spacecraft experienced serious technical failures, including thruster malfunctions and helium leaks, and was eventually deemed unsafe to bring the crew back to Earth. As a result, the two astronauts remained on the ISS for around nine months. They finally returned to Earth on 18 March 2025, when NASA sent SpaceX's Crew Dragon spacecraft to bring them home.

These three events indicate how well China is prepared to handle space emergencies. This could be considered the first emergency mission in China's manned space programme. Yet mission managers were very clear about how to respond to a situation they were facing for the first time. After the problem with the Shenzhou-20 spacecraft was identified, Chinese authorities mainly remained silent, but they knew the procedures to follow, and ultimately they delivered.

Shenzhou-22 was initially planned for launch around April 2026, as the next crew rotation mission after Shenzhou-21. It is remarkable how quickly China was able to deploy a new spacecraft. Since 2021, China's Shenzhou missions have been sending trios of taikonauts to Tiangong for approximately six-month stays. Chinese safety protocols have always required a backup carrier rocket and Shenzhou spacecraft to remain on standby at all times. With the Shenzhou-22 spacecraft and its carrier rocket already positioned at the Jiuquan Launch Centre, also known as the Shuangchengzi Missile Test Centre, Chinese authorities carried out the emergency launch procedure in 15 to 16 days. Under normal circumstances, the standard launch preparation timeline for a Shenzhou mission is about 45 days.

Undertaking an emergency launch in such a short time speaks volumes about China's mission planning discipline, decision-making structures, and industrial capacity. It demonstrates very reliable supply chains. China is known to maintain a continuous production line of Shenzhou spacecraft and Long March-2F rockets. This rapid reaction suggests that China has well-established processes and contingency plans that allow it to keep essential units, subassemblies, and rockets assembled, tested, and on standby for rapid deployment. China has also developed a dedicated human-spaceflight launch complex at Jiuquan. In addition, the country operates four orbital launch sites and one commercial launch site, and can also conduct sea-based launches.

In 2025, China will have already carried out around 72–75 orbital missions by November. In comparison, the Indian space agency ISRO has conducted four rocket launches in the same period. This highlights the scale of investment China is making in its space programme. The emergency launch of Shenzhou-22 would not have been possible without trained personnel and the necessary logistical systems ready to respond in time. This indicates that China can quickly safeguard taikonauts and ensure continuous human-occupied space station operations, even during emergencies.

There has been considerable discussion about a possible space race between the United States (US) and China, particularly regarding which nation will first return humans to the Moon in the 21st century. Both countries are currently aiming for a 2030 deadline for this achievement. At present, both their space stations operate in Low Earth Orbit (LEO) at an altitude of 350–400 km, whereas the Moon is approximately 400,000 km away. Therefore, the successful rapid launch of the Shenzhou-22 mission cannot, by itself, be used as a measure of China's readiness to conduct a crewed lunar mission.

However, when this emergency response capability is considered together with rapidly progressing China's Lunar Exploration Programme, known as the Chang'e Project and their other investments in the domain of space, it suggests that China may indeed give the US 'a run for its money' in the competition to become the first country to land humans on the Moon in the 21st century.

India is currently developing programmes such as Gaganyaan, its human spaceflight mission to LEO, and it has ambitions to establish its own space station and send humans to the Moon by 2040. Clearly, India has much to learn from China's approach to conducting large-scale space missions.

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LVM3-M6 / BlueBird Block-2 Mission

19 Decembner 2025

Source: ISRO | https://www.isro.gov.in/LVM3_M6_BlueBird_Block2_Mission.html

The LVM3-M6 / BlueBird Block-2 Mission is a dedicated commercial mission onboard the LVM3 launch vehicle, which will launch the BlueBird Block-2 communication satellite of AST SpaceMobile, USA. This mission marks the 6th operational flight of LVM3.

LVM3, developed by ISRO, is a three-stage launch vehicle comprising two solid strap-on motors (S200), a liquid core stage (L110), and a cryogenic upper stage (C25). It has a lift-off mass of 640 tonnes, a height of 43.5 m, and a payload capability of 4,200 kg to Geosynchronous Transfer Orbit (GTO). In its earlier missions, LVM3 successfully launched Chandrayaan-2, Chandrayaan-3, and two OneWeb missions carrying 72 satellites. The previous launch of LVM3 was the LVM3-M5/CMS-03 mission, that was successfully accomplished on November 02, 2025.

In this mission, LVM3-M6 will place the BlueBird Block-2 satellite, into the Low Earth Orbit and is the largest commercial communications satellite to be deployed in Low Earth Orbit. It will also be the heaviest payload to be launched by LVM3 from Indian soil. The satellite is part of a next generation of BlueBird Block-2 communication satellites, designed to provide space-based cellular broadband connectivity directly to standard mobile smartphones.

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India's space programme in 2025: Technology, diplomacy and the road to Space Vision 2047

Manish Poswal | 12 Deecember 2025

Source: DD News | https://ddnews.gov.in/en/year-ender-2025-indias-space-programme-in-2025-technology-diplomacy-and-the-road-to-space-vision-2047/

The India's space programme marked a defining phase in 2025, combining major technological demonstrations, deeper global partnerships and a clear push towards long-term goals under Space Vision 2047. The Department of Space's year-end review shows a year focused not just on launches, but on mastering complex capabilities needed for human spaceflight, future space stations and a competitive commercial ecosystem.

Docking, Biology and in-orbit Experiments

A key breakthrough came with the SPADEX (Space Docking Experiment) mission, launched aboard PSLV-C60. Two spacecraft successfully docked and undocked in orbit, demonstrated power transfer and carried out circumnavigation experiments—capabilities essential for future space stations and crewed missions. The satellites docked twice in orbit, underscoring the maturity of India's autonomous rendezvous and docking technologies.

Another first was CROPS-1, India's initial space biology experiment on the POEM-4 platform. Cowpea seeds germinated and grew to the two-leaf stage in microgravity, providing early insights into plant growth systems critical for long-duration human missions.

POEM-4 itself completed 1,000 orbits, hosting 24 payloads from ISRO and private entities, including experiments in robotics, green propulsion, artificial intelligence and biological sciences, highlighting ISRO's emphasis on low-cost, shared access to space.

Solar Science and Earth Observation

ISRO released the first scientific datasets from Aditya-L1, India's solar observatory positioned at the Sun-Earth L1 point. The data, shared globally, offers insights into the Sun's photosphere, chromosphere and corona, strengthening India's profile in solar and space weather research.

On Earth observation, ISRO satellites played a role in agricultural planning by forecasting wheat production at over 122 million tonnes using satellite data and crop growth models. The launch of the ISRO-NASA joint satellite NISAR later in the year further elevated India's role in global Earth monitoring, with the dual-frequency radar satellite capable of tracking ground deformation, ice movement and natural disasters worldwide.

Launch Infrastructure and Propulsion Advances

The Union Cabinet approved the Third Launch Pad at Sriharikota, aimed at supporting next-generation launch vehicles and human spaceflight missions. Parallelly, construction advanced at the new SSLV Launch Complex in Kulasekarapattinam, designed to handle growing small-satellite launch demand.

ISRO marked its 100th launch from Sriharikota with GSLV-F15, while also achieving milestones in propulsion. These included hot tests of the semi-cryogenic engine power head, a 1,000-hour life test of electric plasma thrusters, and the first in-space restart of the C25 cryogenic stage during the LVM3-M5 mission—enhancing mission flexibility for heavier payloads.

Human Spaceflight Gathers Momentum

Human spaceflight remained central in 2025. ISRO conducted the first integrated air drop test of the Gaganyaan crew module parachute system, a critical safety milestone. In a historic first, Indian astronaut Shubhanshu Shukla flew to the International Space Station aboard the Axiom-04 mission, spending 18 days in orbit conducting microgravity experiments and public outreach, marking India's entry into ISS-based human research.

Complementing this were space medicine initiatives, analog missions in Ladakh's Tso Kar Valley, and a new framework agreement with SCTIMST to deepen research in astronaut health and biomedical systems.

Indigenous Technology and Industry Participation

India advanced its push for self-reliance with the delivery of its first fully indigenous 32-bit space-grade microprocessors—VIKRAM3201 and KALPANA3201—developed with SCL Chandigarh. ISRO also signed a technology transfer agreement to commercialise the Small Satellite Launch Vehicle (SSLV), opening the door for industry-led launches.

Private sector participation expanded further with the successful static test of the KALAM-1200 solid rocket motor developed by a startup, tested at ISRO facilities, reflecting the impact of recent space sector reforms.

Global Engagement and Future Vision

India assumed a leadership role in the International Charter on Space and Major Disasters, hosted the Global Space

Exploration Conference (GLEX) 2025 in New Delhi, and showcased its achievements at the International Astronautical Congress in Sydney.

Internally, the Department of Space held Chintan Shivir 2025 to refine strategies for implementing Space Vision 2047, which envisions an expanded human presence in space, stronger commercial participation and advanced scientific missions.

From docking experiments and space biology to human spaceflight and global collaboration, 2025 underscored India's transition from a launch-capable nation to a comprehensive space power—laying the groundwork for ambitious goals in the decades ahead.

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Aerospace Industry

Bangladesh Air Force Signs Agreement With Italy For Purchase of 12 Eurofighter Typhoon Fighter Jets

09 December 2025

[Source: Indian Defense News | https://www.indiandefensenews.in/2025/12/bangladesh-air-force-signs-agreement.html](https://www.indiandefensenews.in/2025/12/bangladesh-air-force-signs-agreement.html)

The Bangladesh Air Force (BAF) has taken a significant step toward modernising its aerial combat capabilities by signing a Letter of Intent (LOI) with Italy's Leonardo S.p.A for the procurement of Eurofighter Typhoon jets.

This agreement, finalised on 9 December 2025 at the Air Force Headquarters in Dhaka, signals a major enhancement of the BAF's frontline fleet with state-of-the-art multirole combat aircraft.

The signing ceremony was attended by key figures, including Air Chief Marshal Hasan Mahmood Khan, Chief of Air Staff of the Bangladesh Air Force, and Antonio Alessandro, the Italian Ambassador to Bangladesh.

Senior officials from the Bangladeshi armed forces and representatives from Leonardo S.p.A also took part, underlining the importance of the agreement in bilateral defence relations.

The LOI outlines the eventual delivery of Eurofighter Typhoon jets, which are poised to form a pivotal part of the BAF's next-generation combat capabilities. These jets are renowned for their versatility, advanced avionics, and multi-role operational strengths, making them well suited for Bangladesh's objective to strengthen national air defence and air superiority in a regional context.

This deal is closely aligned with Bangladesh's broader strategy to modernise its air force. The country currently operates a fleet of 212 aircraft, including 44 fighter jets, according to warpowerbangladesh.com, but seeks to advance its capabilities to be able to counter emerging threats and maintain strategic deterrence.

Earlier in April 2025, Bangladesh also took a decisive step toward diversifying its fighter aircraft inventory by forming an 11-member inter-ministerial committee. This committee, led by the BAF chief of air staff, is responsible for spearheading negotiations for the purchase of 20 Chinese J-10 fighter jets at a cost of $2.2 billion. The intent behind simultaneously pursuing multiple platforms reflects a strategy to build a versatile and robust air combat force.

The involvement of Leonardo, an established European aerospace and defence giant, further expands Bangladesh's defence partnerships beyond its traditional suppliers. The Eurofighter Typhoon, developed by a consortium including the UK, Germany, Italy, and Spain, is a highly respected platform known for its agility, advanced sensors, and weapons systems, capable of performing air superiority, ground attack, and reconnaissance missions.

By incorporating Eurofighter Typhoons into its fleet, the Bangladesh Air Force will gain access to advanced technologies such as AESA radar, integrated electronic warfare systems, and sophisticated weapons compatibility that enhance operational flexibility. This upgrade will contribute significantly to Bangladesh's air defence posture and regional power projection.

The strategic timing of this LOI comes amid increasing regional military modernisation and evolving security dynamics in South Asia. As neighbouring countries also enhance their air forces with new fighter jets and advanced military technology, Bangladesh's move to acquire Eurofighter Typhoons helps maintain a credible and balanced defence capability.

This agreement marks the start of formal procurement negotiations and possible future contracts that will likely include support infrastructure, pilot training, and maintenance packages, ensuring full operational effectiveness of the Eurofighter fleet once delivered.

The LOI between the Bangladesh Air Force and Leonardo S.p.A is a landmark development in Bangladesh's defence modernisation drive. It reflects a clear commitment to acquiring cutting-edge air combat systems that will significantly enhance the country's defence capabilities on multiple fronts. As negotiations progress, the integration of Eurofighter Typhoons alongside other air platforms will define the next era of Bangladesh's air force development.

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Moscow Approves HAL Koraput To Manufacture Su-57E Engines, Elevating India To Elite Fifth-Gen Jet Club With Russia, US, And China

Simonetta Di Pippo | 21 October 2025

Source: Indian Defense News | https://www.indiandefensenews.in/2025/12/moscow-approves-hal-koraput-to.html

The recent developments concerning the Su-57E fighter jet engine technology mark a significant milestone for India's aerospace and defence ambitions.

Following President Vladimir Putin's visit to New Delhi, Russia has reportedly granted India a Transfer of Technology (ToT) agreement, enabling Hindustan Aeronautics Limited (HAL) at Koraput in Odisha to manufacture the Izdeliye 177S engines.

This move positions India alongside Russia, the US, and China as one of the few countries with indigenous capability to produce fifth-generation fighter propulsion systems.

The engine in question, the Izdeliye 177S, is a highly advanced two-shaft, low-bypass turbofan engine equipped with thrust-vectoring control (TVC).

This technology provides the Su-57 with

exceptional low-speed and high angle-of-attack manoeuvrability, enhancing survivability and fuel efficiency during complex missions. Such attributes are critical for deep-penetration strike roles that modern air forces require for strategic advantage.

The ability to locally manufacture these engines not only supports the Su-57E platform but also has important implications for the Indian Air Force's (IAF) existing fleet, particularly the Su-30MKI.

With the 177S engine offering a potential thrust increase of 15–18 percent over the current AL-31FP engines, alongside improvements in reliability and life-cycle costs, it opens the door for future fleet-wide upgrades. This could significantly boost the combat effectiveness and maintenance efficiency of the IAF's frontline fighters.

Reports indicate that HAL Koraput's facilities will undergo audits starting in early 2026, followed by joint prototype engine integration with Russian assistance projected for 2028. Full serial production is anticipated by 2029, aligning these timelines with the expected induction of Su-57E aircraft and the flight testing milestones for India's indigenous Advanced Medium Combat Aircraft (AMCA) MK-1. This synchronisation is crucial to India's ambitions for self-reliance in next-generation fighter technology.

The ToT agreement is comprehensive, including not just manufacturing rights but full access to production drawings, process documentation, and test-bed methodologies.

This means India will gain mastery over the entire engine lifecycle management, from fabrication to maintenance. Such an arrangement far surpasses earlier, more restrictive technology sharing, where sensitive sub-systems were compartmentalised, limiting full operational autonomy.

One of the most noteworthy aspects of this technology transfer is the explicit inclusion of advanced manufacturing techniques. India will receive expertise in the production of single-crystal turbine blades, which are essential for high thermal efficiency and durability under extreme temperatures.

Also included are thermal barrier coatings that enable the turbine inlet to withstand temperatures near 1,800 degrees Celsius and fully integrated digital FADEC (Full Authority Digital Engine Control) systems with hydromechanical redundancy. These technologies represent a leap forward in indigenous engine manufacturing capabilities.

The integration of India's preferred indigenous weapon systems into the Su-57E platform is another key feature of the agreement. Russia has reportedly allowed the incorporation of India's Astra beyond-visual-range missiles and BrahMos cruise missiles.

This strategic flexibility enhances India's ability to tailor the fighter jet's offensive capabilities to its operational needs and strengthens synergy among domestic defence systems.

For India, this development is not merely about acquiring a new engine but also about building a technological foundation integral to the success of the AMCA program.

Propulsion has long been a critical bottleneck in India's quest for fifth-generation fighter design, and the access to such advanced engine manufacturing technology could unlock new indigenous advancements. This positions the country favourably in the global defence manufacturing landscape.

Altogether, the final handover of production autonomy to HAL will be phased, with initial stages closely supervised jointly by Indian and Russian teams.

Over time, as indigenous content thresholds are met and manufacturing maturity is achieved, HAL will assume full operational control. This measured transition ensures quality and reliability without compromising the stringent standards required for a fifth-generation fighter engine.

Russia's approval to transfer Su-57E engine technology to HAL Koraput is a watershed moment for India's defence industrial base. It not only enhances the IAF's current and future combat capabilities but also significantly advances India's status as a producer of cutting-edge fighter propulsion systems.

The move underscores the deepening defence cooperation between India and Russia and signals a new era of technological independence in the aerospace domain.

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DRDO RCI Invites Private Industry to Co-Develop Quantum Avionics for India's Future 6th-Gen Fighter Jets

Raghav Patel | 12 December 2025

Source: Defence.in | https://defence.in/threads/drdo-rci-invites-private-industry-to-co-develop-quantum-avionics-for-indias-future-6th-gen-fighter-jets.16226/

In a significant move that could redefine the future of aerial warfare, the Research Centre Imarat (RCI) of the Defence Research and Development Organisation (DRDO) has invited Indian private companies and start-ups to collaborate on the development of quantum-based avionic sensors.

These advanced technologies are considered the essential core of sixth-generation combat aircraft.

From Science Fiction to Strategic Reality

Quantum avionics represents a major technological leap beyond current fifth-generation fighter jet capabilities. While modern aircraft like the Rafale rely on Active Electronically Scanned Array (AESA) radars and electronic warfare suites, future air dominance systems will require superior performance.

The new quantum systems aim to provide pilots with near-perfect situational awareness even in the most hostile environments. This includes scenarios where GPS signals are blocked, communication lines are jammed, and traditional stealth features are compromised by enemy low-frequency radars.

This initiative aligns with the broader National Quantum Mission, under which the Indian government is actively funding deep-tech start-ups to achieve self-reliance in quantum technologies.

Three Pillars of the Quantum Revolution

RCI is focusing its development efforts on three specific quantum domains:

1. **Quantum Inertial Navigation:** This technology promises navigation accuracy within centimetres, even after flying for hours without satellite guidance (GNSS). This ensures that aircraft can operate effectively in "GPS-denied" zones.

2. **Quantum Magnetometry:** By detecting minute changes in magnetic fields, these sensors can identify submerged submarines or buried Improvised Explosive Devices (IEDs) from high altitudes, effectively turning a fighter jet into a powerful intelligence-gathering asset.

3. **Quantum Radar and Lidar:** Using the principles of quantum mechanics, such as entangled photons, these radars can detect "stealth" aircraft that are invisible to conventional radar systems.

According to recent industry developments, start-ups like QuBeats have already begun making strides in this sector, having reportedly secured grants under the ADITI 2.0 Defence Challenge to develop quantum positioning systems for the Indian Navy.

RCI aims to replicate and expand this success for the Indian Air Force.

The Challenge of Miniaturisation

RCI has already achieved success in developing laboratory-scale quantum accelerometers and magnetometers. These devices have demonstrated sensitivity levels far superior to the ring-laser gyroscopes currently used in the Tejas and Rafale aircraft.

However, the primary challenge lies in transforming these delicate laboratory instruments into rugged, compact units.

These sensors must be able to withstand the extreme conditions of aerial combat, including the intense vibrations and thermal stress of flying at speeds exceeding Mach 2 and executing 9g manoeuvres.

A New Era of Partnership

To address these engineering hurdles, RCI Director B.H.V.S. Narayana Murthy has opened the programme to the private sector through the Technology Development Fund (TDF) and Innovations for Defence Excellence (iDEX) initiatives.

Historically, DRDO projects were developed strictly within government laboratories. This new approach recognises that specialised expertise in areas such as silicon photonics, cryogenic cooling, and single-photon detectors often resides within India’s burgeoning start-up ecosystem.

Companies working with advanced materials, such as diamond NV-centres (Nitrogen-Vacancy), are being quietly approached for joint development partnerships.

Strategic Implications for AMCA and Beyond

The ultimate goal of this collaboration is to produce flight-worthy quantum sensor modules for integration into the AMCA Mk2 and future sixth-generation platforms, which represent the next phase of India's aerospace roadmap.

The operational benefits are profound. A quantum inertial navigation system is immune to jamming or "spoofing," providing Indian pilots with a "fly-through-denial" capability over contested borders.

Furthermore, the ability to detect stealth platforms using quantum radar would neutralise the technological advantage of adversaries operating advanced stealth fighters.

Industry sources indicate that RCI is prepared to fund up to 90 per cent of the development costs for selected partners.

This funding comes with a commitment to full technology transfer and a clear path to production, with the strict condition that all resulting technology—from the chip level to the final aircraft integration—must remain indigenous.

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"Communications dominate war; broadly considered, they are the most important single element in strategy, political or military."

- Alfred Thayer Mahan

The Centre for Aerospace Power and Strategic Studies (CAPSS) is an independent, non-profit think tank that undertakes and promotes policy-related research, study and discussion on defence and military issues, trends and developments in air power and space for civil and military purposes, as also related issues of national security. The Centre is headed by Air Vice Marshal Anil Golani (Retd).

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