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“We must strive to be leaders in technology and innovation and invest in cutting-edge research, development and acquisition to build technological superiority. Innovation must become a part of our DNA, enabling us to easily adapt to emerging threats and challenges.”¹

- Air Chief Marshal VR Chaudhari PVSM AVSM VM ADC

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¹ Dalip Singh, Businessline, October 08, 2023, at <https://www.thehindubusinessline.com/news/iaf-chief-tells-his-force-to-strive-to-become-best-force-in-the-world-by-2032/article67396551.ece>

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Opinions and Analysis

From EW to MUM-T, Ukraine War Shows Indian Military Must Quickly Gear-Up for New-Gen Battle

Air Marshal Anil Chopra (Retd)

*Director General, Centre for Air Power Studies |
26 February 2024*

Source: Eurasian Times | <https://www.eurasiantimes.com/from-e-warfare-to-mum-t-ukraine-war-shows-indian/amp/>

Learning lessons from the Ukraine conflict, where attack helicopters were getting shot up, the US Army has decided to cancel its next-generation, multi-billion dollar Future Attack Reconnaissance Aircraft (FARA) program.

They also plan to end production of the UH-60 V Black Hawk by 2025. They would rather invest in inexpensive sensors and weapons carrying unmanned systems and in space.

Bell and Sikorsky are unable to secure a FARA production deal and will need to rework plans. Similar are the lessons from Gaza and the Red Sea Crisis, where expensive aerial platforms were being neutralized with much cheaper AD weapons.

The US Air Force (USAF) wants to replace the service's fleet of Reaper attack drones with something capable of surviving in hostile peer-contested airspace. Although highly successful at what it does, the MQ-9 Reaper is easily shot down and would not survive over a battlefield protected by modern air defenses.

The Pentagon wants to move on from equipment that may have been effective in uncontested fights in Afghanistan and Iraq and prepare for more powerful, higher-end

adversaries such as Russia and China.

Ukraine not only saw attack helicopters getting shot up, but both sides lost about 50 fighter aircraft each within the very first month of the conflict. This forced Russia to mostly use stand-off weapons and cruise missiles.

The Ukrainian AD weapons were the most effective. Suppression of Air Defences (SEAD) is not always easy or completely effective. The Ukrainian military also made very effective use of small, cheaper kamikaze drones, including some with longer ranges, to symbolically hit Moscow.

The sinking of the large cruiser "Moskva" by sea-skimming cruise missiles was another indication that large, expensive platforms have to remain farther away from defenses. While the Russian Beriev A-50 that has just been shot may have been a fratricide, the large high-value ISR, AEW&C, and FARA platforms can be forced further away by longer-range AD weapons.

Air Supremacy in the Past

Air power is a powerful element and often dominant one in all military campaigns. Military planners view having an environment of at least air superiority as a necessity.

To what extent it could be achieved, and at what cost is the question? Air supremacy allows increased bombing efforts, tactical air support for ground forces, paratroop assaults, cargo operations, and airdrops. The degree of a force's air control is a zero-sum game with its opponent's, increasing control by one corresponds to decreasing control by the other.

Strategic bombing in World War II had partial results. Korea and Vietnam saw that despite overwhelming superior force, it was not possible

to achieve air supremacy in the conventional sense against a determined enemy. The two Arab-Israeli wars and the Bekka Valley operations saw a huge influence on air supremacy.

Despite air supremacy in Kosovo, NATO still lost a stealth strike aircraft to a very old-generation Serbian ground-based air defense system. Iraq and Afghanistan wars saw highly uncontested environments, and lessons may be unrealistic.

Air strikes had once moved from high-altitude bombing to ultra-low levels and once again moved to high altitude with stealth platforms. Aerial missiles and ground-based AD systems continue to restrict air supremacy capability.

Cheaper man-portable missile AD systems (MANPADS) have had their dynamics and are not easy to find and neutralize. India learned the hard way during the initial days of air operations in Kargil when it lost a helicopter to a MANPAD, albeit it was not carrying IR flares.

Also, the further evolution of electronic warfare and directed energy weapons makes things complex. The world has been forced to expensive long-range precision strikes, albeit less expensive than losing a platform.

Air Dominance Future

While the US continues to pursue Next Generation Air Defence (NGAD) fighters, it has to factor the same in a contested environment.

They are conscious that they have to prepare for a future conflict with peer competitors, Russia or China. In order to realize air superiority in a next-generation fighter jet, NGAD could manifest a singular aircraft or a combination of various systems, such as manned, unmanned, optionally manned, cyber, and electronic components. These

configurations may deviate significantly from the traditional notion of a “fighter.”

Well beyond traditional navigation, targeting, communication, and ISR support, space-based assets would include directed energy weapons (DEW) and electronic warfare.

The cost of a modern fifth-generation fighter is around \$100 million. The NGAD would be highly cost-intensive with state-of-the-art avionics and weapons and would cost “multiple hundreds of millions.”

It will not be easy to afford. They may get neutralized by much cheaper systems. The world needs to find cheaper force-multiplier solutions. It may be much cheaper for most countries to concentrate much more on “air denial” than just dominance. Also a 1,000 drone swarm would cost infinitesimally less than the NGAD and prove to be as or more effective.

Air Denial

Despite huge asymmetry, Ukraine was able to deny the over ten times larger and technologically superior Russian Air Forces any level of air superiority through “air denial.”

Effectively restricting the unhindered use of Russian offensive air power and, in turn, slowing the surface offensive. Russian manned aircraft have not flown even close to the border for some time now.

Of course, Ukraine was backed by a huge supply of Western air defense systems to add to the existing Soviet-era S-300s in its inventory. They also have the “home-court” advantage, as they have to concentrate mostly on their own defense.

Many analysts have blamed the Russians for

the poorly run SEAD campaign and called it a self-inflicted failure. While that may be partially true, I do believe that the same may not have been easy against some of the AD systems.

We must remember that despite overwhelming superiority, it was not easy for the Americans to neutralize Iraqi Scud missiles. Mobile AD systems that “shoot and scoot” have worked well in Ukraine.

Their radar comes on for a very short time, and then they quickly shift location, making SEAD difficult. Lessons from Ukraine should induce a re-think on many counts.

Aircraft are “no more just the hunter but also the hunted.” Modern AD weapons like the S-400 cover the entire vertical and horizontal bubble. Denying the expensive fighters and bombers the ability to come into the tactical battle zone will change the dynamics. Close counter-surface force operations by fighters and attack helicopters have become highly risky.

If the targets have to be hit by long-range weapons and cruise missiles, do we need to waste large sums on expensive platforms? Cyber interference, electromagnetic jamming, cheap but effective over-lapping air defenses, drones, and a larger stocking of missiles may be much more effective.

The case for inexpensive drones for both offensive and defensive operations has well been underscored. The tank has been made vulnerable to a top attack kamikaze drone.

The large ships will be hit by firing multiple cruise missiles. Large, expensive UAVs may be good for peacetime surveillance but will be sitting ducks even in a partially contested environment. It is time to get real and calculate the “combat

return your buck.”

Ideas India

India has to face two powerful militaries with peer or better capabilities. While India must retain and strengthen its offensive capability to hit hard and far, India, too, must prepare for the air-denial scenario.

It may be a smarter, more economical choice. They need to build stronger air defenses with high stock levels of missiles. In critical areas, there will be a need for a high density of AD systems.

Modern electronic warfare capabilities that are constantly upgraded will be required. Secure jam-resistant communications will be critical. India must increasingly exploit space as a platform cum force multiplier.

There is a need to master drone and swarm tactics and build inventories. Large inventories are also required for supply chain disruptions.

Meanwhile, India has to accelerate homegrown design and production of drones. Iran and Turkey have been great examples of this, and their systems have been extensively used in recent conflicts.

Drones must cover the full spectrum from very small to mid-sized and stealthy UCAVs with stand-off weapons. Manned Unmanned Teaming (MUM-T) is the future. Drones with greater range and autonomy would be a good investment. Precision strikes may be done better by a swarm.

The stealth fighter and bomber aircraft would still be relevant. It takes a long time to develop them. That process must carry on. We have seen counters to drones and drone swarms already evolving and used in conflict.

Fighters must have long-range precision strike weapons. Their physical entry into highly

contested areas will have to be dynamic.

Lastly, there is a need to hasten. War lessons are ever-evolving. Identifying cheaper yet effective priority areas and then funding appropriately is vital. While we must constantly assess adversary strength and threat to match numbers and capabilities, for me, Space, MUM-T, cyber, proliferation of AD systems, and weapon stocking are priority areas.

Five Years after the Pulwama Terror Strike

*Air Vice Marshal Anil Golani (Retd)
Additional Director General, Centre for Air Power Studies | 13 February 2024*

Source: Hindustan Times | <https://www.hindustantimes.com/opinion/five-years-after-the-pulwama-terror-strike-101707833968706.html>



*EDS: IMAGE VIA DEFENCE PRO** New Delhi:
Four Tejas aircrafts fly past in 'Diamond' formation during the 75th Republic Day parade, at the Kartavya Path in New Delhi, Friday, Jan. 26, 2024. (PTI Photo) (PTI01_26_2024_000808B)(PTI)*

Today is the fifth anniversary of the Pulwama terror attack. Forty Indian security personnel were killed in this heinous attack that was attributed to Jaish-e-Mohammed (JeM), a Pakistan-based and aided terror organisation led by an internationally proscribed terrorist, Masood Azhar. The attack was followed by a punitive strike by the Indian Air Force (IAF) on a terrorist training facility,

a non-military target in Pakistan, across the international border in the early hours of February 26, 2019. This subsequently led to a retaliation by the Pakistan Air Force (PAF) the next day and in the ensuing skirmish, a PAF F-16 was shot down along with an IAF MiG-21, with its pilot taken hostage by Pakistan.

Diplomatic relations nosedived since the Pulwama attack with India withdrawing Most Favoured Nation (MFN) status to Pakistan in February 2019. In August 2019, Pakistan suspended bilateral trade with India. Indo-Pak relations since then have continued in a downward spiral with both nations having withdrawn their staff and closing down their respective consulates. The possibility of any rapprochement appears slim; the fractured verdict in the Pakistan elections has ensured that the military establishment is likely to set the agenda.

Two days after the Pulwama terror attack, the IAF carried out its planned firepower demonstration, Exercise Vayushakti, over the Pokhran range in which 140 fighters including attack helicopters and transport aircraft showcased their capability to hit targets with pinpoint accuracy. The planning for the calibrated response to the Pulwama attack code-named 'Operation Bandar' was a secret known to only a select few. This operation in the early hours of February 26, 2019, took the Pakistan establishment by surprise. More importantly, the international community perceived it as a just and appropriate response by an aggrieved India on a non-military target in response to a terrorist attack on its soil.

The next edition of Vayushakti is scheduled to take place on Saturday (February 17). This version of the exercise will see the participation of 121 aircraft including the indigenous Tejas,

Prachand and Dhruv apart from the Rafale, which will be participating for the first time. Indigenous surface-to-air missile systems, Akaash and Samar, will display their ability to track and shoot down enemy aircraft. This year, the exercise will see participation by the Indian Army aviation assets as well focussing on interoperability, synergy and coordination, not only between various weapon systems and platforms within the service but also inter-service.

In the five years since the Pulwama attack, Pakistan has lost out on international goodwill. It has also lost salience in strategic terms after the United States (US) withdrew from Afghanistan and the Taliban returned to run the government in Kabul. With International Monetary Fund (IMF) bailouts being the norm rather than the exception and a faltering electoral democracy, the prospects of a turnaround in Pakistan's trajectory of growth and prosperity appear remote. India, on the other hand, continues on its path of being a resurgent and responsible nation that not only desires friendly relations with its neighbours but also aims to be a leading voice of the Global South. The military standoff with China in Eastern Ladakh since May 2020 and the break in meaningful diplomatic engagement to resolve the border dispute along the Line of Actual Control to restore the status quo ante, places India in a precarious situation that requires not only political resolve but military heft as well to protect its interests. With a strong government in office, there is no dearth of aggressive political will. The military capability has been displayed during the punitive strike after the Pulwama terror attack and the standoff with China in Galwan. It will once again be displayed during Exercise Vayushakti this weekend. While this may assuage the nation at large on the IAF's prowess and capability, we live in an uncertain

world that is today witnessing long and enduring conflicts that can have disastrous consequences.

Wars and conflicts have metamorphosed into multi-domain operations wherein anything and everything can be weaponised. However, to protect national interests, political will and resolve, capability and capacity are quintessential ingredients. While the former two are available in abundance, the capacity in terms of military hardware remains an issue of concern. There exists a need to not only bolster indigenous production but to also prioritise inter-service requirements and lay out a roadmap that needs to be followed in letter and spirit. The wheels of the military-industrial complex in the country need to turn vigorously. For synergy between the various arms of the military, the institution needs to shed many shibboleths of its past in the national interest. It is time to cast criticism and scepticism aside and counter rhetoric with substance.

Air Power

Russia Successfully Tests S-500 System Against Hypersonic Missile: Russian Media

Vinay Sadham | 28 February 2024

Source: *The News Mill* | <https://thenewsmill.com/2024/02/russia-successfully-tests-s-500-system-against-hypersonic-missile-russian-media/>



Russia successfully tests S-500 system against hypersonic missile: Russian media

Russian news agency Izvestia reported that Russia recently conducted new flight tests of the S-500 missile defence system, testing its ability to shoot down hypersonic missiles, citing sources in the Russian defence ministry.

According to Izvestia, the S-500 system proved its effectiveness by accurately tracking and neutralising targets similar to the Russian hypersonic glide vehicle ‘Avangard’.

While Western countries are struggling to deploy hypersonic missiles, Russia’s claim regarding its ability to shoot down such missiles has drawn significant attention from the global community.

S500 Prometheus: The Cutting-Edge Missile Defence System

The S-500 Prometheus is the cutting-edge missile defence system of Russia, which

reportedly entered service in 2021.

While the S-400 system is primarily designed for air defence against aircraft, cruise missiles, and drones, it can also intercept ballistic missiles with a range of up to 3,500 km within a 60 km radius during their terminal phase.

However, the S-500 Prometheus, a successor to the S-400, is primarily designed to intercept ballistic missiles, including intercontinental ballistic missiles, at a maximum range of 600 km.

According to reports, the S-500 system features two new interceptors, 77N6 and 77N6-N1, designed to destroy incoming ballistic missiles or satellites at a range of 600 km and altitudes close to 200 km.

Some reports also claimed that the system uses the 40N6M, a derivative of the S-400’s 40N6E, with a range of 400 km against aerodynamic targets.

The system can engage 10 ballistic targets simultaneously and is claimed to have the ability to shoot down targets travelling at speeds of up to 7 km/sec.

The S-500 system is not meant to replace the S-400 system but to supplement it along with the A235 system. The system can coordinate with the S-400, forming a comprehensive defence against a wide range of aerial threats.

Can the S-500 Shoot Down Hypersonic Missiles?

Unlike ballistic missiles, hypersonic missiles are capable of travelling within earth’s atmosphere and changing course throughout their flight to evade missile defence systems.

While ballistic missiles can be detected

thousands of kilometres away, hypersonic missiles can only be detected at a distance of a few hundred kilometres, providing a shorter response time to calculate trajectory, prepare, and launch several missiles to intercept the target.

Russia leads the hypersonic race with successful deployments of the Avangard boost glide vehicle and the Zircon hypersonic cruise missile. Meanwhile, Western countries, including the US, are still in the development phase of hypersonic missiles.

Dmitry Kornev, editor of the Military Russia portal, stated that the S-500 system is capable of intercepting missiles travelling at hypersonic speeds, ranging from short-range systems to intercontinental ballistic missiles (ICBMs), including hypersonic missiles that fly at low altitudes.

The success of the S-500 system in intercepting hypersonic missiles is likely achieved through new radars and a powerful computing complex. Additionally, it requires highly manoeuvrable missiles with extremely high speeds to chase the targets, according to Kornev.

Hypersonic defence projects

The United States is actively engaged in the development of the Glide Phase Interceptor (GPI) to intercept hypersonic missiles, with plans for deployment by 2029.

Israel unveiled the new Sky Sonic defence system last year, but no specific timeline was provided. Additionally, European countries are developing two new systems: the MBDA Aquila and the HYDEF system.

Conclusion

While Russia has already been leading the hypersonic missile race, the country now claims to possess a system capable of intercepting such missiles, even as Western countries struggle to deploy similar technologies. This claim has drawn significant attention from the global community.

Ukraine's Air Defence Success Tied to Advanced Missiles and Tactical Manoeuvres – Forbes

Olena Roshchina | 28 February 2024

Source: Ukrainska Pravda | <https://www.pravda.com.ua/eng/news/2024/02/28/7444087/>



Forbes suggests that the success of the Armed Forces of Ukraine in shooting down Russian aircraft is linked to the use of expensive foreign missiles such as Patriot and NASAMS, as well as Russia's "fog of war" brought on by the loss of a third of their Beriev A-50 long-range radar detection aircraft.

The Air Force of the Armed Forces of Ukraine has announced that in 10 days, they have shot down 10 Russian military aircraft: 9 advanced fighter-bombers of the Russian Air Forces, specifically the Su-34 and Su-35, as well as a Beriev A-50 AWACS aircraft.

The publication notes that the Russians are

losing aircraft 20 times faster than they can replace them. Subject to sanctions, the Russian aerospace industry is attempting to produce only a few dozen new combat aircraft annually.

Forbes states that it is unclear how the Ukrainians managed to shoot down so many aircraft.

The author David Axe suggests that the Ukrainian air defence forces have deployed some of their Patriot missile systems to mobile air defence groups that swiftly move along the front lines, laying in wait to intercept Russian aircraft with PAC-2 missiles that have a range of 90 miles (145 km), and then quickly relocating to avoid counterattacks.

However, the distance from which Ukrainians shot down the A-50 on Friday – 120 miles or thereabouts (almost 200 km) – suggests the use of a missile system with a longer range. Axe suggests that it might have been a S-200, which Ukrainians might have taken out of long-term storage.

At the same time, he is confident that the Ukrainians have relocated some of their two dozen NASAMS surface-to-air missile batteries with a range of 25 miles (40 km) closer to the front line. Consequently, on 26 February, the Russians identified and destroyed their first NASAMS launcher near Zaporizhzhia using a missile.

Perhaps Ukraine has deployed all the systems mentioned above and others simultaneously to create a brief moment of "shock and awe," but if that is the case, the author writes, Ukraine will soon run out of missiles for their Patriots and NASAMS, as the United States has not provided any ammunition to Ukraine since the end of

December 2023.

Axe does not rule out the idea that the actions of the Russians have contributed to a sharp increase in losses of Russian aircraft. The Russian military air force conducts more sorties closer to the front line, suppressing Ukrainian forces to facilitate the advance of their ground troops.

As the Ukrainian Center for Defence Strategies explained, "The enemy has overcome the fear of using aviation directly over the battlefield, and although this results in the loss of aircraft, their ground forces gain a significant firepower advantage."

The surge in Russian strike sorties provides Ukrainian air defence with more targets, leading them to shoot down more Russian aircraft.

Ukrainian efforts are aided by the fact that Russian pilots increasingly fail to detect Ukrainian missile launches.

Previously, the Russian air force relied on nine A-50 AWACS planes, flying three "circuits" with three aircraft each in the south, east, and north, to expand sensor coverage across the entire territory of Ukraine. By damaging one A-50 with a drone strike last year and shooting down two more this year, the Ukrainians reduced sensor coverage by a third, creating blind spots where it is difficult for Russian pilots to detect approaching missiles.

Quote: "With both sides expending resources they can't renew – the Ukrainians their American-made missiles; the Russians their Su-34s, Su-35s and A-50s – both sides in the Russia-Ukraine war are waging short-term campaigns they hope will secure them a long-term advantage.

The Ukrainian air force apparently aims to

use its last few Patriot and NASAMS missiles to deplete the Russian air force and prevent future surges in bombing sorties. The Russian air force meanwhile aims to bomb more Ukrainian garrisons into submission, and help Russian ground troops to gain ground, before the Sukhoi squadrons are exhausted for a want of planes and experienced crews."

The author notes that assistance from the United States would be a way out of the looming deadlock, which needs approval in the US House of Representatives. The US Senate has already approved allocating US\$60 billion in new aid to Ukraine.

F-35 is Turning into a “Flying Sensor” for UAV Ground Targeting

Boyko Nikolov | 28 February 2024

[Source: Bulgarian Military | https://bulgarianmilitary.com/2024/02/28/f-35-is-turning-into-a-flying-sensor-for-uav-ground-targeting/#:~:text=US%20developers%20have%20embarked%20on,managed%20by%20the%20US%20Army](https://bulgarianmilitary.com/2024/02/28/f-35-is-turning-into-a-flying-sensor-for-uav-ground-targeting/#:~:text=US%20developers%20have%20embarked%20on,managed%20by%20the%20US%20Army)



Photo by Pfc. Syrr Parker

US developers have embarked on fresh testing trials of their extraordinary F-35 Lightning II alongside unmanned aerial vehicles [UAVs or UCAVs]. These evaluations are part of the Project Convergence Capstone 4 [PC-C4] agenda managed by the US Army.

The principal objective of these tests is to examine the F-35's sensors in an alternate use case – AWAC. In other words, the sensors on this stealth fighter craft will relay information regarding a ground target's location to a drone. Consequently, the ground target becomes the drone's objective, directed by the data from the F-35. This unique approach allows the F-35 to stay out of combat range, preserving its valuable services, and instead employing the cost-effective yet efficient Kamikaze drone.

This innovative examination was executed in collaboration with the US Marine Corps, who provided their F-35 as the sensor source. The US Navy also plays a pivotal role in this venture, functioning as the “battle control node”.

Revolutionizing the F-35

Successful execution of the PC-C4 could revolutionize future military endeavors of both the US and UK armed forces. Both nations currently employ E-3 Sentries AWAC, which perform capably in tactical situations. However, the main drawback of the E-3 Sentries is their vulnerability within combat ranges.

Therefore, the robust 500-mile radio range of the F-35 could effectively replace the E-3 Sentries. The numbers game also significantly impacts this dramatic shift. One can only send a limited number of E-3s, perhaps six or seven at a time on a single mission. In contrast, a fleet of 20 to 30 F-35s can provide far superior coverage within the combat range.

Moreover, the F-35 possesses the added advantage of functioning as an AWACS in combat zones, even after primary AWACS has been pulled out. The F-35 outlasts AWACS craft, especially against adversaries like the Chinese J-20 and

Russian MIG-31. Furthermore, the F-35 has been sold to various European countries by the US over the past year, enabling global surveillance 24/7 if they are used explicitly as AWACS.

The US Navy as a Command Center

In this context, the contribution of the US Navy during F-35 AWACS missions is vital. The F-35 processes far more data than any other contemporary tactical fast jet. However, interpreting this data requires extensive AI and human involvement, only feasible within a flying or ground command center. The US Navy fulfills this role as the ground command post.

“The F-35’s primary application is locating various vehicles and ships,” states U.S. Marine Corps Maj. Matteo Occipinti, who is experienced in piloting the F-35. “There’s a significant technological advancement in sensors, data links, and the seamless integration between them.”

The teamwork and global scope of these trials are crucial to maximizing sensors, battle control nodes, and weaponry, thereby disrupting enemy target tracking and eliminating single-point failures.

The Information is a Commodity

“Information becomes a commodity in battle due to unforeseen circumstances in these exercises,” expresses Morgan Hutts, director of operations for the 134th Air Control Squadron. “It’s about training our Airmen, Soldiers, and Marines, irrespective of rank, to actively seek the information they need at their level. This will help them understand the commander’s intent and boost their lethality.”

The culmination of these experiments will result in enhanced joint and allied cooperation.

This unity will ensure that the Army, as a cog in the joint and multinational wheel of military might, can seamlessly merge effects across all domains to lay the foundation for the Army of 2030.

IAF Strengthens Air Defense with Indigenous SAMAR-2 Missile System

Sumit Arora | 26 February 2024

Source: [Current Affairs.Adda247 | https://currentaffairs.adda247.com/iaf-strengthens-air-defense-with-indigenous-samar-2-missile-system/](https://currentaffairs.adda247.com/iaf-strengthens-air-defense-with-indigenous-samar-2-missile-system/)

File Image: Patriot missile defense systems.



The Indian Air Force (IAF) has taken a significant stride in bolstering the nation’s air defense capabilities with the development of the Surface to Air Missile for Assured Retaliation (SAMAR-2) missile system. This innovative system leverages repurposed Russian R-27 air-to-air missiles, transforming them into a potent surface-to-air defense solution.

SAMAR-2: Extending the Life Cycle of Legacy Assets

As explained by Air Marshal Vibhas Pande, SAMAR-2 represents a strategic approach to maximizing the utility of aging missile systems. By integrating these nearing-expiration assets into a robust air defense network, the IAF ensures their continued effectiveness in safeguarding Indian airspace.

Indigenously Developed Defense Solution

The IAF's 7 Base Repair Depot (BRD) Tughlakabad played a pivotal role in developing the SAMAR system. Through meticulous engineering and adaptation, the team successfully transformed the R-27 missiles into a ground-launched air defense system.

Proven Performance through Testing

The IAF has rigorously tested the SAMAR system, conducting successful firing trials during the Astra Shakti 2023 exercise held at Suryalanka Air Force Station in Andhra Pradesh. These trials validated the system's operational capabilities and readiness for deployment.

SAMAR-2 signifies the IAF's commitment to indigenous defense development and resource optimization. By ingeniously repurposing existing assets and fostering domestic technological expertise, the IAF ensures a robust and self-reliant air defense system for India.

Space

Cabinet Approves Amendment in the Foreign Direct Investment (FDI) Policy on Space Sector

21 February 2024

Source: PIB | <https://www.pib.gov.in/PressReleaseDetail.aspx?PRID=2007865>

The Union Cabinet chaired by Prime Minister Shri Narendra Modi approved the amendment in Foreign Direct Investment (FDI) policy on space sector. Now, the satellites sub-sector has been divided into three different activities with defined limits for foreign investment in each such sector.

The Indian Space Policy 2023 was notified as an overarching, composite and dynamic framework to implement the vision for unlocking India's potential in Space sector through enhanced private participation. The said policy aims to augment space capabilities; develop a flourishing commercial presence in space; use space as a driver of technology development and derived benefits in allied areas; pursue international relations and create an ecosystem for effective implementation of space applications among all stakeholders.

As per the existing FDI policy, FDI is permitted in establishment and operation of Satellites through the Government approval route only. In line with the vision and strategy under the Indian Space Policy 2023, the Union Cabinet has eased the FDI policy on Space sector by prescribing liberalized FDI thresholds for various sub-sectors/activities.

Department of Space consulted with internal stakeholders like IN-SPACE, ISRO and NSIL as well as several industrial stakeholders. NGEs

have developed capabilities and expertise in the areas of satellites and launch vehicles. With increased investment, they would be able to achieve sophistication of products, global scale of operations and enhanced share of global space economy.

The proposed reforms seek to liberalize the FDI policy provisions in space sector by prescribing liberalized entry route and providing clarity for FDI in Satellites, Launch Vehicles and associated systems or subsystems, Creation of Spaceports for launching and receiving Spacecraft and manufacturing of space related components and systems.

Benefits:

Under the amended FDI policy, 100% FDI is allowed in space sector. The liberalized entry routes under the amended policy are aimed to attract potential investors to invest in Indian companies in space.

The entry route for the various activities under the amended policy are as follows:

- a) Upto 74% under Automatic route: Satellites-Manufacturing & Operation, Satellite Data Products and Ground Segment & User Segment. Beyond 74% these activities are under government route.
- b) Upto 49% under Automatic route: Launch Vehicles and associated systems or subsystems, Creation of Spaceports for launching and receiving Spacecraft. Beyond 49% these activities are under government route.
- c) Upto 100% under Automatic route: Manufacturing of components and systems/sub-systems for satellites, ground segment and user segment.

This increased private sector participation would help to generate employment, enable modern technology absorption and make the sector self-reliant. It is expected to integrate Indian companies into global value chains. With this, companies will be able to set up their manufacturing facilities within the country duly encouraging 'Make In India (MII)' and 'Atmanirbhar Bharat' initiatives of the Government.

PM Modi Reveals Names of 4 Astronauts for Gaganyaan Mission

29 February 2024

Source: *Indian Express* | <https://indianexpress.com/article/technology/science/four-gaganyaan-astronauts-announced-9183379/>



Shubanshu Shukla, Prashanth Balakrishnan Nair, Angad Prathap, and Ajit Krishnan have been selected to be the astronauts on India's first crewed mission to space.
(Screengrab)

Prime Minister Narendra Modi on Tuesday announced the names of the four astronauts that will fly to low-Earth orbit as part of the Indian Space Research Organisation's (ISRO) Gaganyaan, which will be the first crewed Indian space mission. The PM made the announcement while visiting the Vikram Sarabhai Space Centre in Thiruvananthapuram, Kerala.

Group Captain Prashanth Balakrishnan Nair, Angad Prathap, Ajit Krishnan and Shubanshu

Shukla have been selected to be the astronauts on India's first crewed mission to space. They are all either wing commanders or group captains in the Indian Air Force (IAF) and have extensive experience working as test pilots, which means they are already trained to be prepared to respond quickly in situations where something goes wrong.

Nair is from the town of Nenmara in Palakkad, according to the Malayalam-language publication Mathrubhumi and joined the Air Force in 1999 after completing a degree in engineering from NSS College, which is also in Palakkad.

The four astronauts have been undergoing training at the space agency's astronaut training facility in Bengaluru. The selection of the astronauts happened at IAF's Institute of Aerospace Medicine. Only three of them will eventually go to space as part of the Gaganyaan mission.

ISRO and Glavkosmos (a subsidiary of Russian space agency Roscosmos) signed a memorandum of understanding for the training of four astronauts in June 2019. The four astronauts trained at Russia's Yuri Gagarin Cosmonaut Training Centre in February 2020 till March 2021.

American space agency NASA will also train an Indian astronaut for a mission to the International Space Station by the end of 2024, said the agency's administrator Bill Nelson, during a visit to Delhi in 2023. The Indian Express reported at the time the selection would most likely happen from among the four people who are preparing for the Gaganyaan mission.

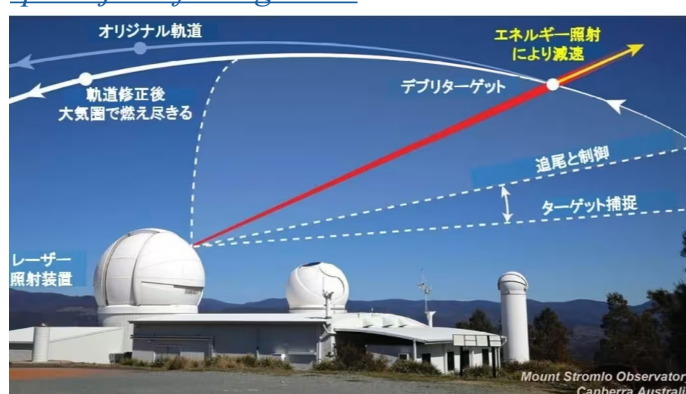
The Gaganyaan mission will demonstrate India's human spaceflight capability by launching astronauts to an orbit 400 kilometres above the Earth for a 3-day mission. After that, they will

be brought back to Earth safely with a landing in Indian sea waters.

Japan Startup Eyes Fusion Laser to Shoot Down Space Junk from Ground

Kazuki Yoshikawa | 14 January 2024

[Source: Nikki Asia | https://asia.nikkei.com/Business/Aerospace-Defense-Industries/Japan-startup-eyes-fusion-laser-to-shoot-down-space-junk-from-ground](https://asia.nikkei.com/Business/Aerospace-Defense-Industries/Japan-startup-eyes-fusion-laser-to-shoot-down-space-junk-from-ground)



EX-Fusion's plan, displayed here in Japanese, is to fire lasers from the ground to slow the speed of space debris, causing it to drop into the Earth's atmosphere.

(Ex-Fusion)

TOKYO -- Osaka-based startup EX-Fusion is attempting to accomplish what once seemed impossible -- taking out minuscule pieces of space junk with laser beams fired from the ground.

Space debris originates from old satellites and rocket bodies. Smaller fragments materialize when these objects collide in orbit at high speeds, with debris as small as a few millimeters known to have caused problems when they strike spaceships and functioning satellites.

The U.S. military identifies and tracks space junk measuring 10 centimeters or more in size. But with the spread of space-related activities across the globe, there is a growing need to track and remove smaller pieces.

Some are tackling the problem using satellites.

Tokyo startup Astroscale Holdings plans to offer a service that removes relatively large space debris with a dedicated satellite.

Elsewhere in Japan, Sky Perfect JSAT is teaming up with the state-backed research institute Riken plus other partners to develop a satellite-mounted laser that will redirect debris into the Earth's atmosphere where it will burn up.

EX-Fusion stands apart in that it is taking the ground-based approach, with the startup tapping its arsenal of laser technology originally developed in pursuit of fusion power.

In October, EX-Fusion signed a memorandum of understanding with EOS Space Systems, an Australian contractor that possesses technology used to detect space debris.

EX-Fusion plans to place a high-powered laser inside an observatory operated by EOS Space outside of Canberra. The first phase will be to set up laser technology to track debris measuring less than 10 cm. Pieces of this size have typically been difficult to target from the ground using lasers.

For the second phase, EX-Fusion and EOS Space will attempt to remove the space debris by boosting the power of the laser beams fired from the surface. The idea is to fire the laser intermittently against the debris from the opposing direction of its travel in order to slow it down. With a decreased orbiting speed, the debris will enter the Earth's atmosphere to burn up.

High-powered lasers are often associated with weapons that blast objects into smithereens. Indeed, the EOS Space group supplies laser weapon systems used to destroy drones.

But lasers designed to remove space debris are

completely different from weapon-grade lasers, EOS Space's executive vice president James Bennett said during a visit to Japan in November.

Current laser weaponry often uses fiber lasers, which are capable of cutting and welding metal and can destroy targets like drones through heat created from continuous firing.

Capturing and removing space junk instead involves diode-pumped solid-state (DPSS) lasers, which are pulsed to apply force to fast-moving debris, stopping it like a brake.

EX-Fusion's signature laser fusion process also involves DPSS lasers, which strike the surface of a hydrogen fuel pellet just millimeters in diameter, compressing it to trigger a fusion reaction.

"The power of a laser for destroying space junk is an order of magnitude lower than for nuclear fusion, but they share technical challenges such as controlling them via special mirrors," EX-Fusion CEO Kazuki Matsuo said.

This makes space debris removal a useful test along the path to commercializing the fusion technology.

EX-Fusion's plan to shoot down space junk from the ground faces development hurdles relating to precision and power. But it has the advantage of allowing for improvements and maintenance to be easily handled on Earth.

The technology could find use in parallel with services for removing larger chunks of debris, handled by companies like Astroscale.

Russia is Working on a Weapon to Destroy Satellites but has not Deployed One Yet

Geoff Brumfiel and Tom Bowman |
15 February 2024

Source: [NPR](https://www.npr.org/2024/02/15/1231594952/russia-national-security-threat-space-nuclear) | <https://www.npr.org/2024/02/15/1231594952/russia-national-security-threat-space-nuclear>



An undated photo shows a SpaceX Falcon 9 rocket carrying Starlink communications satellites into orbit. The Starlink constellation is made up of thousands of satellites that are difficult for adversaries to target.
SpaceX

Russia is developing a weapon that has the potential to threaten satellites but has not yet deployed it, the White House said Thursday, explaining that the development was troubling, but that there was no immediate safety risk.

"We are not talking about a weapon that could be used to attack human beings or cause physical destruction here on Earth," said John Kirby, a spokesperson for the White House National Security Council.

But such a weapon could interfere with systems used for communication, transportation, meteorology and financial transactions — and threaten astronauts in low orbit, he said.

"While I am limited by how much I can share about the specific nature of the threat, I

can confirm that it is related to an anti-satellite capability that Russia is developing," Kirby said.

The Details of the New Weapon are Classified

The White House was briefing a small group of lawmakers about the development on Thursday. The information came to public attention a day earlier, when House Intelligence Committee Chair Mike Turner, R-Ohio, publicly called on President Biden to declassify information "concerning a national security threat."

An official told NPR on Wednesday that the threat concerned a space-based nuclear capability that could allow Russia to target satellites. It was unclear whether that was a nuclear-powered device or a nuclear weapon.

Kirby declined to give any details or description of the capability, saying it was classified.

What the Rules are Around Weapons in Space

The U.S., Russia and China already have the capability to attack satellites, but the Outer Space Treaty of 1967 explicitly bans the use of nuclear weapons in space.

The treaty instructs nations "not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner."

Experts questioned whether a nuclear weapon would be useful against a satellite. In the vacuum of space, a nuclear explosion wouldn't create a destructive shock wave like it does here on Earth, says Brian Weeden, chief program officer with the Secure World Foundation and an expert on space weaponry.

The Russian Embassy did not return NPR's

request for comment.

The Kremlin said the White House was making "another ploy" to try to get Congress to pass a bill with funding for Ukraine. But Kirby rejected that assertion in a one-word answer. "Bollocks," he said.

It could be a Nuclear Weapon or a Reactor

In 2021, Russia fired a missile into space that destroyed a decommissioned Soviet-era satellite. That test proved its ability to knock out satellites at will.

But Russia has also been facing new threats from satellites in its war in Ukraine. Ukrainian forces have been using SpaceX's Starlink constellation on the front line for communications and targeting. Starlink uses thousands of satellites, making it virtually impossible to take out with direct-ascent weaponry.

Nuclear weapons might offer an advantage. In 1962, before the Outer Space Treaty went into force, the U.S. detonated a 1.4 megaton nuclear weapon high above the Pacific Ocean in a test known as "Starfish Prime."

The weapon created an electromagnetic pulse (EMP) that disrupted electronics and communications and was powerful enough to knock out streetlights in Hawaii, some 900 miles away. The test also created an artificial radiation field that damaged numerous satellites in low Earth orbit in the following days and weeks.

Such a weapon could potentially damage a satellite constellation like Starlink, says James Acton, co-director of the Nuclear Policy Program at the Carnegie Endowment for International Peace.

"There is a pretty significant threat from high-

altitude nuclear explosions to satellites," he says. "Nuclear weapons would be a much more efficient way of trying to destroy them."

On the other hand, he says, such an indiscriminate weapon would likely destroy many satellites, not just the intended target.

"That's going to have a ton of other repercussions on all the Russian satellites and all of China's satellites," Weeden says. "And I'm pretty sure the Chinese are not going to be happy about that."

Weeden believes it might be more likely that Russia is developing a space-based nuclear reactor, which could in theory be used to power electronic warfare equipment in orbit.

Russia has been working to develop high-powered space-based nuclear reactors in recent years, with speculation that it might be used for space-based electronic warfare. The idea would be that the reactor would be used to power some sort of jamming device or other weapon that could disable satellites, Weeden says.

The U.S. military has been investing in space-based nuclear power as well in recent years. The Air Force doled out several tens of millions of dollars last year as part of its Joint Emergent Technology Supplying On-Orbit Nuclear power (JETSON) High Power program. Some of that money is going toward developing nuclear power sources for future trips to the moon and Mars, but other parts appear to be developing high-power applications for orbit. And the Defense Advanced Research Projects Agency has also partnered with NASA to develop a nuclear-powered rocket for deep space exploration.

Top Lawmakers are Getting a Briefing

Biden's national security adviser Jake Sullivan was giving a classified briefing to a small group of lawmakers in the House of Representatives on the issue on Thursday.

House Intelligence Committee Chair Mike Turner urged Biden to declassify the information to help Congress, the administration and U.S. allies "openly discuss the actions necessary to respond to this threat."

In response, Senate Intelligence Chairman Mark Warner, D-Va., and ranking member Marco Rubio, R-Fla., said their committee "has the intelligence in question, and has been rigorously tracking this issue from the start."

Their statement added: "We continue to take this matter seriously and are discussing an appropriate response with the administration. In the meantime, we must be cautious about potentially disclosing sources and methods that may be key to preserving a range of options for U.S. action."

Space Force to Lean On Private Sector for Space Tracking Data

Sandra Erwin | 27 February 2024

[Source: Space News | https://spacenews.com/space-force-to-lean-on-private-sector-for-space-tracking-data/](https://spacenews.com/space-force-to-lean-on-private-sector-for-space-tracking-data/)



Lt. Gen. David Miller, U.S. Space Force's Space Operations Command commander, speaks at a change of command ceremony at Peterson Space Force Base, Colo., Jan. 9, 2024. Credit; Dennis Rogers Credit: (U.S. Space Force Photo/Dennis R

WASHINGTON — As the U.S. Space Force continues to refine its plan to leverage commercial services, a top general said he expects space domain awareness to be one area where private sector capabilities will be increasingly needed.

With more congestion and threats to satellites in orbit, the Space Force will need more sophisticated space tracking data and analytics capabilities that can transform raw data into actionable intelligence on activities in orbit, said Lt. Gen. David Miller, commander of Space Operations Command.

Based at Peterson Space Force Base, Colorado, the Space Operations Command is responsible for training and fielding combat-ready forces.

Speaking with reporters Feb. 27, Miller said services provided by commercial satellites can

fill critical capabilities but the Space Force has to carefully look at the pros and cons compared to government-owned systems, and activities performed by military personnel.

“Where they can provide operational utility, mission resilience, rapid reconstitution and backstopping for core capability, I’m all in, and I want to see it happen,” he said of commercial services.

The “price point has to allow us to leverage and maintain that capability,” he said. Further, “it has to be reliable, but also happen on a timeline that meets our mission requirements.”

Space domain awareness is one area where commercial companies can help, he said. “I want to leverage capability for analytics, data interpretation, speed in decision cycles.”

Need for Actionable Intelligence

Space Force officials have pointed out data in and of itself is not overly helpful unless it can be quickly analyzed and interpreted.

Space domain awareness refers to the ability to detect, track and identify objects in orbit, as well as monitor space weather and other activity that could impact operations. It’s considered crucial for things like warning of potential collisions with satellites or spotting potential adversary threats.

Officials point out that the number of satellites and debris objects in orbit has increased significantly, making it challenging to track, maintain custody of threats, and prevent collisions effectively. And they note that legacy systems designed for cataloging objects in space are insufficient for the complexities of modern space operations.

Miller said the commercial strategy has been a “really collaborative process” and the Space Operations Command provided input. The document, which examines how the Space Force could partner with the commercial space industry, is being coordinated with the Pentagon’s space policy and is expected to be released in the near future.

“The demand for space power is only increasing, it’s not decreasing,” Miller said. “There’s more mission areas to be plowed, some to be provided by commercial partners and allies.”

Global Aerospace Industry

Turkiye's First Fighter Jet KAAN Conducts Maiden Test Flight

20 February 2024

Source: TRT Wrold | <https://www.trtworld.com/turkiye/turkiyes-first-fighter-jet-kaan-conducts-maiden-test-flight-17068461>



KAAN's features include high situational awareness, optimised pilot workload, combat damage detection, and more

Türkiye's first domestic fighter jet KAAN, designed and manufactured by Turkish Aerospace Industries (TAI), has successfully conducted its maiden test flight.

Temel Kotil, the head of TAI, said on X that

KAAN stayed in the air for 13 minutes and reached a speed of 230 knots at an altitude of 8,000 feet during the flight on Wednesday.

President Recep Tayyip Erdogan said Türkiye has left behind another critical stage to produce its own fifth-generation fighter aircraft.

"In the coming period, we will continue to give new good news to our nation in the defense industry," he wrote on X.

KAAN aims to rejuvenate the Turkish army's fleet, making Türkiye one of the few countries to own this technology.

Projects for the production of KAAN began in 2016, and the fighter jet was rolled out in March 2023.

The 21-metre aircraft can reach a maximum speed of 1.8 Mach thanks to its twin engines, which can produce 13,000 kilogrammes of thrust each.

It has several features such as high situational awareness, optimised pilot workload, combat damage detection, new generation mission systems, low observability, precision strike, and internal weapon bay.

Türkiye Rising In Defence Industry

Türkiye has become a defence products exporting country thanks to a positive change that happened because the Turkish government decided to make its own weapons in the early 2000s.

Since then, Turkish companies have been producing various military equipment like rifles, armoured vehicles, missile systems, and advanced armed drones, which are now well-known worldwide.

The defence industry of Türkiye has significantly contributed to the national economy reaching a record level of \$5.5 billion in exports, a 27 percent increase from the previous year.

The average export value surpassed \$65 per kilogrammes. This growth serves as an indicator of increased trust in Turkish defence industry products, with the number of countries receiving exports rising from 176 to over 185.

Maiden Flight of Turkey's Most Powerful Drone Marks a New Era in Defense Technology

Safak Costu | 26 February 2024

Source: [BNN Breaking | https://bnnbreaking.com/world/turkey/maiden-flight-of-turkeys-most-powerful-drone-marks-a-new-era-in-defense-technology](https://bnnbreaking.com/world/turkey/maiden-flight-of-turkeys-most-powerful-drone-marks-a-new-era-in-defense-technology)



Maiden Flight of Turkey's Most Powerful Drone Marks a New Era in Defense Technology

In a world where technological prowess defines national strength, Turkey has etched a new chapter in the annals of military innovation. The AKINCI Combat Unmanned Aerial Vehicle (C UCAV), Turkey's latest foray into high-tech warfare, has successfully completed its maiden flight, powered by an engine that boasts an unprecedented 1,700 horsepower. This landmark event not only underscores Turkey's burgeoning expertise in defense technology but also its

commitment to achieving strategic autonomy in military capabilities.

A Leap in Aerial Warfare

At the heart of the AKINCI C UCAV's success is its twin-engine configuration, each delivering 850 horsepower, combining to offer a total of 1,700 horsepower. This formidable power allows the drone to carry out extended surveillance, reconnaissance, and combat operations with enhanced efficiency and lethality. The successful maiden flight, covered by sources such as Flight Global and Daily Sabah, not only represents a significant milestone in the UAV's development but also in Turkey's pursuit of advancing its military technology capabilities.

Strengthening National Defense

The AKINCI C UCAV's capabilities are not just about showcasing technological prowess; they have real-world implications for Turkey's defense strategy. With its powerful engine and advanced combat features, the drone is expected to play a pivotal role in modern warfare scenarios, offering Turkey strategic advantages in surveillance, reconnaissance, and targeted operations. The successful deployment of such technology could redefine power dynamics, not just for Turkey but on a global scale, emphasizing the importance of indigenous capabilities in maintaining national security and sovereignty.

Global Ambitions and Challenges

As highlighted by the successful flight test, the AKINCI C UCAV is a testament to Turkey's growing stature as a defense exporter, with multiple export deals already in place. This achievement not only bolsters Turkey's defense industry but also positions it as a key player in

the global defense market. However, this ascent comes with its own set of challenges, including navigating complex international relations and adhering to global defense protocols. The journey ahead for Turkey's defense sector is promising but fraught with hurdles that will test its resilience and adaptability.

U.K. Government Allots \$10M for Vertical Aerospace Electric Air Taxi Propeller Project

Jack Daleo | 27 February 2024

Source: [India Today](https://www.indiatoday.in/science/story/indian-astronauts-will-fly-to-space-station-in-american-vehicle-isro-chief-2469034-2023-11-29) | <https://www.indiatoday.in/science/story/indian-astronauts-will-fly-to-space-station-in-american-vehicle-isro-chief-2469034-2023-11-29>



Vertical Aerospace is developing next-generation propellers for its flagship, four-passenger eVTOL air taxi. [Courtesy: Vertical Aerospace] Photo by Adam Gasson / Vertical Aerospace

Vertical Aerospace, a U.K.-based manufacturer of electric vertical takeoff and landing (eVTOL) air taxis that previously projected it could run out of money in September, now appears to be flush with cash.

The manufacturer last week said it received a \$10 million grant from the U.K. government through the Aerospace Technology Institute (ATI) program, its fourth grant award through that initiative. The award brings Vertical's total U.K.

government grant funding to \$47 million and follows founder and CEO Stephen Fitzpatrick's personal commitment to provide another \$50 million.

The company will use the money to develop next-generation propellers for the VX4, its flagship, four-passenger eVTOL air taxi. The propellers will be featured on Aircraft Two, a full-scale prototype in production that will build on its Aircraft One model.

Aircraft One is the company's inaugural prototype that suffered a crash during uncrewed testing at Cotswold Airport (EGBP) in August. The accident damaged the model's right wing and landing gear, and rendered it unusable for further flight testing.

"This exciting sustainable propeller project is a fantastic example of our commitment to our world-leading aviation sector, supporting high-skilled, high-paid jobs across the U.K. while developing technologies of the future," said Nusrat Ghani, U.K. minister of state for industry and economic security. "When government and industry collaborate like this, we help our aerospace sector soar to new heights, leading the charge towards net-zero air travel by 2050."

Vertical will head a consortium of U.K. technology organizations and research institutions, including the University of Glasgow, University of Bristol, Cranfield University, and Helitune, a helicopter monitoring specialist.

Of the more than \$25 million being poured into the propeller project, Vertical said it received more than \$10 million, or about half of the company's eligible development costs. Another \$4.5 million will be awarded to other consortium members.

According to Vertical, the new propellers will be lower in weight, inertia, and noise than its existing propellers and will be "delivered to a higher safety standard than any model currently on the market."

"The project will see advancements in rotor technologies vital to the success of eVTOL aircraft developed here in the U.K., growing knowledge, skills and capability in the process," said Mark Scully, head of propulsion and advanced systems technology for ATI. "Through this investment the ATI Programme is enabling the development of ultra-efficient and cross-cutting technologies."

The award follows Fitzpatrick's commitment to support Vertical with \$50 million out of his own pocket. The company last week confirmed it has entered into an investment agreement with its founder and CEO, putting the promise to paper.

By its own estimate, Vertical risked running out of cash by September amid the fallout from its August crash and delays to its certification timeline, which over the years has been pushed from 2024 to 2026. The company reportedly missed a target to raise funding by December. Its previous raise of \$205 million closed more than two years ago.

However, Vertical said Fitzpatrick's contribution will extend its cash runway into mid-2025, with more funding potentially lined up pending the completed flight test campaign of Aircraft Two. Last month, it said the full-scale prototype was nearing completion at partner GKN Aerospace's Global Technology Center in the U.K.

Aircraft Two is expected to be Vertical's certification aircraft that it will use in for-credit type certification testing with the U.K. Civil Aviation Authority (CAA). In addition to the

next-generation propellers, the updated design adds a revamped powertrain, refined flight control system, and battery packs designed to meet thermal runaway safety requirements. It will feature components made by certification partners Honeywell, GKN, Hanwha, Solvay, and Leonardo.

Vertical intends for Aircraft Two to complete a flight campaign and several public demonstrations this year. These are expected to include an appearance at the Farnborough International Airshow at Farnborough Airport (EGLF) in July, as well as flights to and from London Heathrow Airport (EGLL).

In March, Vertical received CAA design organization approval (DOA), a required step in the regulator's type certification process. Only a handful of air taxi firms, including Germany's Volocopter and Lilium, have obtained DOA from the European Union Aviation Safety Agency (EASA).

Indian Aerospace Industry

Tejas Mk1A Flown Successfully with Digital Flight Control Computer

Brigadier SK Chatterji (Retd) | 21 February 2024

Source: [Bharat Shakti](https://bharatshakti.in/tejas-mk1a-flown-successfully-with-digital-flight-control-computer/) | <https://bharatshakti.in/tejas-mk1a-flown-successfully-with-digital-flight-control-computer/>



The development of the Tejas Mk1A programme witnessed another successful milestone when the Digital Fly by Wire Flight Control Computer (DFCC) was integrated in prototype LSP7 and successfully flown on 19 February 2024. The DFCC integrated, is indigenously developed by the Aeronautical Development Establishment (AD).

Digital Fly by Wire Flight Control Computer features Quadraplex Power PC based Processor, high speed autonomous state machine based I/O controller, enhanced computational throughput and complex on-board software complied to DO178C level- A safety requirements.

All critical parameters and performance of the flight controls were found satisfactory. The maiden flight was piloted by Wg Cdr Siddarth Singh KMJ (Retd) of National Flight Test Centre.

Aeronautical Development Agency, has successfully type certified Tejas-Light Combat aircraft (LCA). Indian Air Force has already

operationalised Tejas LCA Mk1. Tejas LCA MK1 equipped squadrons are undertaking all tasks meant for such squadrons.

HAL Prepares First Two Tejas Mk 1As for Delivery to IAF

Akhil Kadidal | 28 February 2024

[Source: Janes | https://www.janes.com/defence-news/news-detail/hal-prepares-first-two-tejas-mk-1as-for-delivery-to-iaf](https://www.janes.com/defence-news/news-detail/hal-prepares-first-two-tejas-mk-1as-for-delivery-to-iaf)



The IAF seeks to acquire the Tejas Light Combat Aircraft Mk 1A to replace its ageing MiG-21 fleet. The Mk 1A has a greater payload and fuel capacity than the earlier Mk 1 aircraft (pictured), plus improved avionics and cockpit features. (Indian Air Force)

Hindustan Aeronautics Limited (HAL) is preparing the first two units of the improved Tejas Light Combat Aircraft (LCA) Mk 1A for delivery to the Indian Air Force (IAF) in March.

A source in HAL told Janes that the company aims to deliver the first two aircraft by 31 March. “The IAF has requested the handover of at least one Mk 1A aircraft before this date,” the source said.

HAL was awarded the contract to produce 83 LCA Mk 1A (including 73 single-seat and 10 two-seat trainers) aircraft in January 2021. As per the contract, HAL was originally scheduled to deliver the first single-seat aircraft in February, with a total of three Mk 1As to be delivered in

2024.

“The production of the first two LCA Mk 1A aircraft is almost complete, and we need to ensure that all systems, parts, and components of the aircraft pass inspections in preparation for the handover to the IAF,” the source said.

Janes understands that HAL is working to avoid a potential rejection of the aircraft by the IAF because of a production defect, however minor. “We are trying to ensure that the aircraft will pass the final inspection,” the HAL source said.

Larsen & Toubro Becomes Third Company in India with Plans to Develop a High-Altitude Platform

12 February 2024

[Source: Unmanned Airspace | https://www.unmannedairspace.info/latest-news-and-information/larsen-toubro-becomes-third-company-in-india-s](https://www.unmannedairspace.info/latest-news-and-information/larsen-toubro-becomes-third-company-in-india-s)



The Indian conglomerate Larsen & Toubro has unveiled plans to develop a Solar-Powered High-Altitude Platform (HAP) capable of staying airborne for up to 12-months. Targeting defense, telecommunications, and environmental monitoring, it promises persistent surveillance and communication, for example providing low-cost mass internet access to remote areas with a 10Gbps base

station. With solar panels and lightweight design, it is designed to offer cost savings and environmental sustainability and to showcase India's aerospace ambitions.

L&T joins two other companies to develop a HAP platforms; Hindustan Aeronautics Ltd (HAL) in partnership with NewSpace Research, and National Aerospace Laboratories (NAL).

Indigenous Micro Turbojet Engine Unveiled by Hyderabad-Based Firm in Partnership with IIT-H

30 November 2023

Source: The Hindu | <https://www.thehindu.com/news/national/tehran/indigenous-micro-turbojet-engine-unveiled-by-hyderabad-based-firm-in-partnership-with-iit-h/article67889499.ece>



Former chairman of DRDO G. Satheesh Reddy with officials of Raghu Vamsi Machine Tools and others at the unveiling of the prototype of the indigenous micro turbojet engine. | Photo Credit: Arrangement

A micro turbojet engine designed and developed indigenously by Hyderabad-based firm Raghu Vamsi Machine Tools with support of the IIT Hyderabad has been unveiled.

Aeronautical Society of India president and former Scientific Advisor to Raksha Mantri and DRDO Chairman G. Satheesh Reddy witnessed the live testing of the engine at the company's facility here as well as inaugurated the assembly

and test lab, Raghu Vamsi Machine Tools said on Monday.

The unveiling of the first of its kind micro turbojet engine Indra RV25: 240N in the country is in alignment with the Atmanirbhar Bharat and Make in India initiatives and underscores the company's capability to design, manufacture and deploy cutting-edge aerospace and defence technologies on a global scale, it said in a release.

Indigenous development of cutting-edge technologies such as these will make India self-reliant and emerge as an export hub of critical military products and solutions. "This success will pave the way for us to build entire suite of micro turbo jet engines up to 100 kgf for use in UAVs, missile propulsion, auxiliary power units and range extenders amongst myriads of other opportunities," Raghuvamsi Group COO Arvind Mishra said.

The firm said products such as these will reduce reliance on imported technologies, components, and expertise and contribute to India's goal of achieving self-sufficiency in critical sectors, bolstering national security and economic resilience. It will also stimulate growth of the domestic aerospace and defence manufacturing ecosystem, creating jobs and fostering economic growth, Raghu Vamsi Machine Tools said.

"We are proud to unveil our fully indigenous Micro Turbojet Engine, a testament of India's ingenuity and determination to become a global hub for aerospace innovation," managing director Vamsi Vikas said.

CSIO, HAL to Set Up Centre of Excellence for Avionics in Chandigarh

Vijay Mohan | 28 February 2024

[Source: Tribune India | https://www.tribuneindia.com/news/chandigarh/csio-hal-to-set-up-centre-of-excellence-for-avionics-in-chandigarh-595430](https://www.tribuneindia.com/news/chandigarh/csio-hal-to-set-up-centre-of-excellence-for-avionics-in-chandigarh-595430)



The proposed CoE signifies a monumental stride in the strategic partnership between CSIO and HAL.

Thinkstock

Central Scientific Instruments Organisation (CSIO) and Hindustan Aeronautical Limited (HAL) will establish a cutting-edge Centre of Excellence (CoE) for Avionics in Chandigarh for advancing research and development in avionics technology to boost aerospace industry.

Avionics are the electronic systems used on aircraft, which include communications and navigation equipment, sensors, cockpit display panels and flight control instruments.

The proposed CoE signifies a monumental stride in the strategic partnership between CSIO and HAL. This collaborative endeavour aims to address challenges in avionics technology with a specific focus on cockpit displays, aeronautics, and space technologies.

A new research block is being constructed in the CSIO campus, which would house the

center. The project is being funded by HAL. Senior functionaries from HAL's various centers visited CSIO and interacted with the scientists here to discuss the modalities of the project.

Envisioned as a central hub for pioneering research, innovation and the exchange of knowledge, the key objectives and focus areas of the center include joint research projects, knowledge exchange, industry-academia collaboration and skill development.

The CoE will concentrate on diverse themes such as cockpit display systems, mechatronics for avionics, artificial intelligence, and thin film and stealth technologies. Development areas span avionics, aeronautics, optics, electronics, and more.

CSIO has already developed the Head-up Display for air force and navy variants of the Tejas Light Combat Aircraft and the HJT-36 jet trainer, different types of aircraft lights, various sensors, calibration equipment and pan camera. In addition, it has been involved in several other defence and security related projects.

Commentary

1. Lessons from Ukraine: Time for India to crystallise military drone strategy - <https://www.firstpost.com/opinion/lessons-from-ukraine-time-for-india-to-crystallise-military-drone-strategy-13743470.html>

Further Reading

1. Russia ‘Doubles Up’ On AWACS Killer Missiles That Can Neutralize ‘Sky Radars’ Guiding Enemy Warplanes - <https://www.eurasiantimes.com/aewcs-playing-crucial-role-in-conflicts-but-awacs/amp/>
2. 50 years of F-16s: Still flying high, soaring higher - <https://www.firstpost.com/opinion/50-years-of-f-16s-still-flying-high-soaring-higher-13720252.html>
3. Touted As “Game-Changer,” US Report Calls V-22 Osprey “Not Operationally Suitable”; What Is The Future Of Tilt-Rotors? - <https://www.eurasiantimes.com/game-changers-us-reports-calls-v-22-ospreys/amp/>
4. Russia is using SpaceX’s Starlink satellite devices in Ukraine, sources say - <https://www.defenseone.com/threats/2024/02/russia-using-spacexs-starlink-satellite-devices-ukraine-sources-say/394080/>

“The term ‘Aerospace’ was introduced in 1958 by the USAF Chief of Staff, General Thomas D White, as a new construct that depicted air and space as a seamless continuum stretching from the Earth’s surface to infinity.”



The Centre for Air Power Studies (CAPS) 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 Marshal Anil Chopra, PVSM AVSM VM VSM (Retd).

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