



CENTRE FOR AEROSPACE POWER AND STRATEGIC STUDIES (CAPSS)

Forum for National Security Studies (FNSS)

AEROSPACE NEWSLETTER



DRDO Successfully Conducts Maiden Flight-Tests of Integrated Air Defence Weapon System

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“Mission Sudarshan Chakra - This mission will be research-based and developed entirely with indigenous technology”

*Shri Narendra Modi
Prime Minister of India*

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Opinions and Analysis

Golden Dome's Gamble: Can Industry Move Fast Enough to Matter?

John Borrego | 21 August 2025

Source: *War on the Rocks* | <https://warontherocks.com/2025/08/golden-domes-gamble-can-industry-move-fast-enough-to-matter/>



In 2019, China's military showcased a hypersonic ballistic missile reportedly capable of breaching existing anti-missile shields. The question facing U.S. strategic planners ever since has been simple but daunting. How do you stop weapons that fast, unpredictable, and affordable enough to be produced at scale?

One increasingly popular answer is the Pentagon's ambitious Golden Dome initiative. It would leverage orbiting interceptors and sensors to destroy missiles (ballistic, hypersonic, cruise, and even drones) at different moments of flight. In President Donald Trump's plan, Golden Dome would be fielded in roughly two to three years at an eventual cost of about \$175 billion. Converting an inspiring goal into reality poses enormous technical and organizational challenges.

While U.S. efforts have successfully

advanced missile tracking constellations, the interceptor layer remains the long pole in the tent. Gen. Michael Guetlein recently noted, "We've demonstrated the physics." Yet, questions remain.

Will the United States be able to produce interceptors at the volume and cost needed for the project to remain feasible? The challenge in this question will not be science, but the capability of the United States to surge manufacturing capability and production. The Golden Dome's architecture calls for three layers of defense (space, upper, and under). To build the architecture and systems necessary to meet this call to action, the United States must fuse the defense primes' integration discipline with the start-up company's speed. If industry works in silos, it will remain a science experiment.

My background is a blend of experience working for conventional primes and venture-backed startups. As a veteran of the aerospace and defense manufacturing industry, the company I work for has a vested interest in the future of hypersonic weapons, missile systems, and space-based interceptors. However, this article is not meant to champion a particular company or solution. Rather, it reflects my opinion of the broader challenges and opportunities facing the industrial complex of the United States when it comes to the challenge of the Golden Dome.

Golden Dome and the Future State of Think BIG.” Deterrence

The Golden Dome concept, a 21st-century iteration of Ronald Reagan’s “Star Wars,” envisions orbital interceptors positioned to destroy enemy missiles during their vulnerable mid-course phases. Unlike earth-based defenses, space-based interceptors could engage threats globally, theoretically creating a shield impenetrable even to hypersonic threats. However, such an orbital deterrent is inherently costly. While official White House estimates place the cost around \$175 billion, others warn it could exceed \$800 billion. Potentially hundreds of satellites, in multiple orbital planes, would be required to provide persistent coverage and tracking. For example, the Missile Defense Agency’s plans anticipate dozens of launches per year for space-based sensors, interceptors, and supporting platforms, as well as ground systems and test ranges.

Nevertheless, political momentum has solidified behind the concept, with presidential directives and initial funding signaling its seriousness. The solution demands not only new doctrine but a radical reshaping of the industrial base by embracing innovation, agility, and collaboration between established primes and agile startups. The Missile Defense Agency plans to leverage industry on a larger scale, pulling away from traditional Department of Defense Directive 5000.01 requirements, utilizing both defense primes and small businesses in an unprecedented fashion. By using non-traditional approaches, the official tagline for the project is “Go FAST,

History, however, counsels caution. Missile-defense systems have consistently exceeded original timelines: Ground-based Midcourse Defense was first fielded in 2004 and is only just transitioning into a Next Generation Interceptor in 2028. The SM-3 required years to mature, over a decade, from an early 2002 flight test to an intercontinental ballistic missile-class intercept in 2020. Even with cheaper rockets cutting costs by 30 to 40 percent, Golden Dome could demand a larger space-based fleet than planned, with 20-year costs estimated at \$160 to \$542 billion. Delivering such a large-scale system in just two to three years would be without precedent. The Missile Defense Agency’s own planning documents indicate a 10-year base contract and phasing reflecting that full deployment will be in tranches.

Exquisite but Inefficient

U.S. hypersonic interceptor development has historically focused on performance, leveraging materials like carbon composites and exotic high-temperature alloys such as tungsten. These materials withstand extreme heat but are expensive and complex to produce. Manufacturing relies on repeated high-temperature curing in scarce facilities, creating a slow, costly, low-volume process ill-suited for mass deployment.

Over a decade and \$12 billion in, America has yet to field an operational hypersonic weapon system. The Air Force’s Air-launched Rapid Response Weapon boost-glide missile

exemplifies these challenges: despite investment and testing, development delays and failures continue. Performance matters, but Pentagon planners now see scalability and affordability — long U.S. weaknesses — as strategic imperatives.

Russian and Chinese Agility

Moscow and Beijing prioritize speed, affordability, and mass production in hypersonic weaponry. Russia's Avangard glide vehicle and Kinzhal missiles employ proven technologies combined with advanced composite materials. By leveraging existing systems, Russia rapidly achieved operational status, fielding systems in Ukraine and elsewhere.

China's approach is even more instructive. Alongside advanced composites, Beijing recently announced a breakthrough that reportedly allows hypersonic missiles to use common stainless steel rather than rare metals like tungsten. By combining ultra-high-temperature ceramic coatings with innovative thermal insulation, China claims it can produce Mach 8-capable hypersonic weapons affordably and at scale. This development could dramatically reduce production costs, enabling a much larger arsenal compared to the American approach. America's focus on exquisite manufacturing techniques leaves us vulnerable to adversaries willing to trade elegance for scale and affordability.

America's adversaries project strength, but the U.S. government and industry should be clear-eyed about the threat. Patriot PAC-

3s have intercepted hypersonic and other advanced missiles in Ukraine and the Middle East, showing defenses can work in limited cases. The real challenge, however, will be mass salvos. China's Dongfeng-series missiles are built to overwhelm radars and command networks with simultaneous, multi-directional strikes. Such volumetric attacks will be the true test of U.S. missile defense readiness.

Don't Send a Ferrari to do a Ford's Job

The timeline that the president has called for is intense. To meet the call, the United States will need to trade some performance for what is manufacturable at speed.

For hypersonic vehicles, United States defense programs have historically relied on exotic non-metallic materials to survive the extreme heat and stress of Mach 5-plus flight. This in turn ensures top-tier performance at hypersonic speeds. The downside is that these exotic materials are difficult and slow to produce. In contrast, using more conventional metallic structures for hypersonic missiles promises faster, cheaper production, but comes with its own trade-offs. Most metals fail by exceeding melting points or yielding under thermal stresses at temperatures lower than the thermal loads a hypersonic airframe experiences.

The alternative is to take high-temperature alloys (such as nickel-based and refractory alloys) and apply a thermal barrier coating, so they survive hypersonic flight. Engineers can coat a metal airframe in ultra-high-temperature ceramic layers and add insulating

material underneath, creating a thermal barrier that keeps the underlying metal from overheating. This approach might sacrifice some performance (for instance, focusing on vehicles in the Mach 5–8 range instead of Mach 20), but it dramatically lowers costs and simplifies and speeds manufacturing.

Using metallic airframes has potential for many reasons, including an industrial base with expertise. Traditional aerospace parts have relied on metals shaped through machining, rolling, stamping, and hydroforming. Newer agile methods — like additive manufacturing and incremental sheet forming — expand capability and speed production. Combined with advanced joining (e.g., laser welding), they allow scale and agility even with harder-to-process materials like carbon composites. Digital tools, predictable supply chains, and known materials further reduce bottlenecks and ensure quality. Lastly, these processes have shown they can be automated, unlike high-performance, exotic materials, which present more challenges and further investment is required.

For U.S. defense planners, finding the right balance between cutting-edge composites and pragmatic metals will be crucial to building hypersonic arsenals that are both advanced and abundant. It is critical to rethink the model, just as the commercial space industry moved away from ultra-expensive launch systems in favor of cost-effective, reliable platforms.

Heritage Meets Innovation

To counter this industrial shortfall, the United States intends to look beyond legacy

aerospace companies. While defense giants like Lockheed Martin, Northrop Grumman, and Raytheon dominate hypersonic contracts, their traditional approach is insufficient alone.

For instance, companies like Stratolaunch, among others, are now participating in hypersonic testing and manufacturing efforts previously reserved for primes. SpaceX initially dominated discussions about Golden Dome’s orbital infrastructure. Yet, concerned about reliance on a single provider, the Pentagon has diversified, engaging with firms like Jeff Bezos’s Project Kuiper and newer launch providers to foster competition, innovation, and cost reduction.

Forging the Dome Through Strength

America’s ability to defend against next-generation missile threats depends less on singular “exquisite” weapons than on the industrial system that produces them. Building concepts like the Golden Dome will require more than ambition: It demands an industrial transformation that fuses experience with speed. Established defense giants bring integration expertise and scale, while newer firms contribute agility and fresh technologies.

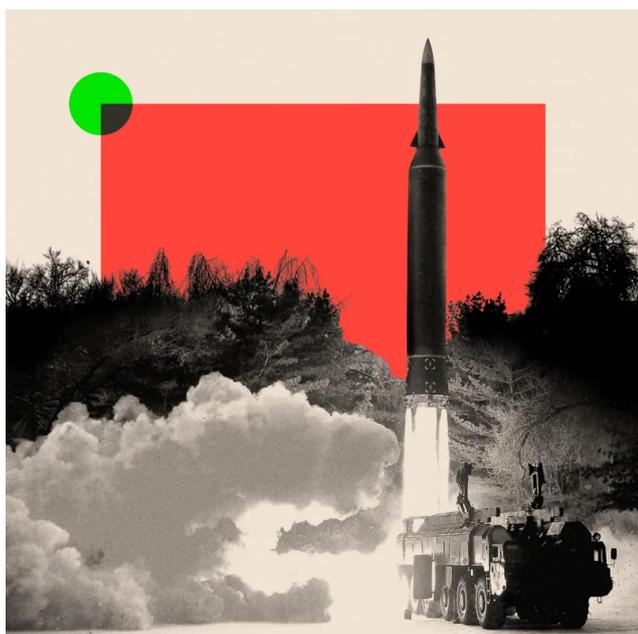
To connect these worlds, a third role is essential: translators, who stitch prime integration to start-up velocity and turn it into deployable capability. By rethinking how programs are managed, contracts structured, and architectures designed, the nation can unlock a more responsive, resilient, and affordable defense enterprise. Success will rest on whether the United States can leverage

its full measure of expertise and technological ingenuity into a unified engine of deterrence.

The Race for the Two Miles-a-Second Super Weapons that Putin Says Turn Targets to Dust

Frank Gardner | 22 August 2025

Source: [BBC](https://www.bbc.com/news/articles/cgeqj1q8gj4o) | <https://www.bbc.com/news/articles/cgeqj1q8gj4o>



Glinting in the autumn sun on a parade ground in Beijing, the People's Liberation Army missiles moved slowly past the crowd on a fleet of giant camouflaged lorries.

Needle-sharp in profile, measuring 11 metres long and weighing 15 tonnes, each bore the letters and numerals: "DF-17".

China had just unveiled to the world its

arsenal of Dongfeng hypersonic missiles.

That was on 1 October 2019 at a National Day parade. The US was already aware that these weapons were in development, but since then China has raced ahead with upgrading them.

Thanks to their speed and manoeuvrability – travelling at more than five times the speed of sound – they are a formidable weapon, so much so that they could change the way wars are fought.

Which is why the global contest over developing them is heating up.

"This is just one component of the wider picture of the emerging geopolitical contest that we're seeing between state actors," says William Freer, a national security fellow at the Council on Geostrategy think tank.

"[It's one] we haven't had since the Cold War."

Russia, China, the US: a Global Contest

The Beijing ceremony raised speculation about a possible growing threat posed by China's advancements in hypersonic technology. Today it leads the field in hypersonic missiles, followed by Russia.

The US, meanwhile, is playing catch-up, while the UK has none.

Mr Freer of the Council on Geostrategy think tank, which received some of its funding from defence industry companies, the Ministry

of Defence and others, argues that the reason China and Russia are ahead is relatively simple.

"They decided to invest a lot of money in these programmes quite a few years ago."

Meanwhile, for much of the first two decades of this century, many Western nations focused on fighting both jihadist-inspired terrorism at home, and counter-insurgency wars overseas.

Back then, the prospect of having to fight a peer-on-peer conflict against a modern, sophisticated adversary seemed a distant one.

"The net result is that we failed to notice the massive rise of China as a military power," admitted Sir Alex Younger, soon after retiring as chief of Britain's Secret Intelligence Service in 2020.

Other nations are also racing ahead: Israel has a hypersonic missile, the Arrow 3, designed to be an interceptor.

Iran has claimed to have hypersonic weapons, and said it launched a hypersonic missile at Israel during their brief but violent 12-day war in June.

(The weapon did indeed travel at extremely high speed but it was not thought to be manoeuvrable enough in flight to class as a true hypersonic).

North Korea, meanwhile, has been working on its own versions since 2021 and claims to have a viable, working weapon (pictured).

The US and UK are now investing in hypersonic missile technology, as are other nations, including France and Japan.

The US appears to be strengthening its deterrence, and has debuted its "Dark Eagle" hypersonic weapon.

According to the US Department of Defense, the Dark Eagle "brings to mind the power and determination of our country and its Army as it represents the spirit and lethality of the Army and Navy's hypersonic weapon endeavours".

But China and Russia are currently far ahead - and according to some experts, this is a potential concern.

Hyper Fast and Hyper Erratic

Hypersonic means something that travels at speeds of Mach 5 or faster. (That's five times the speed of sound or 3,858 mph.) This puts them in a different league to something that is just supersonic, meaning travelling at above the speed of sound (767 mph).

And their speed is partially the reason that hypersonic missiles are considered such a threat.

The fastest to date is Russian - the Avangard – claimed to be able to reach speeds of Mach 27 (roughly 20,700mph) - although the figure of around Mach 12 (9,200mph) is more often cited, which equates to two-miles-a-second.

In terms of purely destructive power, however, hypersonic missiles are not hugely

different from supersonic or subsonic cruise missiles, according to Mr Freer.

"It's the difficulty in detecting, tracking and intercepting them that really sets them apart."

There are basically two kinds of hypersonic missile: boost-glide missiles rely on a rocket (like those DF-17 ones in China) to propel them towards and sometimes just above the Earth's atmosphere, from where they then come hurtling down at these incredible speeds.

Unlike the more common ballistic missiles, which travel in a fairly predictable arc – a parabolic curve - hypersonic glide vehicles can move in an erratic way, manoeuvred in final flight towards their target.

Then there are hypersonic cruise missiles, which hug terrain, trying to stay below radar to avoid detection.

They are similarly launched and accelerated using a rocket booster, then once they reach hypersonic velocity, they then activate a system known as a "scramjet engine" that takes in air as it flies, propelling it to its target.

These are "dual-use weapons", meaning their warhead can be either nuclear or conventional high explosive. But there is more to these weapons than speed alone.

For a missile to be classed as truly "hypersonic" in military terms, it needs to be manoeuvrable in flight. In other words, the army that fired it needs it to be able to change course in sudden and unpredictable ways, even as it is hurtling towards its target at extreme

speeds.

This can make it extremely hard to intercept. Most terrestrial-based radars cannot be relied upon to detect hypersonic missiles until late in the weapon's flight.

"By flying under the radar horizon they can evade early detection and may only appear on sensors in their terminal flight phase, limiting interception opportunities," says Patrycja Bazylczyk, research associate at the Missile Defence Project at the Centre for Strategic and International Studies in Washington DC, which has received some of its funding from US government entities, as well as defence industry companies and others.

The answer to this, she believes, is bolstering the West's space-based sensors, which would overcome the limitations of radars on the ground.

In a real-time war scenario, there is also a terrifying question facing the nation being targeted: is this a nuclear attack or a conventional one?

"Hypersonics haven't so much changed the nature of warfare as altered the timeframes within which you can operate," says Tom Sharpe, a former Royal Navy Commander and anti-air warfare specialist.

"The basics of needing to track your enemy, fire at them, then manoeuvre the missile late on to allow for a moving target (the great advantage of ships) are no different from previous missiles, be that ballistic, supersonic or subsonic.

"Similarly the defender's requirement to track and either jam or destroy an incoming hypersonic missile are the same as before, you just have less time".

There are signs that this technology is worrying Washington. A report published in February this year by the US Congressional Research Service warns: "US defence officials have stated that both terrestrial and current space-based sensor architectures are insufficient to detect and track hypersonic weapons."

Yet some experts believe that some of the hype around hypersonics is overdone.

Is the Hype Overdone?

Dr Sidharth Kaushal, from the Royal United Services Institute defence think tank, is among those who think that they are not necessarily a gamechanger.

"The speed and manoeuvrability makes them attractive against high value targets and their kinetic energy on impact also makes them a useful means of engaging hardened and buried targets, which might have been difficult to destroy with most conventionally armed munitions previously."

But though they travel at five times the speed of sound or more, there are measures to defend against them - some of which are "effective," argues Mr Sharpe.

The first is making tracking and detection more difficult. "Ships can go to great lengths to protect their position," he adds.

"The grainy satellite picture available from commercial satellites only needs to be a few minutes out of date for it to be of no use for targeting.

"Getting satellite targeting solutions current and accurate enough to use for targeting is both difficult and expensive."

But he points out that artificial intelligence and other emerging technologies will likely change this over time.

Caution Around the Russia Threat

The fact remains that Russia and China have stolen a march when it comes to developing these weapons. "I think the Chinese hypersonic programmes... are impressive and concerning," says Mr Freer.

But he adds: "When it comes to the Russians, we should probably be a lot more cautious about what they claim."

In November 2024, Russia launched an experimental intermediate-range ballistic missile at an industrial site in Dnipro, Ukraine, using it as a live testing ground.

The missile, which Ukraine said travelled at hypersonic speeds of Mach 11 (or 8,439mph), was given the name 'Oreshnik', Russian for hazel tree.

President Vladimir Putin said that the weapon travelled at a speed of Mach 10.

Its warhead is reported to have deliberately fragmented during its final descent into several,

independently targeted inert projectiles, a methodology dating back to the Cold War.

Someone who heard it land told me that it was not particularly loud but there were several impacts: six warheads dropped at separate targets but as they were inert, the damage was not significantly greater than that caused by Russia's nightly bombardment of Ukraine's cities.

For Europe, the latent threat to Nato countries comes primarily from Russia's missiles, some of which are stationed on the Baltic coast in Russia's exclave of Kaliningrad. What if Putin were to order a strike on Kyiv with an Oreshnik, this time armed with a full payload of high explosive?

The Russian leader claimed this weapon was going into mass production and that they had the capacity, he said, to turn targets "to dust".

Russia also has other missiles that travel at hypersonic speeds.

Putin made much of his air force's Kinzhal (Dagger) missiles, claiming they travelled so fast it was impossible to intercept. Since then, he has fired plenty of them at Ukraine — but it turns out that the Kinzhal may not be truly hypersonic, and many have been intercepted.

Of concern to the West is Russia's super-fast and highly manoeuvrable Avangard. At a ceremony for its unveiling in 2018 – along with five other so-called 'superweapons' - Putin declared it was unstoppable.

Dr Sidharth Kaushal suggests its primary role may actually be "overcoming US missile defences".

"Russia's state armament programmes also suggest its production capacity for a system like Avangard is limited," he argues.

Elsewhere, as the contest for strategic supremacy in the Western Pacific heats up between the US and China, the proliferation of China's ballistic missile arsenal poses a serious potential threat to the US naval presence in the South China Sea and beyond.

China has the world's most powerful arsenal of hypersonics. In late 2024, China unveiled its latest hypersonic glide vehicle, the GDF-600. With a 1,200kg payload, it can carry sub-munitions and reach speeds of Mach 7 (5,370mph).

'Milestone moment' in the UK's rush to catch up

The UK is behind in this race, especially as it's one of the five nuclear-armed permanent members of the UN Security Council. But belatedly, it is making an effort to catch up, or at least to join the race.

In April, the Ministry of Defence and the Defence Science and Technology Laboratory announced that UK scientists had reached "a landmark moment" after the successful completion of a major testing programme.

The UK's propulsion test was the result of a three-way collaboration between the UK

government, industry and the US government. Over a period of six weeks a total of 233 "successful static test runs" were carried out at the NASA Langley Research Centre in Virginia, USA.

John Healey, the UK's Defence Secretary, called it "a milestone moment."

But it will still be years before this weapon is ready.

As well as creating hypersonic missiles, the West should focus on creating strong defence against them, argues Mr Freer.

"When it comes to missile warfare, it's all about two sides of the same coin. You've got to be able to do damage limitation while also having the ability to go after the enemy's launch platforms.

"If you've got both hands available, and you can both defend yourself to an extent and also counter attack... then an adversary is a lot less likely to attempt to initiate conflict."

However, Tom Sharpe is still cautious about the extent to which we should be concerned at the moment.

"The key point with hypersonics," he says, "is that both sides of this equation are as difficult as each other - and neither are perfected... yet".

Glimpses of China's New Air Combat Drones Emerge Ahead of Massive Military Parade

Joseph Trevithick | 17 August 2025

Source: TWZ | <https://www.twz.com/air/glimpses-of-chinas-new-air-combat-drones-emerge-ahead-of-massive-military-parade>



More imagery of Chinese 'loyal wingman' type drones, or at least mockups thereof, that are set to make their official debut at a major upcoming military parade has emerged. The uncrewed aircraft are just one part of a massive reveal of new capabilities around this event, some possibly aspirational, but some very real.

At least five different loyal wingmen drones, also now commonly referred to as Collaborative Combat Aircraft (CCA) by the USAF, had already been expected to be shown at the upcoming parade in Beijing, based on satellite imagery of the preparations that TWZ previously reported on. It is possible that some of the designs are higher-performance uncrewed combat air vehicles (UCAV) with enhanced degrees of autonomy, but that could still have collaborative capabilities. The GJ-11 Sharp Sword stealthy flying-wing drone, a centerpiece of Chinese UCAV developments to date, and lower-tier medium-altitude long-endurance (MALE) types will also be part of

the parade.

We can now see that one of the designs that will be shown at the parade, seen below, has a clear resemblance to the FH-97, which is at least heavily inspired by the XQ-58A Valkyrie from U.S. drone maker Kratos. However, the others do not readily align with known Chinese types.

Yesterday, a new image emerged offering a better look at one of the designs, which has a traditional wing and tail arrangement, as well as a top-mounted air intake. Another picture of this drone also began circulating online earlier today. As noted, it has distinct similarities to the FH-97, which was first shown publicly at China's Zhuhai Airshow in 2021. The angular shaping of the vertical stabilizers, in particular, very much aligns with the FH-97, as well as the XQ-58.

Comparisons have also been drawn to General Atomics YFQ-42A, which is now under development for the U.S. Air Force's CCA program, but that design has vertical stabilizers with a different trapezoidal shape.

It is worth noting here that the company behind the FH-97, Aerospace Times Feihong Technology Corporation, a subsidiary of the state-run China Aerospace Science and Technology Corporation (CASC), also presented a very different design dubbed the FH-97A in 2022. Unlike the FH-97, the FH-97A is a dead ringer for the MQ-28 Ghost Bat developed by Boeing's division in Australia. What we are seeing now might be a further addition to the FH-97 line.

Today, additional images emerged showing two of the other new drone designs, which are tailless with modified delta wings. One of the designs has a very slender nose in front of a significantly wider body, while the other (also seen in an image at the top of this story) has a broader nose and center section. Both of them are still under wraps, with details that could point to their engine layouts and other features obscured. Based on their sizes compared to the trucks carrying them, the two drones are significantly larger than the FH-97-esque design. The larger size of the drones also points to higher performance.

It's also worth noting that the drone with the broader design is highly similar, if not the same, as an airframe or mockup thereof spotted in satellite imagery of the Chinese plane maker Shenyang's main plant earlier this year, which TWZ was first to report on. However, it is not entirely clear from what we can see now if the wings on the two designs are exactly the same.

Two other drone designs seen in the previous satellite imagery of the parade preparations, which also appear to be tailless with modified diamond-like delta and cranked-kite wings, have yet to come into clearer view.

As TWZ has previously reported, all of this reflects China's clear pursuit of multiple CCA and/or UCAV designs for land-based use, as well as operations from aircraft carriers and big-deck amphibious warfare ships. The two-seat J-20S stealth fighter is also now routinely depicted acting as an airborne drone controller, a role TWZ has long highlighted as being ideal for the aircraft. The KJ-500 airborne early

warning and control aircraft is also regularly discussed as part of China's future crewed-uncrewed air combat ecosystem, and it has been suggested that the H-6 missile carrier aircraft could act as a launch platform for lower-tier tactical drones.

China has also secured a broader position as a global leader in advanced uncrewed aviation developments. What appears to be a very large, low-observable, flying-wing, high-altitude, long-endurance unmanned aircraft also emerged earlier this year, as TWZ was first to report.

Beyond CCA/UCAV-type drones, the upcoming parade, which will take place on September 3, will mark the 80th anniversary of the country's victory over Japan in World War II, is going to feature a variety of what Chinese authorities have referred to as "new-type combat capabilities."

On the uncrewed aviation front, what looks to be a new vertical takeoff and landing-capable drone will be on display. From what can be seen of the design so far, it may have a twin intermeshing rotor design. This is a rare configuration for helicopters, crewed or uncrewed. The Kaman Corporation in the United States is best known for producing designs with this configuration, including a pair of CQ-24 drone versions of the company's K-MAX helicopter, which the U.S. Marine Corps operated for a time in Afghanistan.

Imagery of the ongoing preparations shows that a number of new missile designs are also set to make their public debut. This includes

the YJ-17, which has a shape in line with past 'waverider' type hypersonic missiles, as well as the YJ-19, with a style of air intake often seen on designs with scramjet engines. Another design, labeled YJ-20, has a long conical-like shape that is very much in line with a mysterious missile seen being fired from what was said to be a Type 055 destroyer in a video that appeared online in 2022.

What may be a new intercontinental ballistic missile (ICBM), or another type of very large weapon with a ballistic-missile like capability, as well as other new ground-launched missiles, also look set to be unveiled at the parade.

Previously unseen very large uncrewed underwater vehicles (UUV) with torpedo-like shapes, as well as uncrewed surface vessels (USV), will also be showcased at the parade.

Images now circulating online also confirm that a number of new crewed tracked and wheeled armored vehicles will also be featured prominently in the parade. There had been speculation that at least one new armored vehicle design would break cover at the event after a video showing mysteriously unidentified vehicles concealed underneath large, box-like structures began circulating on social media in July. Some of the armored vehicle crew members seen taking part in the parade preparations are wearing headsets of a kind often associated with augmented reality vision systems. Uncrewed ground vehicles (UGV) will also be on display at the parade.

A variety of ground-based air and missile defense systems, including directed energy

weapons, will take part in the parade, as well.

It is, of course, important to stress that it is not immediately clear how many of the drones and other ‘new’ systems that will take part in the parade are actually operational or even close to being put into service. Mockups have been shown at many major Chinese military parades in the past. At the same time, in many cases, those designs have turned into very real capabilities, with the GJ-11 being one of the best-known examples. A stealthier iteration of the GJ-11 design was one of the big reveals at a parade to mark the 70th anniversary of the founding of the Communist state in China in 2019.

All of this reflects larger efforts by the Chinese People’s Liberation Army (PLA) to modernize its capabilities across the board. While the PLA retains a heavy regional focus, including around preparedness for a potential military intervention against Taiwan and enforcing China’s widely rejected territorial claims in the South China Sea, it has also been working to expand its ability to project power further and further abroad. The PLA’s nuclear deterrence capabilities and associated doctrine have also evolved significantly in recent years.

Altogether, Beijing looks set to make full use of the upcoming parade on Sept. 3 to send signals globally through the official debut of a host of new CCA/UCAV-type drones and many other advanced capabilities, big and small.

AMCA vs. KAAN vs. KF-21: India, Turkey & Korea’s Fighter Jets Battle for Air Supremacy—Who Leads the Pack? OP-ED

Air Marshal Anil Chopra (Retd) | 06 August 2025

Source: Eurasian Times | <https://www.eurasantimes.com/amca-vs-kaan-vs-kf-21-india-turkey-and-koreas/>



Turkish Aerospace and Indonesia’s Defense Ministry signed a deal for 48 KAAN 5th-gen fighter jets (Via X)

Fifth-generation fighter aircraft have been the flavour of all discussions in South Asia. A British Royal Navy F-35 fighter jet was stuck in Thiruvananthapuram, India, for 37 days after a mid-air emergency forced it to land on June 14.

It finally flew back to the UK on July 22.

It put into question the logistics-maintenance capability of the Western world and the top defence manufacturer, Lockheed Martin.

Amidst India’s Op Sindoor, Pakistan released a cat among the pigeons, announcing plans to acquire the Chinese fifth-generation

FC-31 aircraft by the end of 2025.

That sent Indian security analysts into a tizzy, suggesting interim options for the Indian Air Force (IAF). Sensing an opportunity, Russia offered its Su-57 “Felon” with full transfer of technology (ToT) and Make-in-India option.

China has inducted fifth-generation J-20 fighters in large numbers and is already flight-testing two sixth-generation fighters.

As President Trump unleashed a tariff war against India, New Delhi realised the uncertainty of the American defense supply connection.

Heat-of-the-moment statements were made by the Indian establishment rejecting the F-35 as a possible choice for the IAF. Meanwhile, informed media leaks indicated South Korea’s domestically developed KF-21 Boramae could emerge as a potential candidate for India’s Multi-Role Fighter Aircraft (MRFA) program, as New Delhi looked to address ongoing gaps in its combat air fleet.

In the past, Japan had invited India to join the sixth-generation Global Combat Air Programme (GCAP), a project to develop a sixth-generation fighter jet.

This trilateral effort, led by Japan, the United Kingdom, and Italy, aims to share the substantial costs and technological challenges of developing this advanced aircraft.

Meanwhile, European partners, France, Germany, and Spain, in the Future Combat

Air System (FCAS) sixth-generation fighter aircraft had been squabbling on work share, bringing uncertainty.

As Turkey pushes its TAI Kaan fifth-generation fighter, Pakistani technical teams are working closely on the program in Turkey, with the option of making it a possible joint program.

Turkey’s open support to Pakistan during Op Sindoor still reverberates in the Indian security establishment. It is interesting to compare the three stand-alone middle power programs, the Kaan, KF-21, and AMCA.

TAI TF Kaan

The TAI Kaan, also referred to as the TF “Turkish Fighter,” is a stealth, twin-engine, air superiority fighter designed to replace the Turkish Air Force’s fleet of F-16 Fighting Falcons.

BAE Systems has supported technology development and transfer. By the end of 2022, system functionality review (SFR) and system requirements review (SRR) were completed.

The prototype completed its maiden flight on 21 February 2024. Only one prototype has been produced to date. It was announced by TAI that the second prototype of KAAN is under construction and will fly in the last quarter of 2025.

In 2024, it was announced that Turkish corporations TÜBİTAK (aerial weapons and EW systems) and Aselsan (radar and avionics)

would support TAI in the development and construction of the aircraft. TAI's Advanced Carbon Composites fuselage facility, which was commissioned to produce fuselages for Lockheed Martin's Joint Strike Fighter (F-35) program, has been tasked with developing the fuselage.

Aircraft systems and capabilities include a domestic Integrated Radio Frequency System (IRFS), which includes the MURAD AESA nose radar with GaN-based transistors, electronic warfare capabilities such as wideband spectrum monitoring, directional jamming, and synthetic-aperture radar (SAR) imaging modes, including ISAR, dot-SAR, and strip-SAR.

The system also integrates cognitive operational mechanisms and neural network-based decision support systems.

The Integrated Electro-Optical System (IEOS) includes an Infrared Search and Track (IRST), an Electro-Optical Targeting System (EOTS), and a Distributed Aperture System (DAS) for global day/night imaging and an IR-Missile Warning System (MWS).

There is an Integrated Communication, Navigation and Identification System (ICNI), a Self-Protection Suite, an RF decoy dispensing system (CMDS), and a jamming system based on Digital Radio-Frequency Memory (DRFM). The Autonomous Wingman Operations (OKU) framework enables KAAN to control accompanying platforms, such as ANKA-III and Super-ŞİMŞEK, using encrypted data links.

The aircraft's computational systems provide capabilities for autonomous mission execution, task assignment to UAVs, and coordination with other platforms in air, land, and naval domains, as well as air defence systems.

The system allows for intelligence, surveillance, target acquisition, and reconnaissance (ISR), targeting, and air superiority tasks through collaborating aircraft and reduces the workload of on-board pilots. The aircraft is planned to have eight internal and six external (3 per wing) hard points.

Rolls-Royce offered technology transfer for the EJ200 engine and joint development of a derivative for the TF-X program. In May 2022, Turkey announced that it was imperative for them that the engine be produced in Turkey with intellectual property rights.

It was thus decided that ten General Electric F110 engines would be delivered to TEI as the first batch according to the agreement between Tusaş Engine Industries (TEI) and GE Aerospace for initial aircraft development.

On 2 July 2022, the Defence Industry Agency published the invitation to tender for the domestic development of the engine. It stated that TRMotor, which is a subsidiary of TAI, had submitted its proposal, and Turkish Air Engine Company (TAEC), a consortium by Kale Group and Rolls-Royce, will submit its offer soon.

On 15 January 2025, Haluk Görgün, President of the Defence Industry Agency,

said that after 2030, KAAN will fly with a completely domestic engine. On May 15, 2025, TEI, the Turkish state-backed aerospace engine manufacturer, published the first official image and technical data of the TEI-TF35000.

The next phase involves detailed design and qualifications carried out in the 2022-2029 period. The production of the first aircraft, called Block-0, will be completed in 2026, and the first flight will be accomplished in 2026-7. Until that date, TAI aims to manufacture three prototypes.

The Block-1 configuration is planned to be developed until 2029. The manufacture of 10 Block-1 fighter jets is planned within the scope of Phase-2, and the aircraft will be delivered to the Turkish Air Force between 2030 and 2033.

In Phase-3, between 2034 and 2040, development and mass production activities of other TF-X blocks are planned with the target of producing two aircraft a month. The aircraft may surpass \$100 million per unit.

In July 2023, at the 16th International Defence Industry Fair, a protocol agreement was signed to bring Azerbaijan into the project. On 22 July 2025, Turkey announced Egypt's participation in the Kaan program, including co-production of the aircraft. This agreement reflects a strategic shift and a focus on practical industrial collaboration between the two nations.

Indonesia signed a purchase contract for 48 KAANs on 26 July 25. The total order is

planned to be delivered with domestically produced engines in approximately 10 years. According to reports from Turkish media, the contract is valued at US\$10 billion. Turkey will provide cooperation in production engineering and technology transfers.

It has been claimed that Saudi Arabia is considering purchasing 100 KAAN fighter jets, and that the United Arab Emirates is also interested in KAAN. Ukraine's ambassador to Ankara had openly declared his country's interest in Kaan.

Turkey has offered Malaysia the opportunity to participate in the Kaan. Turkey and Pakistan are reportedly set to establish and operate a joint factory to produce the Kaan jet. The collaboration could be mutually beneficial, with Turkey gaining from lower production costs and Pakistan gaining access to advanced technology.

KAI KF-21 Boramae

The KAI KF-21 Boramae "Fighting Hawk", formerly known as KF-X, is a South Korean-led fighter aircraft development program with the initial goal of producing multirole fighters for the Republic of Korea Air Force (ROKAF).

The airframe uses stealth technology but carries weapons externally, and features such as internal bays will be introduced later with the KF-21EX program. It is South Korea's second domestic fighter jet development program, following the FA-50.

The program is led by the South Korean

government, which holds 60 percent of the program's shares. Indonesia took a 20 percent stake in the program in 2010 and has participated in the program through Indonesian Aerospace since the start of KF-21 development in 2011.

The remaining 20 percent is held by private partners, including the manufacturer Korea Aerospace Industries (KAI). In August 2024, Indonesia's stake was reduced to 7.5 percent at the Indonesian government's request.

In April 2021, the prototype was rolled out. The first test flight was on 19 July 2022, with manufacturing scheduled to begin in 2026. The six prototypes (including two two-seat) will be tested for performance verification.

At least 40 aircraft are planned to be delivered by 2028, with South Korea expecting to deploy 120 of the aircraft by 2032. It will also be available for export. The ROKAF will begin replacing its F-4D/E Phantom II and F-5E/F Tiger II jets with KF-21s. Later, F-16 Fighting Falcons and F-15EX Eagle IIs will also be replaced.

The initial goal for the program was to develop a single-seat twin-engine multirole fighter with stealth capabilities exceeding both the Dassault Rafale and Eurofighter Typhoon but less than those of the Lockheed Martin F-35 Lightning II.

Target is to be superior to the F-16 Fighting Falcon, with 50 percent greater combat range, 34 percent longer airframe lifespan, better avionics, active electronically scanned array

(AESA) radar, more-effective electronic warfare, and data link capabilities.

In May 2016, the U.S. government and Lockheed Martin tentatively agreed to transfer 21 technologies to KAI under the terms of offset trade, which is part of a contract for South Korea to introduce the F-35A.

Later, the US government blocked the transfer of four vital technologies: AESA radar,IRST, electro-optical targeting pod (EO TGP), and radio frequency jammer (RF jammer) technology. South Korea was required to develop these technologies domestically.

While KAI was the primary builder, numerous other domestic and foreign companies were contracted to provide aircraft components or support.

Several of these firms had worked with KAI on the T-50. For certain sensitive technologies, such as AESA radar, EO TGP,IRST, and RF jammer, foreign companies were only consulted for testing support and technical advice to avoid arms-trading restrictions.

Hanwha Aerospace signed an agreement with General Electric to manufacture General Electric F414 engines for the KF-X aircraft.

According to the contract, Hanwha is to manufacture key parts, assemble the engines locally, and oversee the installation of the engines on the aircraft. AESA radar was co-developed with Hanwha Systems under the leadership of Korea's Agency for Defence Development (ADD).

Elta Systems helped to test the demonstrative prototype hardware of the AESA radar. Saab provided technical advice to LIG Nex1, which develops Multi-Function Radar (MFR) software for AESA radars.

IRST is based on the processor unit (PU) designed by Hanwha Systems and a Leonardo sensor head unit (SHU) called the SkyWard-K with a modified back-end and Korean software that replaces the original program. US aerospace contractor Texstars was selected by KAI to develop canopy and windshield transparencies for KF-X.

Triumph Group was selected by KAI to provide airframe-mounted accessory drives (AMADs) for the KF-X. Cobham received contracts to provide missile ejection launchers, communications antennae, external fuel tanks, and oxygen systems. MBDA was contracted to integrate the Meteor beyond-visual-range air-to-air missile (BVRAAM) onto the aircraft.

Elbit Systems was contracted by Hanwha Systems to provide terrain-following/terrain avoidance (TF/TA) systems for the aircraft. There are many other technology vendors.

All six prototypes are already being used for flight testing. The aircraft has completed most of the basic flight testing, including supersonic flight, night refuelling, and all-weather and long-range operational capabilities.

KF-21 Block I will have air-superiority capabilities with limited air-to-ground functions and will have service entry in 2026. KF-21 Block II will be a swing-role fighter,

incorporating attack and reconnaissance capabilities and scheduled for deployment in 2028.

Blocks I and II are designed to function as advanced 4.5+ generation fighters, offering greater survivability through reduced radar cross-section (RCS), more sophisticated avionics, and relatively cost-effective performance compared to alternative platforms in their class.

KF-21 Block III will be developed as a 5.5+ generation fighter jet, featuring internal weapons bays, enhanced stealth through radar-absorbent materials, and upgraded AESA radar with next-gen avionics. It will support unmanned teaming, network-centric warfare, and improved situational awareness.

A domestically developed Korean engine is also planned to replace the current F414-GE-400, reducing foreign dependence. The aircraft can carry 7,700 kg external payload on 10 hard points. Weapons are mostly of Western origin.

The two-seat KF-21EA will serve as an electronic warfare aircraft comparable to the EA-18G Growler. The KF-21EX is a planned advanced variant of the KF-21 Boramae that aims to significantly enhance the jet's strike capability, survivability, and operational effectiveness, particularly within a manned-unmanned teaming (MUM-T) construct.

It will have an internal weapons bay. The aircraft will also receive several stealth-focused upgrades, including a reprofiled canopy, low-RCS radome, and new conformal

antennas, to improve its survivability against radar threats. KF-21N will be a carrier-based version of the fighter.

40 KF-21 Block I has been ordered, and deliveries are expected to be completed by 2028. 80 KF-21 Block II are planned to be ordered and delivered by 2032.

Indonesia's planned purchase of 48 aircraft is on track despite some hiccups. South Korea has been wooing India for the project. The Royal Malaysian Air Force (RMAF) is reportedly considering Russia's Sukhoi Su-57 and the KF-21 for its Multi-Role Combat Aircraft (MRCA) program.

KAI signed a Memorandum of Understanding (MoU) with the Peruvian Air Force Maintenance Service (SEMAN) to manufacture KF-21 fighter jet components in Peru. In 2024, the Philippines announced its interest in purchasing 40 jet fighters.

The KF-21 is currently being offered to the Polish Air Force, which has expressed interest in acquiring an additional 32 multirole fighters to strengthen its combat capabilities.

Potential Saudi involvement in the KF-21 fighter jet project has also been under discussion. In April 2025, the United Arab Emirates signed a letter of intent to further the cooperation on the program.

India's AMCA Status

The AMCA (Advanced Medium Combat Aircraft) program in India is considered urgent

due to the country's declining fighter squadron strength, the modernization of rival air forces, and the need to maintain a technological edge in air combat.

The program aims to replace aging aircraft and introduce a fifth-generation fighter, addressing both operational and strategic requirements.

The IAF is down to 29 fighter squadrons vis-à-vis the sanctioned strength of 42, and several more are scheduled for retirement in the coming years. IAF was forced to stretch the MiG-21 aircraft fleet, and the last of these squadrons will wind down mid-September 2025.

The IAF plans to induct a total of 120 AMCA. This includes 40 AMCA Mk 1 (partially stealth) and 80 AMCA Mk 2 variants.

The single-seat, twin-engine, fifth-generation stealth, multirole AMCA is being designed by the Aeronautical Development Agency (ADA), an aircraft design agency under the Ministry of Defence (MoD).

The AMCA is intended to perform a multitude of missions, including air supremacy, ground-strike, Suppression of Enemy Air defenses (SEAD), and electronic warfare (EW) missions. It is intended to supplant the Sukhoi Su-30MKI air superiority fighter, which forms the backbone of the IAF fighter fleet.

The AMCA design is optimized for low radar cross-section and super-cruise capability.

As of July 2025, the prototype development phase is underway after the completion of the feasibility study, preliminary design stage, and detailed design phase. The AMCA programme, originally launched in 2010 as a 20-tonne class fighter, is now a 25-tonne class fighter.

The design work was completed in 2023, and approval for the ₹15,000 crore (US\$1.8 billion) project for prototype development was received from CCS in March 2024. A total of 5 prototypes are to be built. The first three prototypes will carry out developmental flight trials, whereas the next two will focus on weapon trials. The prototype will be rolled out every 8-9 months.

The initial plan was to form a Special Purpose Vehicle (SPV) consisting of ADA, Hindustan Aeronautics Limited (HAL), and a private company for the development and production of AMCA.

At the Aero India 2025, a full-scale engineering model of the AMCA was publicly demonstrated for the first time. As revealed during the event, ADA had laid out a 10-year development roadmap from the phase that began in April 2024.

The prototype rollout is planned for late 2028 or early 2029, followed by the first flight in 2028, certification by 2032, and induction in 2034. Each prototype will cost ₹1,000 crore (US\$120 million).

Proposal for AMCA Industry Partnership Model

The government is yet to decide the production partner for the aircraft since ADA has proposed to hand over the responsibility to private sector companies rather than HAL, given the company's "not-so-great delivery track record".

Multiple meetings had been held, and HAL pushed for an additional assembly line dedicated to AMCA if required. Meanwhile, the government has shifted to an "industry partnership model" instead of the initial plans for SPV.

ADA's push for changing the production partner is to avoid any further delays following setbacks from development funding and a lack of clearance from the US government for license production of engines. The private sector partner would be responsible for development, production, and lifetime maintenance of the jet and the aero-engine.

The MoD formed a panel to examine increasing the role of private sector companies in the development of the AMCA. A top-level committee has evaluated a "clear-cut strategy and production-cum-business model" to accelerate the development of AMCA.

The committee is tasked with devising a plan to "shrink timelines" to get AMCA from drawing board to air, as well as the high-thrust indigenous engine development. On 27 May 2025, the MoD cleared the "Advanced Medium Combat Aircraft (AMCA) Programme

Execution Model”.

Under the model, the ADA will release an Expression of Interest (EOI) to develop AMCA through industry partnership. Both private and public sector companies can bid either as an independent entity or as a consortium or joint venture to get the contract.

As of now, the prototype rollout is expected by 2028-29, first flight by 2029, service introduction by 2034, and series production by 2035.

The HAL is reportedly set to evaluate responses from 24 companies to select a partner firm for the formation of a consortium. This consortium, structured under the public-private partnership (PPP) model, will subsequently bid to become the designated AMCA development consortium.

On 18 June 2025, the EOI was released by ADA, which is meant to shortlist Indian companies for prototype development, flight testing, and certification of the AMCA.

The document calls for “reputed” Indian companies that are compliant with Indian laws and are experienced in the aerospace and defence sector. The bidder has to establish dedicated facilities for the series production of the aircraft.

The bidder has to complete the development, prototyping, flight test, and certification of the AMCA within eight years of signing the contract. While the deadline of responding to the EOI is 16 August, before which a pre-EOI meeting is

scheduled.

AMCA Success Strategic Imperative

Both Kaan and KF-21 have flown, but the programs have their limitations. The timelines are not very favourable. They are very heavily dependent on Western technology and systems.

The French Air Force does not currently operate any fifth-generation fighter aircraft. The Dassault Rafale is a highly advanced, 4.5-generation fighter with some stealth features. This could be India’s interim model by acquiring more F-4/5 variant Rafale.

AMCA’s early success is a strategic imperative for India, enhancing its air combat capabilities and reducing reliance on foreign platforms.

The AMCA is meant to provide a technological advantage over adversaries and enable India to compete in modern air warfare. The program aims to reduce reliance on foreign technology and boost indigenous aerospace capabilities.

India must quickly decide on a major private player to be the lead integrator. The integrator must then form a consortium of private industries, as has been done in most programs around the world.

Meeting the projected induction timeline of the AMCA is crucial to address the operational gaps and maintain a credible deterrent.

In essence, the AMCA is not just a fighter jet project; it’s a national security priority that

requires swift and decisive action to maintain India's aerial dominance and strategic posture.

In the race for fifth-generation fighter supremacy, India's Advanced Medium Combat Aircraft (AMCA) stands out against Turkey's TAI Kaan and South Korea's KAI KF-21 due to its strategic emphasis on indigenous technology.

While all three programs reflect ambitious middle-power aspirations, the AMCA's focus on self-reliance offers unique advantages in a geopolitically volatile world.

Sky Grab: China's Ambitious Plans to Dominate the Orbital Internet Race

Y Nithyanandam | 25 August 2025

Source: [Money Control | https://www.moneycontrol.com/news/opinion/sky-grab-china-s-ambitious-plans-to-dominate-the-orbital-internet-race-13483960.html#google_vignette](https://www.moneycontrol.com/news/opinion/sky-grab-china-s-ambitious-plans-to-dominate-the-orbital-internet-race-13483960.html#google_vignette)



Liftoff of the Long March 5B from China's Wenchang carrying the first group of Guowang satellites. (Source: [Ourspace/Spacenews.com/File photo](https://www.ourspace.com/news/long-march-5b-liftoff))

China is racing ahead to wire the sky on its terms — and that should deeply concern anyone who values open information.

In just 22 days between late July and mid-August, Beijing launched 38 satellites across five separate missions. These were not weather or scientific craft, but the foundations of Guowang — China's answer to SpaceX's Starlink and other global competitors. Guowang, when translated, means national network.

What's Unfolding is not Simply Commercial Competition, but a Contest Over Who Shapes Global Information Flows.

Starlink has already transformed connectivity, with thousands of satellites in orbit providing internet access almost anywhere on Earth. Ukraine has depended on it to keep

communications alive during war, and remote villages from Alaska to Africa are online. For years, this quiet revolution has carried an American imprint.

China wants to redraw that map. Guowang plans to orbit some 13,000 satellites, with another project — Qianfan — aiming for 15,000 more. If both succeed, they will dwarf existing networks. But these are not just for the internet. Guowang satellites are far heavier than Starlink's, rumoured to carry synthetic aperture radars, optical sensors, and inter-satellite lasers. This is a dual-use network, civil in name but military-capable from inception.

Beijing has studied Starlink's wartime utility closely. The lesson was not just about replicating a business model but also about designing a system that doubles as national infrastructure and strategic weapon.

Starlink became military-relevant by accident. Guowang is built with that role in mind.

And this carries consequences far beyond China. Starlink has been resisted by authoritarian governments precisely because it undermines censorship regimes. Guowang offers them an alternative — internet connectivity consistent with state control.

In a world where governments can choose their satellite provider based on ideology, the divide between open and closed societies will harden both on Earth and in orbit.

The pace of China's build-out is equally

telling. To mount five launches in just over three weeks required a tightly coordinated industrial base: satellite factories, multiple rocket lines, launch sites, tracking stations, and range safety infrastructure working in sync.

This is the muscle of scale and resilience — the ability to replenish quickly in peace or war. Satellites in low Earth orbit are short-lived and vulnerable. The side that can replace them fastest holds the upper hand.

The genuine concern is not the existence of another global constellation — redundancy is healthy. The danger lies in the values embedded within it.

The internet that grew under democratic systems, however flawed, carried with it a bias toward openness. A system designed to privilege state power will make very different assumptions about speech, privacy, and access. Once nations buy into such infrastructure, switching is prohibitively expensive. Politics follows pipes — or in this case, satellites.

This is not a problem for the 2030s. At China's current pace, Guowang could have hundreds of satellites operational within two years and thousands by the decade's end. For this, China must work hard, as the Guowang program needs significant acceleration to meet its 2032 deadline for half the constellation. Similarly, Qianfan has launched only 90 satellites against its target of 648 by the end of 2025. If achieved as planned, each satellite is another brick in a new wall — or a bridge, depending on who controls it.

So, What Must Democracies Do?

First, call it what it is. This is not just commercial rivalry but a fight over the plumbing of the information age. Decisions taken 500 kilometres above Earth will dictate who can speak, listen, or cut others off.

Second, build credible alternatives. Satellite internet must be affordable and accessible in the developing world. Respect sovereignty but defend fundamental freedoms. If democracies don't provide an option, others will.

Third, expand launch capacity. SpaceX has revolutionised access, but no strategic domain should depend on one company or man. Spread capacity across allies, build surge potential, and prepare for rapid replenishment.

Finally, update the rules. Today's space laws were written for a world of hundreds of satellites, not tens of thousands. Without new agreements on traffic, spectrum, debris, and military behaviour, we risk collisions and an orbital cold war.

What once seemed improbable is now reality: Beijing is mounting a serious challenge to American and allied dominance in space. Sun Tzu advised shaping the battlefield before the first blow. That is precisely what a dense, dual-use, rapidly replenishable satellite constellation does — it sets the rules before the contest begins.

India cannot afford to sit this out. Our ₹1,200 crore earth observation push is a start, seeding sovereign capability and a private space

ecosystem. But this must be scaled with intent. For now, our satellite internet access depends on partners like Starlink. The geopolitics, however, are unambiguous. India needs its constellation — built on Indian terms — if it is to shape the skies rather than be shaped by others.

Why India Should Fund Ghatak-Based 50-Ton Manned Stealth Bomber Rather than Acquiring Easily Detectable Tu-160 'White Swan'

M S Chatterji | 28 August 2025

Source: [Defence.in](https://defence.in/threads/why-india-should-fund-ghatak-based-50-ton-manned-stealth-bomber-rather-than-acquiring-easily-detectable-tu-160-white-swan.15098/) | <https://defence.in/threads/why-india-should-fund-ghatak-based-50-ton-manned-stealth-bomber-rather-than-acquiring-easily-detectable-tu-160-white-swan.15098/>



A significant debate is emerging within India's strategic circles as defence analysts are advising the government to prioritise the development of an indigenous 50-ton manned stealth bomber over acquiring Russia's formidable Tu-160M 'White Swan'.

The core argument is that a domestically produced aircraft, evolved from the existing Ghatak stealth drone program, would provide a crucial strategic edge in modern warfare.

Such a platform, designed for covert operations deep inside enemy territory, is seen as vastly superior to the large, non-stealthy Russian bomber, which could be vulnerable to advanced air defence systems.

This proposal aligns with India's national

policy of self-reliance, known as 'Aatmanirbhar Bharat', aiming to secure the nation's technological independence and military strength.

The Offer: Russia's Tu-160M 'White Swan'

Russia, a traditional defence partner, has reportedly offered India its upgraded Tupolev Tu-160M strategic bomber to enhance the Indian Air Force's (IAF) long-range strike capabilities.

Known as the 'White Swan', the Tu-160M is the heaviest and fastest supersonic strategic bomber in the world, capable of flying at more than twice the speed of sound and carrying a massive payload of long-range cruise missiles.

Despite these impressive specifications, experts point to critical vulnerabilities that make it a questionable choice for India's current geopolitical landscape.

The primary concern is the bomber's lack of stealth. With a weight approaching 200 tons, the Tu-160M possesses a very large radar cross-section (RCS), making it easily detectable by modern surveillance systems from hundreds of kilometres away.

In a potential conflict, advanced air defence networks, such as the S-400 systems operated by China, could track and intercept the bomber long before it reaches its target.

Relying on such a high-profile foreign asset also introduces risks related to supply chain disruptions and limits India's autonomy

in upgrading and maintaining the fleet.

The Indigenous Vision: A Scaled-Up Ghatak Bomber

The proposed alternative stems from an existing Indian program: the Ghatak Unmanned Combat Aerial Vehicle (UCAV).

Developed by the Defence Research and Development Organisation (DRDO), the 13-ton Ghatak is a stealth drone built on a 'flying-wing' design, similar to the American B-2 Spirit bomber.

This design, combined with advanced radar-absorbent materials, gives the Ghatak a very low radar profile, making it ideal for penetrating heavily defended airspace for strike and surveillance missions.

It features an internal weapons bay capable of carrying 1.5 tons of precision munitions.

The vision put forward by analysts involves scaling this proven stealth design into a 50-ton manned fighter bomber.

This new aircraft would retain the essential stealth characteristics of the Ghatak while incorporating a much larger payload and range.

Such a platform would be specifically engineered to operate covertly behind enemy lines, striking high-value targets without being easily detected—a capability the Tu-160M cannot provide.

Strategic and Technological Advantages

Developing a homegrown stealth bomber offers several key benefits for India's national security and industrial base.

- **Superior Survivability:** The flying-wing airframe is inherently stealthy. This would allow the bomber to evade sophisticated enemy radar and air defence systems, ensuring a higher probability of mission success and safe return.
- **Powerful Payload and Reach:** Analysts suggest a quadjet design using four powerful 130kN engines, possibly derived from the engine being developed for India's Advanced Medium Combat Aircraft (AMCA). This configuration would enable the bomber to carry a diverse and heavy payload, including BrahMos-NG cruise missiles, Agni-1P ballistic missiles, and laser-guided bombs over extended distances.
- **Force Multiplication:** The bomber could operate in coordination with unmanned Ghatak drones through a concept known as Manned-Unmanned Teaming (MUM-T). In this scenario, drones could fly ahead to scout, jam enemy radar, or engage air defences, thereby increasing the safety and effectiveness of the main manned bomber.
- **Technological Self-Reliance:** By building upon technologies from the Ghatak and AMCA programs, India would retain full control over the intellectual property. This fosters a domestic ecosystem for advanced

aerospace manufacturing and ensures strategic independence from foreign suppliers. funding for both the unmanned drone and its proposed manned bomber derivative.

Challenges and The Path Forward

Transforming this vision into reality involves overcoming significant technical and financial hurdles. The project is estimated to require an investment of at least 15,000 crore.

A major challenge lies in developing the high-thrust jet engines required, an area where India has previously faced delays with its Kaveri engine program.

Furthermore, flying-wing aircraft lack conventional tails and rudders, demanding highly sophisticated flight control computers and software to maintain stability.

However, there is strong evidence of India's growing capability in this domain. In 2022, the DRDO successfully conducted flight trials of the Stealth Wing Flying Testbed (SWIFT), a scaled-down prototype of the Ghatak drone.

This success demonstrates that Indian engineers are mastering the complex aerodynamics and control systems associated with flying-wing designs.

The final and most critical hurdle is timely government funding. The main Ghatak UCAV program is reportedly awaiting formal clearance from the Cabinet Committee on Security (CCS), with a potential induction timeline in the late 2030s.

Experts urge the government to fast-track

Any delay risks widening the technological gap with regional adversaries like China, which is actively developing its own fleet of stealth aircraft, including the Xian H-20 bomber and GJ-11 Sharp Sword drone.

An indigenous stealth bomber would provide India with a credible deterrent, fundamentally enhancing its ability to project power and protect its interests in a complex region.

AIR POWER

Air Chief AP Singh on Op Sindoor: How unshackled Air Power & Controlled Escalation Fueled Decisive Victory

Air Vice Marshal Anil Golani

*Director General, Centre for Aerospace Power
and Strategic Studies | 14 August 2025*

Source: Economic Times | https://government.economictimes.indiatimes.com/blog/air-chief-ap-singh-unpacks-op-sindoor-the-role-of-air-power-in-indias-decisive-victory/123300356?utm_source=latest_news&utm_medium=homepage



*Chief of the Air Staff Air Chief Marshal AP Singh
addressing the 16th edition of the Air Chief Marshal
LM Katre Memorial Lecture, in Bengaluru.*

The Air Chief has spoken. As the dust seemed to gather steam in the Indian parliament and the narrative of downed jets refused to die down, Air Chief Marshal AP Singh, in a candid address during the Air Chief Marshal LM Katre Memorial lecture in Bengaluru on 09 Aug 2025 elaborately covered the IAF's operations during 'Op Sindoor.'

The debate on political will and clear and

unambiguous directions from the political leadership was also put to rest. While giving a detailed briefing on the number of PAF aircraft shot down, the damage inflicted on their radars, command and control centres, hangars and airfields with satellite imagery as irrefutable evidence the Air Chief exorcised the ghosts of Balakot.

After the Pulwama attack on 14 Feb 2019 in which 40 CRPF personnel had been killed, the IAF carried out 'Op Bandar' on 26 Feb 2019 carrying out an attack on the Pakistani terror training facility at Jabba Top. Questions were then raised on the efficacy of the IAF strike in the absence of verifiable satellite imagery and other proof. The narrative also shifted focus to the Indian Mig 21 getting shot down over PoK and the pilot being captured by Pakistan.

The statements by the IAF Chief and the present geopolitical construct need a considered analysis that would give us key insights and takeaways, not only for the utilisation of the military as an instrument of national power and the way ahead, but also for India to navigate its way in this tumultuous world.

"There was very clear political will, very clear directions that were given to us, and there were no kind of restrictions put on us." The Air Chief further went on to say that, "we, the armed forces, decided what will be the escalation ladder that we want to ride on. We decided how we want to control the escalation."

Air power works best when there are no

limitations placed on its employment. This fact if clearly understood by the political leadership would yield untold results as was evident during Op Sindoor. The IAF faced a near peer and professional adversary which was ready and waiting.

In these circumstances, the audacity and the sagacity of the military leadership in exercising restraint while administering the requisite degree of force to coercively deter the adversary merits consideration.

Offensive employment of air power includes air defence which otherwise might sound defensive. It was the air defence assets of the IAF, including the S-400 'Triumf' surface to air missiles that destroyed five PAF fighters and one large aircraft well inside Pakistan territory. The latter, according to the Air Chief, was "actually the largest-ever recorded surface to air kill by India." He called the S-400 a 'game changer'.

The centralised planning towards making this operation happen was instrumental in its success. According to the Air Chief, the discussions between the three service chiefs were facilitated by the CDS, who not only brought them all together but also ensured that it happened with great synergy and integration among the services. The National Security Advisor, Ajit Doval also played a major role in getting all the intelligence agencies and the service chiefs together.

If there is clarity within the political leadership while exercising control when they must and delegating when they need to, there

would be no reason for the military leadership to falter.

In this short, swift and intense conflict between India and Pakistan that lasted for 88-90 hrs from 07-10 May 2025, the IAF, used as the primary military instrument of choice, came out with flying colours. Shattering the myth of 'air defence' being 'defensive' and air power being escalatory, it reinforced the doctrinal precepts of the employment of air power as being offensive, while controlling the escalation ladder to its advantage.

Displaying maturity, the IAF leadership decided upon the targets and the Designated Mean Points of Impact (DMPI) for the air to surface stand off weapons, employed apart from the loitering munitions. In the largest ever face off between two professional and near peer air forces, there is no denying the fact that the IAF came out on the winning side leading to a cease fire that was accepted on its own terms.

While you can choose your friends, sovereign nations do not have the luxury of choosing their neighbours. Pakistan and China, both are here to stay and the possibility of any dialogue with Pakistan seems remote under the circumstances. Air power would be the instrument of choice, given its attributes of reach, flexibility, precision, lethality and the response.

Of course, the employment of air power is always contextual. But it needs to be noted that there hasn't been any other example of its use in the recent past where two near peer adversaries have got locked into combat with

each other.

While looking ahead at the integrated capability development of the armed forces, the nation would do well to ensure that this combat arm of the three services gets its due. With clear political objectives and a firm resolve to treat any terror attack as an act of war, the higher defence organisation including the military and the intelligence agencies need to work together in an integrated manner to achieve the desired results without any delay.

This is something that would have to be factored in while looking at the integration of the three services in the future. The planning and operational execution of the plans would require clearly delineated responsibilities that factor core expertise of the instrument of force being exercised and the operational role of the service chiefs should not get compromised.

The next crisis may not be similar, however, scenario building and gaming during peacetime while bracing for the future with keen attention to requisite capability build-up would certainly help the IAF to be better prepared in its response. "Train like you fight and fight like you train" the famous adage by the well known boxer, Mohammed Ali can only be ignored at one's own peril.

Flight Safety Through Airworthiness

Prof (Dr) GS Sachdeva | 06 August 2025

Source: CAPSS | <https://capsindia.org/flight-safety-through-airworthiness/>



The preliminary investigation report regarding the accident of Air India flight AI-171, relating to the crash of a Boeing 787 Dreamliner on June 12, 2025, has been made public. The report identified fuel starvation as the cause of the accident, resulting from the fuel release valves of both engines being closed. However, it has not been able to determine when or how it happened, who was responsible, or why. It is equally surprising that this state of fuel non-ingestion into the engines had not come to notice at the time of pre-flight servicing, or during the pilot's pre-flight checks, or the power run. Or did it happen after take-off on its own, despite spring locks?

This impugned process of shutting down fuel surely required positive action, whether advertent or inadvertent. However, apart from insinuations regarding transparency and intent, the preliminary report has presented half-baked conclusions, with the needle of suspicion pointing at the pilots. It leaves more profound questions unanswered. Possibly, a detailed report of the accident investigation will, in due course,

reveal more substantiated facts and pertinent details about the critical fault activity and the actual activator. Nevertheless, mudslinging has begun, and the Indian Pilots' Federation intends to sue the United States (US) media for allegedly motivated leaks and an unfounded blame game, in the interest of the manufacturers. Indeed, the cover-up does not appear foolproof and Indian officials have rebutted foreign media claims.

On the Indian side, early newspaper reports and some leaked rumours, albeit unconfirmed, point towards a corporate syndrome of Operations dominance and suppression of maintenance stakes due to an obsession with achieving and sustaining punctuality in flight services in a competitive market. Although this aim is laudable, it could impose a high cost. Maintenance of aircraft at all stations, pre-flight checks, periodic servicing and life-based overhauls are all important and deserve Six Sigma quality assurance. Isolated instances of rectification of glitches in aircraft, aeroengines or rotables may take longer than the scheduled time in servicing or testing. This does not need to be rushed to enable the aircraft to continue operations or rejoin the operational fleet by the due date. Spare capacity and cushions in operations can always be accommodated without disrupting the routine of maintenance mandates and technical standards.

It is a well-known fact that various issues have plagued the Boeing 787 fleet since its operational life began in 2011. The most memorable one relates to the lithium batteries causing a couple of electrical fires due to the alleged manufacturing defect. Even technical problems due to structural and

manufacturing defects were reported, which resulted in multiple groundings and safety checks worldwide. An insider at Boeing, John Barnett, who worked as a quality manager for 30 years, revealed that production workers, under pressure, have been fitting substandard parts, including ones retrieved from the dustbins. This seems an alarming concession. He has further claimed that he "had uncovered serious problems with oxygen systems."

Another whistleblower, Sam Salehpour, a Boeing engineer, expressed safety concerns in 2024 and cautioned that "Boeing should ground every 787 Dreamliner jet worldwide." The voiced concerns led to the ordering of an investigation by the Federal Aviation Administration, which is currently underway. In another incident, two flight attendants refused to change their reports about a technical problem with the door of a Boeing 787 that occurred during AI-129 flight on May 14, 2024, at Heathrow Airport. Allegedly, the Dreamliner's door malfunctioned; although the slide raft was deployed, the door opened in "manual mode" when it should have opened in "armed mode." When the cabin crew refused to change their reporting, they were dismissed in two days.

The crux of all this is that the airworthiness of aircraft, though sacrosanct and a sacred trust of air technicians, has been compromised at times for various reasons or purposes. In the ethics of aircraft maintenance, such shortcuts should be taboo because the serviceability and safety of the aircraft, with *abundanti cautela*, reign supreme, and no supervisory staff should become accomplices to any incorrect

practices. This methodology of compromises and “jugaad” will ultimately lead to sorrow for the perpetrator and to many other innocents. Regrets will then be insufficient, and the sin would be unpardonable.

The duties of the Director General of Civil Aviation (DGCA) are legislated with regard to airline operations, aircraft maintenance, air traffic management, and other related matters. This authority can rightfully demand and enforce proper oversight to ensure strict compliance. Deficiencies in this task and derelictions by the DGCA staff may have tragic consequences. Technical alerts should not only be issued but also complied with and acted upon for the safety of passengers, on-board crew, the aircraft, and those on the ground. This calls for cooperation from all duty-bound personnel and other stakeholders, who should be willing to provide their input voluntarily in their own interest to prevent accidents. Needless to mention, air accidents result in economic losses for the aircraft and its products, reputational embarrassment for the airline and manufacturer, liability payouts to passengers, and operational disruptions. Hence, the creed of airworthiness of aircraft deserves to be respected by all.

Pentagon Blocking Ukraine Long-Range Missile Strikes on Russia: Report

Ellie Cook | 24 August 2025

Source: News Week | <https://www.newsweek.com/pentagon-block-ukraine-long-range-missile-strikes-russia-2118425>



Pete Hegseth, U.S. Secretary of Defense, in Washington, D.C. on July 14, 2025. Kay Nietfeld/picture-alliance/dpa/AP Images

The Department of Defense has been blocking Ukraine from using long-range missiles to strike deep into Russian territory, according to a new report.

Why it Matters

Ukrainian use of long-range missiles has long been a thorny issue for the U.S., although the Joe Biden administration finally greenlit Kyiv's use of American Army Tactical Missile System (ATACMS) missiles as it left office last year. ATACMS have a range of roughly 190 miles.

Kyiv had long clamored for permission to use long-range Western weaponry far across the border. Ukraine instead turned to its homegrown drones to strike hundreds of miles

into Russian territory.

What to Know

Elbridge Colby, the Pentagon's policy chief, developed a review process to decide whether Kyiv would be able to fire long-range Western weapons into Russia, the Wall Street Journal reported on Saturday, citing anonymous U.S. officials.

The review, which came into effect in the "late spring," covers both U.S.-made kit like ATACMS and weapons donated by Kyiv's European backers that hinge on U.S. support to be used effectively, according to the report.

Ukraine previously said the restrictions on long-range strikes constrained its ability to fight Russia and to defend itself. Two officials told the outlet that Kyiv had attempted to use ATACMS against Russia, but was rebuffed on at least one occasion.

The decision on whether Ukraine could use these missiles ultimately falls to Defense Secretary Pete Hegseth, the Journal reported.

"Secretary Hegseth is working in lockstep with President Trump," Karoline Leavitt, the White House press secretary, said in a statement.

"President Trump has been very clear that the war in Ukraine needs to end. There has been no change in military posture in Russia-Ukraine at this time."

Newsweek could not independently verify the report, and the Pentagon declined to comment. Newsweek has reached out to the

White House and the Ukrainian military for comment.

Trump has flip-flopped in his feelings on Ukraine, the administration swinging from authorizing a pause in intelligence flow to Kyiv earlier this year to approving more weapons for the country via other NATO members.

Trump said earlier this week it is "very hard, if not impossible, to win a war without attacking an invader's country." Before taking office, he said in December he disagreed "very vehemently with sending missiles hundreds of miles into Russia."

The administration has been reluctant to strong-arm the Kremlin in peace negotiations, although Trump on Friday suggested he could resort to "massive sanctions or massive tariffs" on Russia if progress toward an agreement isn't quickly reached.

Ukraine signed up to a U.S. ceasefire proposal back in March. Russia refused to consent, and has since offered little indication it will move on its demands while resisting confirmation of a direct meeting between Russian President Vladimir Putin and Ukraine's leader, Volodymyr Zelensky.

The operators of a Russian nuclear power plant in the country's western Kursk region and the region's governor said in posts to messaging app Telegram early on Sunday that Russian air defenses had intercepted a Ukrainian drone close to the site shortly after midnight local time. Kursk borders northeastern Ukraine.

The Ukrainian drone detonated as it fell, damaging an auxiliary transformer and sparking a fire, the station in Kursk said. There were no casualties, but one of the reactors was working at 50 percent capacity, the nuclear plant said, adding radiation levels hadn't changed.

Alexander Khinshtein, the acting governor of the Kursk region, shared a similar statement. The United Nations' nuclear watchdog said it was aware of reports that a transformer at the Kursk site had caught fire "due to military activity," but said it could not independently verify the information. In a later update, the IAEA said it confirmed that radiation was normal around the site.

Ukraine's military said early on Sunday had attacked the Ust-Lega sea terminal in Russia's western Leningrad region, which it described as "one of the key logistics hubs" for the Kremlin's operations in the Baltic Sea and tied to Moscow's profits from energy exports.

Kyiv said it had also targeted "a number of logistics facilities" in Russia's Belgorod and Voronezh regions, which border Ukraine, as well as an oil refinery in the country's Samara region.

Ukraine has consistently targeted sites linked to Russian oil and gas, saying it hopes to cut off Moscow's access to resources that prop up its war effort.

What People are Saying

President Donald Trump said on Thursday, referring to fighting a war without being able

to strike the enemy's own soil: "It's like a great team in sports that has a fantastic defense, but is not allowed to play offense."

What Happens Next

It's not clear how quickly U.S.-brokered efforts to reach a peace deal will move, with months of slow progress frustrating the White House.

Sudarshan Chakra Air Defence System Completes Successful Maiden Test

Manu Pubby | 25 August 2025

Source: *Economic Times* | https://economictimes.indiatimes.com/news/defence/sudarshan-chakra-air-defence-system-completes-successful-maiden-test/articleshow/123489550.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

India has carried out the first firing tests of a new Integrated Air Defence Weapon System (IADWS) that consists of missiles and high-powered lasers to take down enemy air threats. The multi-layered system is designed to defeat threats ranging from incoming aircraft and missiles to drones using different weapons that can be engaged simultaneously.

The new system will be part of the Sudarshan Chakra project announced by Prime Minister Narendra Modi earlier this month from the Red Fort and will in the future integrate long-range interceptors capable of taking down ballistic missiles as well.

Officials said on Friday that IADWS was tested off the coast of Odisha and three different targets - two high-speed fixed wing unmanned aerial vehicle targets that simulated incoming fighter jets and a multi-copter drone - were simultaneously engaged and destroyed completely.

"IADWS is a multi-layered air defence system comprising all indigenous quick reaction surface-to-air missiles (QRSAM),

advanced very short range air defence system (VSHORADS) missiles and a high-power laser-based directed energy weapon (DEW)," they said.

A Centralised Command and Control Centre developed by Defence Research & Development Laboratory was at the heart of the system, linking the VSHORADS and DEW that have been developed by Research Centre Imarat and Centre for High Energy Systems and Sciences respectively.

Officials added the targets were destroyed at different ranges and altitudes to check the effectiveness of the system. "All the weapon system components including the missile systems and drone detection and destruction system, weapon system command and control along with communication and radars, performed flawlessly which was confirmed by Range instruments deployed to capture the flight data," they said.

DRDO is also working on a long-range air defence system under Project Kusha, which would be capable of taking on aerial threats at a distance of over 400 km. Being developed in partnership with the private sector, Kusha will also be integrated into the IADWS.

Following the successful test, defence minister Rajnath Singh complimented DRDO, the armed forces and the industry for the successful development of IADWS and said that the new system will strengthen area defence for important facilities.

Australia, Partner Nations Project Air Power in Exercise Talisman Sabre 2025

Atul Chandra | 06 August 2025

Source: Halldale.com | <https://www.halldale.com/defence/australia-partners-project-air-power-talisman-sabre-2025>



A RAAF F/A-18F Super Hornet beside a USAF KC-135 tanker as it refuels a RC-135W over the Northern Territory during TS2025. Source: Australia Department of Defence

Australia and partner nations participating in Exercise Talisman Sabre 2025, showcased their ability to project airpower with a total of 279 aircraft, flying over 5500 flight hours and 2000 sorties (peaking at 200 sorties daily), over a two-week period.

TS 2025 concluded on July 27 bringing together over 40,000 personnel from 19 nations.

The 11th iteration of the biennial large-scale military exercises took place across Queensland, Western Australia, South Australia, the Northern Territory, New South Wales, Christmas Island and, for the first time, Papua New Guinea.

The participating forces trained on a wide range of complex missions including integrated air and missile defense, anti-submarine warfare, multi-domain strike operations, base response drills, force projection, and distributed logistics and mobility.

In a Defence release, Commander Air Task Group 640.7 Air Commodore Louise desJardins said Talisman Sabre was not just about flying aircraft. “Talisman Sabre gave us a chance to train in a high-end, realistic environment where we tested our skills, teamwork and technology under pressure.” He added, “It was a powerful demonstration of how Air Force contributes to Australia’s defence – by projecting air power as part of an integrated force – alongside our international partners and colleagues in the land, sea, cyber and space domains.”

The participating forces also undertook key airbase operations from austere environments, including air traffic control, medical support, air base command and integrated security protection with the Australian Army.

Talisman Sabre is the largest Australia-US bilaterally planned, multilaterally conducted exercise with partner nations, including Canada, France, Fiji, Germany, India, Indonesia, Japan, the Netherlands, New Zealand, Norway, Papua New Guinea, the Philippines, Republic of Korea, Singapore, Thailand, Tonga and the United Kingdom.

The Australian aircraft involved in the exercises included the F-35A Lightning II, P-8A Poseidon, C-17A Globemaster III, C-130J

Hercules and C-27J Spartan, with air battle management coordinated between the RAAF's 3 Control and Reporting Unit, 114 Mobile Control and Reporting Unit and 2 Squadron's E-7A Wedgetail.

Space

Hijacked Satellites and Orbiting Space Weapons: In the 21st Century, Space is the New Battlefield

David Klepper | 18 August 2025

Source: AP News | <https://apnews.com/article/space-weapons-trump-satellites-russia-0fdd31a1e3d350a54823e8a3d228fc17>



China's Long March 2F rocket, carrying three astronauts for the Shenzhou 20 manned space mission, blasts off at the Jiuquan Satellite Launch Center in Jiuquan, northwestern China, April 24, 2025. (AP Photo/Andy Wong, File)

WASHINGTON (AP) — As Russia held its Victory Day parade this year, hackers backing the Kremlin hijacked an orbiting satellite that provides television service to Ukraine.

Instead of normal programming, Ukrainian viewers saw parade footage beamed in from Moscow: waves of tanks, soldiers and weaponry. The message was meant to intimidate and was an illustration that 21st-century war is waged not just on land, sea and air but also in cyberspace and the reaches of outer space.

Disabling a satellite could deal a devastating blow without one bullet, and it can be done by targeting the satellite's security software or disrupting its ability to send or receive signals from Earth.

"If you can impede a satellite's ability to communicate, you can cause a significant disruption," said Tom Pace, CEO of NetRise, a cybersecurity firm focused on protecting supply chains.

"Think about GPS," said Pace, who served in the Marines before working on cyber issues at the Department of Energy. "Imagine if a population lost that and the confusion it would cause."

Satellites are the Short-Term Challenge

More than 12,000 operating satellites now orbit the planet, playing a critical role not just in broadcast communications but also in military operations, navigation systems like GPS, intelligence gathering and economic supply chains. They are also key to early launch-detection efforts, which can warn of approaching missiles.

That makes them a significant national security vulnerability, and a prime target for anyone looking to undermine an adversary's economy or military readiness — or deliver a psychological blow like the hackers supporting Russia did when they hijacked television signals to Ukraine.

Hackers typically look for the weakest link in the software or hardware that supports a

satellite or controls its communications with Earth. The actual orbiting device may be secure, but if it's running on outdated software, it can be easily exploited.

As Russian forces invaded Ukraine in 2022, someone targeted Viasat, the U.S.-based satellite company used by Ukraine's government and military. The hack, which Kyiv blamed on Moscow, used malware to infect tens of thousands of modems, creating an outage affecting wide swaths of Europe.

National security officials say Russia is developing a nuclear, space-based weapon designed to take out virtually every satellite in low-Earth orbit at once. The weapon would combine a physical attack that would ripple outward, destroying more satellites, while the nuclear component is used to fry their electronics.

U.S. officials declassified information about the weapon after Rep. Mike Turner, R-Ohio, issued a public warning about the technology. Turner has pushed for the Department of Defense to provide a classified briefing to lawmakers on the weapon, which, if deployed, would violate an international treaty prohibiting weapons of mass destruction in space.

Turner said such a weapon could render low-Earth orbit unusable for satellites for as long as a year. If it were used, the effects would be devastating: potentially leaving the U.S. and its allies vulnerable to economic upheaval and even a nuclear attack.

Russia and China also would lose satellites, though they are believed to be less reliant on the same kinds of satellites as the U.S.

Turner compared the weapon, which is not yet ready for deployment, to Sputnik, the Russian satellite that launched the space age in 1957.

“If this anti-satellite nuclear weapon would be put in space, it would be the end of the space age,” Turner said. “It should never be permitted to go into outer space. This is the Cuban Missile Crisis in space.”

Mining the Moon and Beyond

Valuable minerals and other materials found on the moon and in asteroids could lead to future conflicts as nations look to exploit new technologies and energy sources.

Acting NASA Administrator Sean Duffy announced plans this month to send a small nuclear reactor to the moon, saying it’s important the U.S. does so before China or Russia.

“We’re in a race to the moon, in a race with China to the moon,” Duffy said. “To have a base on the moon, we need energy and some of the key locations on the moon. ... We want to get there first and claim that for America.”

The moon is rich in a material known as helium 3, which scientists believe could be used in nuclear fusion to generate huge amounts of energy. While that technology is decades away, control over the moon in the intervening years could determine which

countries emerge as superpowers, according to Joseph Rooke, a London-based cybersecurity expert who has worked in the U.K. defense industry and is now director of risk insights at the firm Recorded Future.

The end of the Cold War temporarily halted a lot of investments in space, but competition is likely to increase as the promise of mining the moon becomes a reality.

“This isn’t sci-fi. It’s quickly becoming a reality,” Rooke said. “If you dominate Earth’s energy needs, that’s game over.”

China and Russia have announced plans for their own nuclear plants on the moon in the coming years, while the U.S. is planning missions to the moon and Mars. Artificial intelligence is likely to speed up the competition, as is the demand for the energy that AI requires.

Messages left with Russia’s Embassy in Washington were not returned.

Despite its steps into outer space, China opposes any extraterrestrial arms race, according to Liu Pengyu, a spokesperson for China’s Embassy in Washington. He said it is the U.S. that is threatening to militarize the final frontier.

“It has kept expanding military strength in space, created space military alliances, and attempted to turn space into a war zone,” Liu said. “China urges the U.S. to stop spreading irresponsible rhetoric, stop expanding military build-up in space, and make due contribution to upholding the lasting peace and security in

space.”

What the US is doing about Security in Space

Nations are scrambling to create their own rocket and space programs to exploit commercial prospects and ensure they aren't dependent on foreign satellites. It's an expensive and difficult proposition, as demonstrated last week when the first Australian-made rocket crashed after 14 seconds of flight.

The U.S. Space Force was created in 2019 to protect American interests in space and to defend U.S. satellites from attacks from adversaries.

The space service is far smaller than the more well-established services like the Army, Navy or Air Force, but it's growing.

The U.S. military operates an unmanned space shuttle used to conduct classified military missions and research. The craft, known as the X-37B, recently returned to Earth after more than a year in orbit.

The Space Force called access to space a vital national security interest.

“Space is a warfighting domain, and it is the Space Force's job to contest and control its environment to achieve national security objectives,” it said in the statement.

American dominance in space has been largely unquestioned for decades following the end of the Cold War and the fall of the Soviet Union. But the new threats and competition posed by Russia and China show the need for

an aggressive response, U.S. officials say.

The hope, Turner said, is that the U.S. can take steps to ensure Russia and China can't get the upper hand, and the frightening potential of space weapons is not realized.

“You have to pay attention to these things so they don't happen,” Turner said.

Eyes in the Sky: Pakistan's New Satellite goes Live to Power Progress

Ashfaq Ahmed | 17 August 2025

Source: [Gulf News](https://gulfnews.com/world/asia/pakistan/eyes-in-the-sky-pakistans-new-satellite-goes-live-to-power-progress-1.500235704) | <https://gulfnews.com/world/asia/pakistan/eyes-in-the-sky-pakistans-new-satellite-goes-live-to-power-progress-1.500235704>



The Pakistani satellite has successfully established stable communication with ground stations and is transmitting high-resolution imagery. Photo for illustrative purpose only

Eyes in the Sky: Pakistan's new satellite goes live to power progress

High-tech remote sensing satellite to boost agriculture, disaster response, and development across the nation

DubaiL Pakistan's newest remote sensing satellite, launched last month from China's Xichang Satellite Launch Centre, is now fully operational, the Space and Upper Atmosphere Research Commission (Suparco) confirmed.

The satellite has successfully established stable communication with ground stations and is transmitting high-resolution imagery, poised to revolutionise decision-making in key sectors including urban development, precision agriculture, disaster management, and climate monitoring.

Orbiting Earth

This latest addition joins an expanding fleet of Pakistani satellites orbiting Earth. One of the earliest, the Pakistan Remote Sensing Satellite-1 (PRSS-1), launched in 2018, continues to operate in Sun-Synchronous Low Earth Orbit (LEO), providing free satellite imagery for academic research. In 2025, PAUSAT-1, a collaborative project between Pakistan Air University and Istanbul Technical University, was also launched, underscoring the growing role of academic institutions in space research.

Major Milestone

Earlier this year, Pakistan celebrated a major milestone with the launch of its first fully indigenous satellite, PRSC-EO1, an electro-optical Earth observation satellite developed entirely by local engineers at Suparco. Launched in January 2025, PRSC-EO1 represents a critical step toward self-reliance in space technology, APP reported.

Newest Satellite

According to Suparco, the newest satellite is equipped with advanced imaging capabilities that can monitor urban sprawl, track infrastructure growth, and support smarter regional planning. For a disaster-prone country like Pakistan, the satellite's real-time data will also enhance early warning systems and rapid response efforts in the event of floods, earthquakes, and landslides.

Environmental scientists will gain a powerful

tool to study glacier melt, deforestation, and long-term climate change, vital in a region deeply affected by global warming. The satellite is also expected to significantly advance precision agriculture by mapping crop cycles and optimising irrigation and water use, critical for food security in an increasingly resource-stressed region.

Strategic Initiative

The satellite will contribute to strategic initiatives such as the China—Pakistan Economic Corridor (CPEC) by supporting infrastructure development, resource allocation, and geohazard risk management.

“These capabilities collectively enhance national decision-making, promote sustainable socio-economic development, and strengthen Pakistan’s technological autonomy,” Suparco stated.

With multiple successful launches in recent years and a growing emphasis on domestic innovation, Pakistan’s space program is fast emerging as a key player in regional space and Earth observation initiatives.

PM Modi Meets Shubhanshu Shukla; Astronaut Shows Earth Photos Clicked from ISS, Gifts Axiom-4 Mission Patch

19 August 2025

Source: Times of India | <https://timesofindia.indiatimes.com/india/modi-shux-meet-pm-meets-indias-first-iss-astronaut-shubhanshu-shukla-receives-mission-patch-earth-photos/articleshow/123366878.cms>

NEW DELHI: Prime Minister Narendra Modi on Monday met Astronaut Shubhanshu Shukla, pilot of the Axiom-4 Space Mission to the International Space Station (ISS), at his Lok Kalyan Marg residence.

PM Modi welcomed Shukla with a warm hug and walked alongside him with his arm on the astronaut's shoulder, highlighting the significance of the moment.

During the meeting, Shukla presented the Axiom-4 mission patch to the Prime Minister and shared photographs of the Earth taken from the ISS. Shukla, who returned to India early Sunday, had received a rousing welcome at the Delhi airport.

After the meeting, PM Modi took to X and posted, "Had a great interaction with Shubhanshu Shukla. We discussed a wide range of subjects including his experiences in space, progress in science & technology as well as India's ambitious Gaganyaan mission. India is proud of his feat."

Earlier in the day, Shukla was honoured in the Lok Sabha during a special discussion

celebrating his milestone mission.

Shukla completed an 18-day Axiom-4 mission on July 15, conducting over 60 experiments with three other crew members aboard the ISS—a key step towards India's human spaceflight ambitions under the Gaganyaan programme.

Parliamentary Affairs Minister Kiren Rijiju said the special discussion in the House was aimed at celebrating Shukla's achievements and India's growing space capabilities. "Our hero astronaut Group Captain Shubhanshu Shukla has returned home after a successful mission to the ISS. Parliament will honour him with a special discussion on his historic milestone and India's journey towards Viksit Bharat," Rijiju posted on X. He urged Opposition MPs to participate in the debate in the same spirit as they had during Operation Sindoor, though they chose to boycott, causing repeated disruptions.

Breaking ranks, Congress MP Shashi Tharoor praised Shukla on social media. "Since the Opposition are not participating in the special discussion, let me say how proud all Indians are of the recent mission of Commander Shubhanshu Shukla to the ISS. It served as a stepping stone to our nation's human spaceflight program, Gaganyaan," Tharoor wrote.

PM Modi had earlier lauded Shukla in his Independence Day address, reiterating India's plan to build its own space station. ISRO Chairman V Narayanan said the first module is expected to be placed in orbit by 2028, with the station fully operational by 2035.

Union MoS for science and technology Jitendra Singh criticised Opposition MPs for not acknowledging the achievement. "Your anger can be with the government and the BJP, but it is surprising you can be angry with an astronaut. He is not linked to any political party. You are angry with the earth, you are angry with the sky and today you seem to be angry with space as well," Singh said.

Shukla's journey included nearly a year of intensive training in the US before being selected for the Axiom-4 mission. On his return, he expressed gratitude to the nation and said he would share his experiences with students and scientists across India. He is also set to attend National Space Day events later this month.

Modi Mulls Plan to Build Pool of Astronauts, Urges Youth to Join in

Aksheev Thakur | 24 August 2025

Source: [Tribune India](https://www.tribuneindia.com/news/india/pm-modi-calls-on-youth-to-power-indias-space-future/) | <https://www.tribuneindia.com/news/india/pm-modi-calls-on-youth-to-power-indias-space-future/>



Prime Minister Narendra Modi addresses the nation on the National Space Day on Saturday. PTI

The Prime Minister Narendra Modi on Saturday urged India's youth to join the pool of astronauts that the country will soon create for future missions.

In a video message on National Space Day, Modi also called on space startups to aim at building five unicorns in the sector over the next five years.

“We are coming up with a pool of astronauts soon. I invite young people to join this pool. There will be immense opportunities in the space sector. I would also urge space startups to create unicorns in the next five years. Today, we see five to six launches a year, but I hope we reach a point where we can launch one rocket every week,” he said.

Recalling India's milestones, the Prime Minister said in 2023 the country became the first

to reach the moon's South Pole, and this year it became the fourth nation to successfully conduct undocking and docking of satellites in space.

He stressed that the private sector must take the lead in enabling India to achieve weekly rocket launches. He added that while India is advancing in breakthrough technologies such as the semi-cryogenic engine and electric propulsion, “the time has come to explore those regions of space where vital mysteries for the future of humanity are concealed. Beyond galaxies lies our horizon!”

Modi also highlighted the private sector's growing role in space, saying: “Soon, the first PSLV rocket built by our private sector will be launched. I am glad that India's first private communication satellite is also being developed. Through public-private partnership, preparations are underway to launch an Earth Observation Satellite Constellation.”

Union Minister for Science and Technology Jitendra Singh added that an Indian would announce Viksit Bharat 2047 from the surface of the moon in 2040. “India's space programme has entered a transformative phase. It is no longer about symbolic achievements but is now a vital contributor to scientific progress, technological innovation and public welfare,” he said.

Singh outlined future milestones, including India's first human spaceflight under the Gaganyaan mission in 2027, the Chandramitra mission in 2028, Chandrayaan-4, a Venus mission and the establishment of the Bharatiya Antariksh Station by 2035.

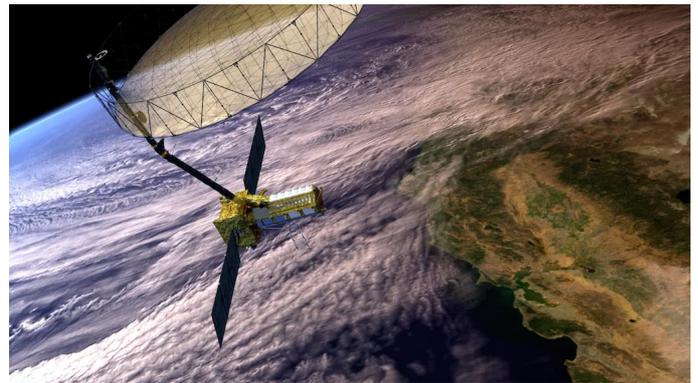
Indian astronaut Group Captain Shubhanshu

Shukla said he was excited about the country's future endeavours, noting that international agencies were also watching closely. "Space agencies in Japan and Europe have even asked me to invite them to join future missions launched from Indian soil," he said.

ISRO's Space Expansion: India will Triple Number of Satellites within Next 4 Years

19 August 2025

Source: *Business Today* | <https://www.businesstoday.in/india/story/isros-space-expansion-india-will-triple-number-of-satellites-within-next-4-years-490129-2025-08-19>



India to triple its satellite count in space by 2029

India currently operates 55 satellites in orbit, but the number will triple within the next three to four years, ISRO Chairman V Narayanan said on Tuesday. He also outlined the space agency's ambitious roadmap that includes a 40-storey-high rocket, a space station by 2035, and new missions to Venus and beyond.

Speaking at the convocation ceremony of Osmania University in Hyderabad, Narayanan said ISRO is already working on the next generation of launch vehicles with unprecedented payload capacity. "Right now, we are working on a next-generation launcher. You know, what is the capacity of the rocket? The first launcher, (Dr APJ) Abdul Kalam ji, which he built was a 17 tonne lift-off mass, capable of placing 35 kg in low earth orbit. Today, we are conceiving a rocket to place

75,000 kg in low earth orbit. The rocket is of 40-storey building height," he said.

Narayanan said the coming year is lined up with multiple projects, including a NAVIC (Navigation with Indian Constellation) satellite, the N1 rocket, and the launch of a 6,500 kg communication satellite of the United States using Indian launchers. ISRO also plans to launch the Technology Demonstration Satellite (TDS) and GSAT-7R, a military communication satellite for the Indian Navy to replace the GSAT-7 (Rukmini).

Looking further ahead, Narayanan announced that "by 2035, a 52-tonne mass space station is going to be built," while India's Venus Orbiter mission remains on the workbench.

He highlighted India's achievements in human spaceflight, recalling the recent mission of astronaut Shubhanshu Shukla to the International Space Station. "The original project was scheduled for June 11. However, a day before, a team-led by me identified a leakage in the rocket, it was postponed to June 25," Narayanan said. "And with that, if the rocket would have taken off, it would have been a catastrophic failure. Based on the insistence of Indians, the Indian education system, the training of ISRO, the rocket was corrected. Today we have accomplished a safe mission, not only Subashanhu Shukla, but along with him three more international astronauts."

Speaking later to reporters, Narayanan confirmed, "Shubhanshu Shukla has successfully come back (after spending 20 days

in space). His experience is going to feed India's Gaganyaan programme." Asked about Prime Minister Narendra Modi's call for building a pool of 40-50 astronauts to lead future missions, Narayanan replied, "In the future it will happen. Whatever the prime minister has said, it will happen."

Placing India's journey in perspective, Narayanan noted that the country has launched more than 4,000 rockets since 1975, when its first satellite Aryabhata was placed into orbit with foreign support. Since then, 133 satellites of various types have been launched, including GSAT-11, a 6,000 kg high-throughput communication satellite.

India, he added, has set benchmarks in space science. "India has the best camera on the moon with 32-centimeter resolution and is the only country till today to have succeeded Mars orbiter mission in the first attempt while none of the developed countries could do so," he said. He also recalled that ISRO was the first organisation to launch 104 satellites in a single rocket on the first attempt.

Narayanan said that ISRO has built the Aditya L1 satellite to study the sun. "Not only studying the sun, it has brought 20 terabit data. India is one among four countries having the capability which has built the satellite for studying the sun," he said.

Indigenous Clocks Delay ISRO's Plans to Replace Defunct Navic Satellites

Jacob Koshy | 23 August 2025

Source: *The Hindu* | <https://www.thehindu.com/sci-tech/science/indigenous-clocks-delay-isros-plans-to-replace-defunct-navic-satellites/article69969206.ece>



NVS-02 undergoing a vibration test. Photo: ISRO

India's Officials at the Indian Space Research Organisation (ISRO) say they are looking to launch at least three satellites before 2026-end, to replace defunct satellites that are part of the 'Indian GPS' or Navic (Navigation with Indian constellation) system. However, there seems to be a key element impeding the launch — the development of indigenous clocks.

These high-precision clocks — now proposed at five per satellite — are what provides accurate timing (and hence location) services to users on earth. The Navic satellites provide more accurate location services to the military and slightly less accurate ones for civilian purposes.

Nine satellites of the Indian Regional Navigation Satellite System (IRNSS), informally called Navic, have been launched

since 2013. Eight of them reached their intended orbit. The last of this constellation of satellites (IRNSS-1I) was launched in 2018. These constellation of satellites are akin to the Russian GLONASS, the Chinese Beidou, the American GPS and European Galileo constellation of satellites to provide location services. However, the Navic, is expected to do so only within India and a radius of 1,500 km. This is however viewed more as a fall back system in the case of future global conflicts and India being denied access to these foreign constellations.

Last month, the ISRO revealed via a Right To Information request that five of the Navic satellites were completely defunct with all three of their clocks in each satellite not working. In one of the three satellites with functioning atomic clocks, two of the three clocks have failed. Only two satellites of the constellation, therefore, have functional atomic clocks. The atomic clocks in this constellation of satellites were imported by the ISRO from the firm SpectraTime.

For the next series of satellites to replace the impaired and ageing fleet of IRNSS satellites —two of the three being used have passed or are close to their rated shelf life of 10 years though it's possible for these systems to function beyond — the ISRO has decided to install indigenously developed rubidium clocks.

"Each satellite will have five clocks though we are still in the process of developing them," Nilesh Desai, Director, Space Applications Centre, a key part of the ISRO, told *The Hindu* on the sidelines of a conclave in Delhi to

commemorate National Space Day on Saturday.

Another official familiar with the ISRO said that while the rubidium clocks are based on an indigenous design, there were key components that needed to be imported and this was contributing to procurement challenges and delays in commissioning.

So far, to replace its decrepit fleet of IRNSS satellites, ISRO has launched two satellites NVS-01 in May 2023 and NVS-02 in January 2025. Only NVS-01 successfully reached its designated orbit and is working as intended, with NVS-02 failing to reach the specific orbit required to function as a navigational satellite.

By 2040, India is aiming to launch at least a 100 satellites, several of them to provide earth imaging and communication services for both government and private sector applications.

Aerospace Industry

India to Make Advanced Jet Engines with France

Saurabh Trivedi | 2 August 2025

[Source: The Hindu | https://www.thehindu.com/news/national/india-to-make-advanced-jet-engines-with-france/article69965367.ece](https://www.thehindu.com/news/national/india-to-make-advanced-jet-engines-with-france/article69965367.ece)



Union Defence Minister Rajnath Singh arrives to attend the meeting with women military officers as they participate in the United Nations Peacekeeping Mission, in New Delhi on August 22, 2025. | Photo Credit: ANI/PIB

In a major boost to India's fifth-generation fighter aircraft programme, Defence Minister Rajnath Singh on Friday (August 22, 2025) announced that India will jointly manufacture advanced jet engines with French aerospace major Safran.

Mr. Singh was speaking at an event in Delhi where he said that the collaboration marks

a decisive step in India's efforts to achieve self-reliance in defence aviation and reduce dependence on foreign suppliers. With engine manufacturing work set to begin in India, the project is expected to fill a critical capability gap and accelerate development of indigenous fighter aircraft, he said.

“Our vision of self-reliance in defence is not just about reducing imports. It is about creating an ecosystem where Indian industry, public and private, develops world-class capability, where we not only meet domestic requirements but also emerge as a global supplier of high-quality defence products,” said Mr. Singh.

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requirements but also emerge as a global supplier of high-quality defence products,” said Mr. Singh.

More Orders for Tejas

He said Hindustan Aeronautics Limited (HAL) had received orders worth ₹66,000 crore for 97 Tejas fighter aircraft, in addition to an earlier order for 83 aircraft worth ₹48,000 crore.

“Our Tejas aircraft is set to become a brilliant example of India's indigenous defence capabilities. It's not that we haven't faced problems in this endeavour, but we have decided that we will find a solution to every problem and surely establish the full capability to build fighter aircraft in India,” he added.

Mr. Singh also extended an invitation to global defence companies to partner with India, citing Airbus's ongoing production of C295 transport aircraft in collaboration with Tata Aerospace.

“Today there is an opportunity for all the big defence companies of the world to invest in India and co-produce defence equipment here. Our Make in India is not limited to India only. When you Make in India, you will make for the world,” he said.

Referring to a recent statement made by Pakistan's Army Chief regarding comparing India's economy to a sports car and Pakistan's to a “dump truck”, Mr. Singh said this was not merely troll material but a revealing admission. “If two countries got independence together, and one built an economy like a sports car with

hard work, right policies and vision, while the other remains stuck in failure, it is their own doing. This is not a joke, it is a confession,” he stated.

“We must ensure that along with India’s prosperity, our fighting spirit for our defence capability and national honour remains equally strong. Operation Sindoor has already shown our resolve. We will not allow any illusion about India’s strength to take root in Pakistan’s mind,” he said.

ISRO Conducts Air Drop Test Ahead of December Gaganyaan Launch

24 August 2025

Source: [India Today](https://www.indiatoday.in/science/story/isro-conducts-air-drop-test-ahead-of-december-gaganyaan-launch-2775990-2025-08-24) | <https://www.indiatoday.in/science/story/isro-conducts-air-drop-test-ahead-of-december-gaganyaan-launch-2775990-2025-08-24>



The test marks a critical phase in validating the safety mechanisms that will ensure astronauts’ secure return to Earth. (Photo: X/@isro)

In a major step towards India’s ambitious maiden human spaceflight mission, the Indian Space Research Organisation (ISRO) has successfully conducted its first Integrated Air Drop Test (IADT-01) of the parachute-based deceleration system designed for Gaganyaan.

The test marks a critical phase in validating the safety mechanisms that will ensure astronauts’ secure return to Earth.

The demonstration was carried out in close coordination with the Air Force, Defence Research and Development Organisation (DRDO), Navy and Coast Guard, reflecting the collaborative spirit underpinning the Gaganyaan programme.

The parachute system is crucial for controlled recovery of the crew module after

atmospheric re-entry.

During the test, a mock module was released from an aircraft and safely descended under the guidance of the newly developed parachute assembly, successfully proving its performance.

According to ISRO officials, the aim of IADT-01 was to evaluate the end-to-end functioning of the complex parachute deployment sequence, which includes extraction, drogue chute activation, followed by the main parachute deployment, ensuring smooth deceleration before landing.

This is a vital capability demonstration that gives Isro greater confidence as we move closer to the crewed flight.

The Gaganyaan mission, scheduled for launch in December, will mark India's first venture into testing human expeditions to low Earth orbit.

The manned mission, which will launch in 2028, will make the nation the fourth country to achieve independent crewed spaceflight capability.

The mission is designed to carry a three-member crew to an orbit of about 400 km for a period of up to three days before safely returning to Earth.

Officials emphasised that this successful trial strengthens astronaut safety parameters, one of the foremost priorities of the programme.

Future tests will include additional parachute

validations, pad abort trials, and recovery rehearsals at sea to ensure operational readiness.

With global attention turning towards India's expanding space programme, the accomplishment of IADT-01 comes as a significant confidence booster.

As the December deadline approaches, ISRO and its partner agencies are now entering the final phase of preparations, determined to ensure that India's first human spaceflight mission sets a benchmark for technological prowess and safety.

HAL to Outsource Complete Module Assembly of Fighter Jets to Private Sector, Significantly Accelerating Production Timelines

Raj Basu | 25 August 2025

[Source: Defence.in | https://defence.in/threads/hal-to-outsource-complete-module-assembly-of-fighter-jets-to-private-sector-significantly-accelerating-production-timelines.15341/](https://defence.in/threads/hal-to-outsource-complete-module-assembly-of-fighter-jets-to-private-sector-significantly-accelerating-production-timelines.15341/)



In a landmark strategic shift aimed at accelerating the production of fighter aircraft, Hindustan Aeronautics Limited (HAL), the nation's leading aerospace and defence corporation, is set to outsource the complete assembly of major aircraft modules to private Indian companies.

This move is expected to dramatically reduce manufacturing timelines for the Tejas Mk1A and potentially Tejas Mk2 and AMCA.

Under the new model, private firms that already supply key structural components-such as the fuselage, wings, and tail sections-will now deliver these parts as fully equipped, pre-assembled modules.

This means the sections will arrive at HAL's final assembly line with all necessary internal

systems, including wiring, hydraulic lines, and other sub-assemblies, already installed.

The initiative is designed to resolve production bottlenecks and significantly increase the delivery rate of aircraft to the Indian Air Force (IAF).

This enhanced collaboration deepens the existing relationship HAL has with established partners in the private defence sector.

Companies like Larsen & Toubro (L&T), which supplies the wings, VEM Technologies (centre fuselage), Dynamatic Technologies (front fuselage), Alpha Tocol Engineering Services (rear fuselage), and Tata Advanced Systems Limited (TASL) (vertical tail), will see their roles expand significantly.

They will transition from being suppliers of basic structures to providers of complex, integrated modules ready for final integration.

The new strategy aligns HAL's manufacturing process with global aerospace giants like Boeing and Airbus, which have long relied on a modular assembly approach.

By receiving pre-equipped sections, HAL can concentrate its resources on the critical final stages of aircraft production: integrating the engine, avionics, and weapon systems, followed by comprehensive testing and certification.

This change is projected to enable HAL to potentially double its annual production of the Tejas Mk1A from the current 16 aircraft to a target of 30 by 2027, crucial for fulfilling the existing order of 83 jets for the IAF.

While this operational overhaul promises a major boost in production capacity, it involves a financial trade-off for the state-owned enterprise.

Historically, the in-house task of equipping these modules was a significant source of revenue for HAL. By outsourcing this high-value work, HAL's profit margins on each aircraft are expected to decrease.

This comes after the company's margin on the Tejas Mk1A was already reduced from approximately 12% to 6% following rigorous negotiations with the IAF, highlighting the financial pressures involved in meeting the nation's security needs efficiently.

SpaceX has Built the Machine to Build the Machine. But what about the Machine?

Eric Berger | 21 August 2025

Source: ARS Technica | <https://arstechnica.com/space/2025/08/spacex-has-built-the-machine-to-build-the-machine-but-what-about-the-machine/>



A Starship upper stage is moved past the northeast corner of Starfactory in July 2025. Credit: SpaceX

STARBASE, Texas—I first visited SpaceX's launch site in South Texas a decade ago. Driving down the pocked and barren two-lane road to its sandy terminus, I found only rolling dunes, a large mound of dirt, and a few satellite dishes that talked to Dragon spacecraft as they flew overhead.

A few years later, in mid-2019, the company had moved some of that dirt and built a small launch pad. A handful of SpaceX engineers working there at the time shared some office space nearby in a tech hub building, "Stargate." The University of Texas Rio Grande Valley proudly opened this state-of-the-art technology center just weeks earlier. That summer, from Stargate's second floor, engineers looked on as the Starhopper prototype made its first two flights a couple of miles away.

Over the ensuing years, as the company

began assembling its Starship rockets on site, SpaceX first erected small tents, then much larger tents, and then towering high bays in which the vehicles were stacked. Starbase grew and evolved to meet the company's needs.

All of this was merely a prelude to the end game: Starfactory. SpaceX opened this truly massive facility earlier this year. The sleek rocket factory is emblematic of the new Starbase: modern, gargantuan, spaceship-like.

To the consternation of some local residents and environmentalists, the rapid growth of Starbase has wiped out the small and eclectic community that existed here. And that brand new Stargate building that public officials were so excited about only a few years ago? SpaceX first took it over entirely and then demolished it. The tents are gone, too. For better or worse, in the name of progress, the SpaceX steamroller has rolled onward, paving all before it.

Starbase is even its own Texas city now. And if this were a medieval town, Starfactory would be the impenetrable fortress at its heart. In late May, I had a chance to go inside. The interior was super impressive, of course. Yet it could not quell some of the concerns I have about the future of SpaceX's grand plans to send a fleet of Starships into the Solar System.

Inside the Fortress

The main entrance to the factory lies at its northeast corner. From there, one walks into a sleek lobby that serves as a gateway into the main, cavernous section of the building. At this corner, there are three stories above the ground floor. Each of these three higher levels contains

various offices, conference rooms and, on the upper floor, a launch control center.

Large windows from here offer a breathtaking view of the Starship launch site two miles up the road. A third-floor executive conference room has carpet of a striking rusty, reddish hue—mimicking the surface of Mars, naturally. A long, black table dominates the room, with 10 seats along each side, and one at the head.

But the real attraction of these offices is the view to the other end. Each of the upper three floors has a balcony overlooking the factory floor. From there, it's as if one stands at the edge of an ocean liner, gazing out to sea. In this case, the far wall is discernible, if only barely. Below, the factory floor is crammed with all manner of Starship parts: nose cones, grid fins, hot staging rings, and so much more. The factory emitted a steady din and hum as work proceeded on vehicles below.

The ultimate goal of this factory is to build one Starship rocket a day. This sounds utterly mad. For the entire Apollo program in the 1960s and 1970s, NASA built 15 Saturn V rockets. Over the course of more than three decades, NASA built and flew only five different iconic Space Shuttles. SpaceX aims to build 365 vehicles, which are larger, per year.

Wandering around the Starfactory, however, this ambition no longer seems undoable. The factory measures about 1 million square feet. This is two times as large as SpaceX's main Falcon 9 factory in Hawthorne, California. It feels like the company could build a lot of Starships here if needed.

During one of my visits to South Texas, in early 2020 just before the onset of the COVID-19 pandemic, SpaceX was building its first Starship rockets in football field-sized tents. At the time, SpaceX founder Elon Musk opined in an interview that building the factory might well be more difficult than building the rocket.

"If you want to actually make something at reasonable volume, you have to build the machine that makes the machine, which mathematically is going to be vastly more complicated than the machine itself," he said. "The thing that makes the machine is not going to be simpler than the machine. It's going to be much more complicated, by a lot."

Five years later, standing inside Starfactory, it seems clear that SpaceX has built the machine to build the machine—or at least it's getting close.

But what happens if that machine is not ready for prime time?

A Pretty Bad Year for Starship

SpaceX has not had a good run of things with the ambitious Starship vehicle this year. Three times, in January, March, and May, the vehicle took flight. And three times, the upper stage experienced significant problems during ascent, and the vehicle was lost on the ride up to space, or just after. These were the seventh, eighth, and ninth test flights of Starship, following three consecutive flights in 2024 during which the Starship upper stage made more or less nominal flights and controlled splashdowns in the Indian Ocean.

It's difficult to view the consecutive failures

this year—not to mention the explosion of another Starship vehicle during testing in June—as anything but a major setback for the program.

There can be no question that the Starship rocket, with its unprecedentedly large first stage and potentially reusable upper stage, is the most advanced and ambitious rocket humans have ever conceived, built, and flown. The failures this year, however, have led some space industry insiders to ask whether Starship is too ambitious.

My sources at SpaceX don't believe so. They are frustrated by the run of problems this year, but they believe the fundamental design of Starship is sound and that they have a clear path to resolving the issues. The massive first stage has already been flown, landed, and re-flown. This is a huge step forward. But the sources also believe the upper stage issues can be resolved, especially with a new "Version 3" of Starship due to make its debut late this year or early in 2026.

The acid test will only come with upcoming flights. The vehicle's tenth test flight is scheduled to take place no earlier than Sunday, August 24. It's possible that SpaceX will fly one more "Version 2" Starship later this year before moving to the upgraded vehicle, with more powerful Raptor engines and lots of other changes to (hopefully) improve reliability.

SpaceX could certainly use a win. The Starship failures occur at a time when Musk has become embroiled in political controversy while feuding with the president of the United States. His actions have led some in government and private industry to question whether they should

be doing business with SpaceX going forward.

It's often said in sports that winning solves a lot of problems. For SpaceX, success with Starship would solve a lot of problems.

Next steps for Starship

The failures are frustrating and publicly embarrassing. But more importantly, they are a bottleneck for a lot of critical work SpaceX needs to do for Starship to reach its considerable potential. All of the technical progress the Starship program needs to make to deploy thousands of Starlink satellites, land NASA astronauts on the Moon, and send humans to Mars remains largely on hold.

Two of the most important objectives for the next flight require the Starship vehicle to fly a nominal mission. For several flights now, SpaceX engineers have dutifully prepared Starlink satellite simulators to test a Pez-like dispenser in space. And each Starship vehicle has carried about two dozen different tile experiments as the company attempts to build a rapidly reusable heat shield to protect Starship during atmospheric reentry.

The engineers are still waiting for the results of their experiments.

In the near term, SpaceX is hyper-focused on getting Starship working and starting the deployment of large Starlink satellites that will have the potential to unlock significant amounts of revenue. But this is just the beginning of the work that needs to happen for SpaceX to turn Starship into a deep-space vehicle capable of traveling to the Moon and Mars.

These steps include:

- Reuse: Developing a rapidly reusable heat shield and landing and re-flying Starship upper stages
- Prop transfer: Conducting a refueling test in low-Earth orbit to demonstrate the transfer of large amounts of propellant between Starships
- Depots: Developing and testing cryogenic propellant depots to understand heating losses over time
- Lunar landing: Landing a Starship successfully on the Moon, which is challenging due to the height of the vehicle and uneven terrain
- Lunar launch: Demonstrating the capability of Starship, using liquid propellant, to launch safely from the lunar surface without infrastructure there
- Mars transit: Demonstrating the operation of Starship over months and the capability to perform a powered landing on Mars.

Each of these steps is massively challenging and at least partly a novel exercise in aerospace. There will be a lot of learning, and almost certainly some failures, as SpaceX works through these technical milestones.

SpaceX prefers a test, fly, and fix approach to developing hardware. This iterative approach has served the company well, allowing it to develop rockets and spacecraft faster and for less money than its competitors. But you cannot fly and fix hardware for the milestones above

without getting the upper stage of Starship flying nominally.

That's one reason why the Starship program has been so disappointing this year.

Then there are the Politics

As SpaceX has struggled with Starship in 2025, its founder, Musk, has also had a turbulent run, from the presidential campaign trail to the top of political power in the world, the White House, and back out of President Trump's inner circle. Along the way, he has made political enemies, and his public favorability ratings have fallen.

Amid the fallout between Trump and Musk this spring and summer, the president ordered a review of SpaceX's contracts. Nothing happened because government officials found that most of the services SpaceX offers to NASA, the US Department of Defense, and other federal agencies are vital.

However, multiple sources have told Ars that federal officials are looking for alternatives to SpaceX and have indicated they will seek to buy launches, satellite Internet, and other services from emerging competitors if available.

Starship's troubles also come at a critical time in space policy. As part of its budget request for fiscal year 2026, the White House sought to terminate the production of NASA's Space Launch System rocket and spacecraft after the Artemis III mission. The White House has also expressed an interest in sending humans to Mars, viewing the Moon as

a stepping stone to the red planet.

Although there are several options in play, the most viable hardware for both a lunar and Mars human exploration program is Starship. If it works. If it continues to have teething pains, though, that makes it easier for Congress to continue funding NASA's expensive rocket and spacecraft, as it would prefer to do.

What about Artemis and the Moon?

Starship's "lost year" also has serious implications for NASA's Artemis Moon Program. As Ars reported this week, China is now likely to land on the Moon before NASA can return. Yes, the space agency has a nominal landing date in 2027 for the Artemis III mission, but no credible space industry officials believe that date is real. (It has already slipped multiple times from 2024). Theoretically, a landing in 2028 remains feasible, but a more rational over/under date for NASA is probably somewhere in the vicinity of 2030.

SpaceX is building the lunar lander for the Artemis III mission, a modified version of Starship. There is so much we don't really know yet about this vehicle. For example, how many refuelings will it take to load a Starship with sufficient propellant to land on the Moon and take off? What will the vehicle's controls look like, and will the landings be automated?

And here's another one: How many people at SpaceX are actually working on the lunar version of Starship?

Publicly, Musk has said he doesn't worry too much about China beating the United States back

to the Moon. "I think the United States should be aiming for Mars, because we've already actually been to the Moon several times," Musk said in an interview in late May. "Yeah, if China sort of equals that, I'm like, OK, sure, but that's something that America did 56 years ago."

Privately, Musk is highly critical of Artemis, saying NASA should focus on Mars. Certainly, that's the long arc of history toward which SpaceX's efforts are being bent. Although both the Moon and Mars versions of Starship require the vehicle to reach orbit and successfully refuel, there is a huge divergence in the technology and work required after that point.

It's not at all clear that the Trump administration is seriously seeking to address this issue by providing SpaceX with carrots and sticks to move the lunar lander program forward. If Artemis is not a priority for Musk, how can it be for SpaceX?

This all creates a tremendous amount of uncertainty ahead of Sunday's Starship launch. As Musk likes to say, "Excitement is guaranteed."

What is Block-2 BlueBird? US-Based Satellite to be Launched by ISRO Using India's Heaviest Rocket

Vinay Prasad Sharma | 11 August 2025

Source: [WION View | https://www.wionews.com/trending/what-is-block-2-bluebird-us-based-satellite-to-be-launched-by-isro-using-india-s-heaviest-rocket-1754903864878?utm_source=izooto&utm_medium=push_notifications&utm_campaign=What+is+Block-2+BlueBird%3F+US-based+satellite+to+be+launched+by+ISRO+using+India%E2%80%99s+heaviest+rocket](https://www.wionews.com/trending/what-is-block-2-bluebird-us-based-satellite-to-be-launched-by-isro-using-india-s-heaviest-rocket-1754903864878?utm_source=izooto&utm_medium=push_notifications&utm_campaign=What+is+Block-2+BlueBird%3F+US-based+satellite+to+be+launched+by+ISRO+using+India%E2%80%99s+heaviest+rocket)



Once reliant on foreign aid but now leading globally, the Indian Space Research Organisation (ISRO) is set to launch a 6,500 kg US-based communication satellite, the Block-2 BlueBird (BlueBird 2), in the next couple of months, the chairman of the space agency, V. Narayanan, said on Sunday. The development comes after the launch of the NISAR satellite, the world's costliest Earth observation mission in collaboration with NASA.

While speaking at an event near Chennai, V. Narayanan stated that this mission will

follow the historic launch of the NASA-ISRO Synthetic Aperture Radar (NISAR) mission onboard a GSLV-F16 rocket on July 30. "In another couple of months, a country that received a tiny rocket from the United States, is going to launch a 6,500 kg communication satellite built by the America using our own launcher from Indian soil. What a significant growth it is," he said, TOI reported.

What is the US's BlueBird 2 Satellite?

Block-2 BlueBird, developed by the US-based company AST SpaceMobile, is a next-generation satellite that is built to revolutionise global connectivity. As per V. Narayanan, this satellite has large communication range measuring up to 2,400 sq ft. Block-2 BlueBird is specially designed with an aim to achieve a data transmission speed of up to 12 Mbps, prompting hassle-free voice, data, and video communication for end users. Interestingly, this satellite will also facilitate direct-to-smartphone broadband connectivity, without the need for specialised terminals.

India will receive this next-generation satellite in September, and it will be launched from the Sriharikota spaceport aboard the heaviest rocket in ISRO's fleet, the LMV-3-M5. The interesting part of the Block-2 BlueBird satellite is that it uses AST & Science's patented technologies to connect directly to cellphones in the space environment for the SpaceMobile Constellation.

The satellite features a 64.38 sq m communication array, enabling direct mobile connectivity through 3GPP-standard

frequencies. It has forged partnerships with leading telecom operators worldwide.

NASA's Foreign Aid to Global Leader

Narayanan recalled that when ISRO was established in 1963, India lagged six to seven years behind advanced spacefaring countries. That same year, the United States donated a tiny rocket, marking the beginning of the Indian Space Programme. "It was on November 21, 1963," he said.

He added that leveraging satellite data given by the US in 1975, ISRO showcased 'mass communication' by installing 2,400 television sets across 2,400 villages of 6 Indian states.

"From that (kind of humble beginnings), the 30th of July was a historical day for the Indian space programme. We have launched the NISAR satellite. The costliest satellite ever built in the world. The L Band SAR payload from the USA and S Band payload provided by ISRO. The satellite was placed in orbit precisely by Indian launcher (GSLV). And today, we are shoulder to shoulder with advanced countries," Narayanan remarked.

Narayanan also reiterated ISRO's commitment to completing the Bharatiya Antariksh Station, India's own space station, by 2035. The 52-tonne facility will be set up in five modules, with the first module likely to be placed in orbit in 2028.

India, US Set to Seal \$1 Billion Tejas Jet Engine Deal Amid Tariff Tensions

Eric Berger | 21 August 2025

Source: [Teccan Herald](https://www.deccanherald.com/india/india-us-set-to-seal-1-billion-tejas-jet-engine-deal-amid-tariff-tensions-3698747) | <https://www.deccanherald.com/india/india-us-set-to-seal-1-billion-tejas-jet-engine-deal-amid-tariff-tensions-3698747>



Indian Air Force (IAF) LCA Tejas performs an aerobatic display during the Aero India 2023 air show at Yelahanka air base in Bengaluru, India, February 13, 2023. Credit: Reuters Photo

New Delhi: Amid ongoing tariff tensions, India is likely to sign a mega defence deal with the US to buy 113 additional F-404 engines from General Electric for 97 Tejas LCA jets, which the Hindustan Aeronautics Limited will manufacture.

The deal worth around \$1 billion is likely to be inked by September, according to an ANI report that quoted unnamed defence officials.

A week ago, the Cabinet Committee on Security approved the purchase of 97 additional Tejas LCA Mk-1A from HAL at a cost of Rs 62,000 crore to boost the Indian Air Force's depleting squadron strength.

Indian officials said the new deal would help HAL complete the delivery of 180 Tejas LCA Mk-1A in time.

Due to a long delay in GE's supply of F-404, the Bengaluru-based aviation major is yet to supply the homegrown fighter jets to the Indian Air Force.

HAL plans to meet its production targets, with the first batch of 83 aircraft slated for delivery by 2029-30, and the subsequent 97 by 2033-34, provided GE fulfils its promise of supplying two engines per month.

HAL is also parallelly negotiating with GE to buy 200 more powerful GE-414 engines for the advanced versions of Tejas LCA and the indigenous fifth-generation advanced medium combat aircraft.

Sources said the ongoing discussions involving HAL, Defence Ministry and US officials might conclude in a few months.

The indigenous fighter aircraft programme, backed by the Defence Ministry and Air Headquarters, will promote indigenisation and also give a leg-up to small and medium enterprises engaged in defence business.

Indian and US officials on Tuesday held a 2+2 discussion on defence and military cooperation. The two countries are working on a new 10-year framework for India-US major defence partnership.

“Warfare is joint, but physical geography is not—the air domain is different.”

- Colin S. Gray



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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