



CENTRE FOR AIR POWER STUDIES (CAPS)

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AEROSPACE NEWSLETTER



An Indian Air Force's Rafale aircraft taking off

Image Courtesy: [thedefensepost.com](https://www.thedefensepost.com)

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“Ongoing conflicts have demonstrated an inescapable need to have a strong and capable Air Force. Adopting the latest technology along with innovative and out-of-the-box thinking will play a decisive role in today’s multi-domain environment”¹

*- Air Chief Marshal AP Singh PVSM AVSM
Chief of the Air Staff, Indian Air Force*

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¹ <https://pib.gov.in/PressReleasePage.aspx?PRID=2063089>

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Opinions and Analysis

A Frightening Future: Experts Outline the Growing Threat of Cyber Attacks Against Space Systems

Shaun Waterman | 18 November 2024

Source: *Satellite Today* | <https://www.satellitetoday.com/cybersecurity/2024/11/18/a-frightening-future-experts-outline-the-growing-threat-of-cyber-attacks-against-space-systems/>



CyberSat in Reston, Virginia, on Nov. 18. Photo: Via Satellite

RESTON, VIRGINIA — Ransomware in space and the possibility of satellite kidnapping were just two of the scary future threats against space systems discussed at the CyberSat conference in Reston, Virginia, on Monday.

The FBI has already observed hacking attempts against satellites in orbit, said David Bray, a former career federal IT official and now distinguished fellow at the Stimson Center think tank in Washington, D.C.

Increasingly, satellites are equipped with the means to update software, firmware and even eventually hardware while in orbit, Bray said. But that creates a broader attack surface for hackers and other cyber attackers, he said, noting that ransomware gangs, flush with

billions of dollars they'd earned from their crimes, and often acting at the behest or with the connivance of national governments, are investing heavily in R&D.

“That’s probably going to happen ... the first ransomware attack on a satellite in space, given how fast things are moving in political events,” Bray said. “[We may not know] whether it’s a true non state actor, or an adversary nation, hiding behind non state actors.”

The scenario becomes scarier still if you contemplate that most satellites are designed to be able to maneuver on orbit to a limited extent, a capability that means a successful cyber-attacker might be able to crash a hacked satellite into an orbital neighbor, said Col. Erica Mitchell, commander of U.S. Space Force’s Delta 26, the unit that defends the nation’s spy satellite agency the National Reconnaissance Office from cyberattacks and online espionage.

“Satellites, if taken over by an unfriendly force, can become weapons as space debris, if being driven by the wrong person,” Mitchell explained.

There are more than 100 million objects greater than 1 mm in diameter orbiting the Earth, according to IARPA, the scientific research arm of the U.S. intelligence community, which has a program to develop technology to track them. Because of the huge speeds involved, over 22,000 miles an hour, even tiny objects can cause significant damage.

“Once you start to contemplate that,” said Megan Moloney, a former FBI analyst now associate director of the Defense & Security

Segment for the consulting firm Guidehouse Federal, “the idea of a satellite hijack is chilling.”

As the U.S. and its rivals work toward on-orbit servicing for satellites, that same technology could enable their capture, diversion or even destruction, said Bray.

“At the same time as we build the vehicles to be able to do this [on-orbit servicing], we also are probably pushing closer to the first great train robbery in space,” he said.

Agencies and their leaders need to start thinking now about counter-measures, deterrence, and how to calibrate their actions if it happens. “What is the proportionate response, if and when a country takes your satellite hostage?” Bray asked.

Meanwhile, the system of rules and international treaties in place to assure the safety and security of space systems on orbit is under increasing pressure from the growing numbers of players, and the growing willingness of some to push the envelope of allowed behavior, like the Russians putting a nuclear armed satellite in orbit.

Bray cited unconfirmed reports earlier this month suggested that the Chinese made unannounced changes to the orbit of 22 of the 60 satellites in their BeiDou constellation, which provides a global position, navigation and timing (PNT) service, much like GPS does for the United States.

“But in theory, you’re supposed to announce these kinds of orbital changes to the ITU before

you make them. But it looks like we could be going into a world in which some countries are testing these norms,” Bray said.

And these escalating threats may not come just from nation states directly, added Moloney.

“The future threat is tricky, because the threat that is now is really getting everybody’s attention,” she said.

With more players and more commercial players in space, future threats to space systems could include commercial entities acting either at the behest or with passive compliance from an adversary, Moloney said. One non-space example of this is Yvgeny Primakov, who set up the Internet Research Agency, the troll farm in St. Petersburg which carried out the hack and dump operation against DNC officials in the run up to the 2016 election.

Beyond even commercial entities, the barriers to entry for cyber attacks on space systems are getting lower every year, raising the prospect that hacktivists or lone hackers might get in on the act, warned Col. Mitchell.

“With the future threat, I think the past might be prologue, and we may be looking at an Anonymous-like organization that decides to start attacking in space,” she said.

Elon Musk Calls F-35 Fighter Jets 'Obsolete': Are Drones Ready For Modern Warfare?

Jose Enrico | 26 November 2024

Source: Tech Time | <https://www.techtimes.com/articles/308460/20241126/elon-musk-calls-f-35-fighter-jets-obsolete-are-drones-ready-modern-warfare.htm>



Photo: CLEMENT MAHOUDEAU/AFP via Getty Images

As technology transforms the face of the battlefield, the impasse over whether drones can replace advanced crewed fighter jets like the F-35 Lightning II has increased.

High-profile figures, such as Elon Musk, aver that the future lies in uncrewed systems; however, military experts insist that human-piloted aircraft must coexist with autonomous machinery.

Elon Musk Ignites Frenzy Over F-35 Amplitude

Last week, Tesla and SpaceX CEO Elon Musk called the F-35 an outdated aircraft in the era of drones. As Business Insider observes over social media, he argued that manned fighters are obsolete, putting pilots at risk unnecessarily in scenarios of modern warfare,

which increasingly feature advanced airborne threats and drones.

Drawing on the conflict in Ukraine, where drones have become critical tools for surveillance and strikes, Musk said autonomous warfare is the future in waiting.

"Manned fighter jets are obsolete in the age of drones anyway. Will just get pilots killed," Musk said via NDTV.

Why Drones Are Changing the Nature of Warfare

Drones have revolutionized war due to their ability to offer inexpensive alternatives for reconnaissance, precision strikes, and tactical maneuvers. Drones are small, versatile, and relatively cheap.

As such, it has proven to be of immense value for land conflict warfare. With expansive air and sea combat theater, especially in the Indo-Pacific region, drones have limitations with regard to payload capacity, speed, and range.

The Case for Crewed Fighter Jets

According to experts, despite the advancements in drone technology, crewed aircraft like the F-35 could still remain indispensable.

According to airpower analyst Justin Bronk, "no current uncrewed system can offer the range and versatility of the F-35."

The stealth fighter at the same time is a

bomber, surveillance platform, electronic warfare tool, and communication hub, functions that drones cannot as yet fully replicate.

Critical decision-making skills are brought to unpredictable combat situations by human pilots, while autonomous systems, as efficient as they are, often lack the adaptability necessary for missions dynamic in nature.

Human pilots provide invaluable flexibility and situational awareness for missions where rapid, nuanced decisions are essential.

Hybrid Approach: Crewed and Uncrewed Systems

The US DoD is weighing hybrid approaches that fully take advantage of the strengths and weaknesses of crewed and uncrewed aircraft. Programs, such as pilotless F-16s and collaborative combat systems, are seeking to increase the efficiency of operations.

As noted by Mark Gunzinger at the Mitchell Institute for Aerospace Studies, an optimal solution will be some form of hybridizing the complementary strengths of crewed and uncrewed systems to maximize combat effectiveness.

"If I develop an aircraft that does not require a human in the cockpit, I could develop one that could pull 15 Gs, 20 Gs because you're no longer worried about the physiology of the human," retired naval aviator Guy Snodgrass said.

What Future Airpower Looks Like

Although the F-35 is expensive and, in many

ways imperfect, it remains an essential bridge to the future of airpower. The armed forces are still perfecting their tactics so that drones and crewed aircraft can operate in tandem. That hybrid capability promises adaptability and resilience as battlefield conditions continue to shift.

Air Power

Rajnath Singh Urges Air Force to Prioritise Operational Readiness, Indigenisation

Shivani Sharma | 20 November 2024

[Source: India Today | https://www.indiatoday.in/india/story/rajnath-singh-urges-indian-air-force-to-prioritise-operational-readiness-indigenisation-2636527-2024-11-20](https://www.indiatoday.in/india/story/rajnath-singh-urges-indian-air-force-to-prioritise-operational-readiness-indigenisation-2636527-2024-11-20)



Defence Minister Rajnath Singh with the senior leadership of the Indian Air Force. (Photo: X/@rajnathsingh)

Defence Minister Rajnath Singh on Tuesday highlighted the critical role of the Indian Air Force in safeguarding national sovereignty and called on the senior leadership to ensure operational preparedness and indigenous advancement of the force.

Delivering his address at the Air Force Commanders' Conference in Delhi, Singh stressed the government's commitment to

fostering 'Atmanirbharta' (self-reliance) in defence capabilities.

He asked the Air Force to enhance the processes of capability and capacity building to align with the country's national aspirations.

He commended the Air Force for its unwavering professionalism and adaptability in the face of evolving challenges.

Before the address, Singh was welcomed by Chief of the Air Staff, Air Chief Marshal AP Singh, who briefed him on the Air Force's operational capabilities.

The conference was attended by key defence officials, including Chief of Defence Staff General Anil Chauhan, Defence Secretary RK Singh, DRDO Chairman Dr SV Kamat, and Secretary (Defence Production) Sanjay Kumar, alongside the Air Force's senior leadership.

The ongoing conference has facilitated detailed discussions on critical operational, administrative and strategic issues. It provides a platform for the Air Force's leadership to assess current challenges and strategise in future directions to maintain excellence.

As part of the proceedings, the leadership will also interact with the chiefs of the Army and Navy, underscoring the importance of joint operational synergy.

Milestone in Air Interoperability with India

21 November 2024

Source: Defence | <https://www.defence.gov.au/news-events/releases/2024-11-21/milestone-air-interoperability-india>

Australia and India have signed an arrangement to enable the Royal Australian Air Force (RAAF) and the Indian Armed Forces to conduct air-to-air refuelling.

Minister for Defence Industry and Capability Delivery, the Honourable Pat Conroy MP, and India's Minister for Defence Shri Rajnath Singh announced the arrangement during bilateral discussions on 21 November.

Under the arrangement, RAAF's air-to-air refuelling aircraft, the KC-30A Multi-Role Tanker Transport, will be able to refuel Indian Armed Forces aircraft.

Deputy Chief of Air Force, Air Vice-Marshal Harvey Reynolds, AM, signed the arrangement on 19 November in New Delhi at Australia-India Air Staff Talks.

Air Vice-Marshal Reynolds welcomed the arrangement, saying it strengthens the defence relationship between Australia and India.

“India is a top-tier security partner for Australia, and through our Comprehensive Strategic Partnership we are continuing to prioritise practical and tangible cooperation that directly contributes to Indo-Pacific stability,” Air Vice-Marshal Reynolds said.

“The ability to conduct air-to-air refuelling

with the Indian Armed Forces elevates our interoperability and enables us to cooperate more effectively in a range of different scenarios.

“This arrangement is a significant step forward in our relationship with India, and will provide valuable opportunities for our personnel to work closely together, share knowledge and expertise, and build trust and understanding.”

RAAF also conducts training and engagement activities with Indian Navy P-8I Neptune surveillance aircraft. The signing of this arrangement is the first step towards KC-30A refuelling the P-8I, increasing India’s reach and persistence in the Indo-Pacific region.

China Shows off Military Technology at Zhuhai Air Show

12 November 2024

[Source: ANI News | https://www.aninews.in/news/world/asia/china-shows-off-military-technology-at-zhuhai-air-show20241112150726/](https://www.aninews.in/news/world/asia/china-shows-off-military-technology-at-zhuhai-air-show20241112150726/)



Z-20 helicopter at display during the Zhuhai Air Show 2024 (Photo/Reuters)

Hong Kong, November 12 (ANI): The extraordinary energy and innovation of China's military-industrial complex show few signs of waning, if exhibits at this year's spectacular

Zhuhai Air Show in southern China, not far from Hong Kong, are anything to go by.

More formally known as the China International Aviation and Aerospace Exhibition, the 2024 edition is being held in the coastal city of Zhuhai 12-17 November.

Whether it is jet engines screaming overhead during aerobatic demonstrations, diesel engines propelling heavy armoured vehicles over obstacles, or missiles, drones and other technology sitting resplendent in exhibition halls, this air show is the occasion where China shows off its military and technological prowess.

However, the biennial show is still in recovery mode after the impact of COVID-19 and an increasingly authoritarian attitude towards foreign companies and overseas media.

The largest ever iteration of the show occurred in 2018, when 150,000 trade visitors and 300,000 members of the general public flocked to the six-day show. In the same year, 425 members of the media attended.

However, this year foreign media are not welcome, a similar case to the preceding 2022 edition when just 193 journalists, all from China, attended. Figures for this year's event are not yet available, but organizers were talking it up as the largest show ever in Zhuhai.

One of the most profound revelations at Zhuhai Air Show 2024 is the J-35A stealth fighter in People's Liberation Army Air Force (PLAAF) markings. There had been rumours last year that the PLAAF was interested in this

brand new fighter platform, and the examples that are appearing this week in Zhuhai are likely to be initial operational training and evaluation aircraft, according to Rick Joe, an expert on the PLA and a regular contributor to The Diplomat publication. He told ANI that he doubts the J-35A is yet operational in any frontline capacity.

The J-35A bears a lot of external similarities to the American-designed and built F-35 from Lockheed Martin. With the arrival of the J-35 platform alongside the J-20, China will have two operational fifth-generation stealth fighter types in service. This makes it the second country in the world to do so, following in the footsteps of the USA that operates both the F-35 Lightning II and the F-22 Raptor.

What then is the Role of the J-35A in the PLAAF?

Joe told ANI, "I see the J-35A as a lower-cost, medium-weight, not-quite-as-long-range complement to the J-20/J-20A. However, its role does not particularly differ, i.e. the J-35A is likely still an air superiority aircraft primarily, with a secondary strike role like the J-20."

The analyst also expects the J-35A to be as well-equipped as the J-20/J-20A in terms of sophistication of weapons, avionics and prioritization of signature reduction. The twin-engine J-35A is slightly smaller than the J-20, and some manufacturing techniques should ensure it is cheaper to build than its brethren.

With the arrival of the J-35A developed and manufactured by the Shenyang Aircraft Corporation, Joe does not expect J-20/J-20A

procurement to slow at all, however. Indeed, the arrival of the J-35A "may be due to a desire to further increase fifth-gen procurement rates as soon as possible, on top of the expansion of J-20/J-20A procurement rates that we've seen CAC [Chengdu Aircraft Industry Group] undergo in recent years".

Of course, the PLAAF's J-35A fighter is piggybacking on the J-35 for the PLA Navy (PLAN). The navy will acquire the carrier-borne J-35 version to operate off its growing fleet of aircraft carriers. Joe speculated that, by procuring a conventional J-35A, then the air force can leverage development and future operational costs otherwise borne solely by the PLAN.

An export version of the J-35A is also likely (perhaps to be called the J-35A), with Joe saying that such a version "may be more appealing to overseas customers, because PLA procurement guarantees an upgrade and sustainment pathway". Many in Pakistan have been claiming for some time that Islamabad will buy the J-35A, even though there has been no hard evidence or announcements from official sources that the platform has been procured to date.

Returning to the PLAN's J-35 version, Joe believes it is currently in advanced testing. "They're very secretive, so it is hard to say what they are doing at this stage, but I would not be surprised if the PLAN had a couple of airframes in initial operational test and evaluation, and it probably will not take too long for carrier compatibility flight testing to commence at sea." This commentator said the J-35 would be compatible with new catapult-

equipped carriers as well as two older Russian-style carriers that have only a ski jump ramp.

The J-35A was not the only Fighter to Debut at this year's Zhuhai Air Show.

Another making its maiden appearance was a J-15T fighter of the PLAN. The latest in a family line of carrier-borne fighters, the J-15T is designed to operate on catapult-assisted take-off but arrested recovery (CATOBAR) carriers such as the newest Fujian, which is yet to be commissioned into the Chinese navy.

The J-15T appearing at Zhuhai appears to be a late prototype, according to Joe, as it uses domestically manufactured WS10 engines rather than Russian AL-31 jets. Also in attendance at this year's extravaganza is the J-15D, which is a specialist carrier-borne electronic warfare version of this fighter. Indeed, PLAN aviation is out in force in Zhuhai, for a Z-20J anti-submarine warfare helicopter also participated.

The Z-20, a Chinese copy of the successful American Black Hawk helicopter family, is expanding into a number of different variants, and the Z-20J is important to the navy as it slots in size between the compact Z-9 and large Z-8 families.

Of interest, Russia sent its new fifth-generation Su-57 fighter to perform an aerial display in the skies over Zhuhai too. The Russian Air Force also dispatched its Russian Knights aerobatic display team to perform for the Chinese public. The appearance of the former, especially, speaks of the close relations between China and Russia, as well as cash-strapped Moscow's attempts to find buyers of

the aircraft.

Some were hopeful that China's mysterious H-20 stealth bomber would put in an appearance, but it is probably too early in its development for this to occur. Instead, to tease and tantalize, computer-generated images showed a video of a hypothetical H-20 working alongside J-35A fighters.

AVIC, China's premier state-owned aerospace company, displayed a full-size mock-up of a sixth-generation fighter at Zhuhai, but this was nothing more than a fantasy item.

China is known to be working on a sixth-generation fighter, tentatively called the J-XD, but it is so secretive that visitors can be certain it does not resemble the fake fighter on display this year at Zhuhai.

Also new was a mock-up of a PL-15E air-to-air missile with a folding tail. This is significant, Joe said, because it would enable the J-20 and J-35 to carry six such missiles in their internal weapons bay, rather than the current four that they can accommodate. It is unclear if the PL-15E has been updated in terms of propulsion and guidance, but China is known to be developing another new beyond-visual-range air-to-air missile. Again, up to six such missiles are expected to be carried by the J20 and J-35.

China is renowned for producing a dazzling array of drones, and one highlight this year is a CH-7 stealthy flying-wing unmanned combat aerial vehicle (UCAV) developed by the China Aerospace and Technology Corporation (CASC). Video footage of one undergoing flight

testing at some unknown location was the first definitive evidence of the CH-7 since a model of the design with 22m wingspan appeared at Zhuhai 5-6 years ago. A mock-up of the CH-7 was exhibited alongside a YJ-21E anti-ship missile, a hypersonic weapon that can be launched by the UCAV and which was unveiled at Zhuhai Air Show 2022.

Whilst on the topic of unmanned technology, China State Shipbuilding Corporation (CSSC) sailed its high-speed 500-ton unmanned surface vessel (USV) to Zhuhai for the show. This adds a new dimension to the air show, since vessels can now tie up in the water at the venue.

Christened the Orca and officially known as the JARI-USV-A, this USV is 58m long, has a beam of 23m and can sail more than 4,000nm. It employs a trimaran hull, and can be used for missions such as strike, air defence, missile interception, anti-submarine warfare and autonomous combat.

Its armaments include a remote-controlled weapon station, a vertical launch system for anti-ship missiles and air defence missiles, as well as rockets.

The Orca even has a stern flight deck that can land a drone or perhaps a small helicopter. Returning to land, another important debut is the HQ-19 air defence system belonging to the PLAAF. This is the Chinese equivalent of the American THAAD system, which stands for Terminal High Altitude Area Defence.

Mounted on a heavy 8x8 truck chassis, the HQ-19 is a Chinese system designed to intercept incoming ballistic missiles. Six missiles are

carried in cylindrical canisters on each launcher vehicle, and the weapons are launched from a near vertical angle.

Hyping it up, Chinese commentators claim the HQ-19 has robust countermeasures capabilities, and that it can intercept both ballistic and hypersonic missiles. However, China remains coy on its range and intercept altitude. The fact that it is appearing in Zhuhai indicates that it has already entered PLA service.

Another interesting air defence system on display is the HQ-17AE unmanned ground vehicle. This 8x8 chassis is bristling with dozens of two different types of surface-to-air missiles, as well as radars and electro-optic system to pinpoint incoming targets. It seems optimized for defending against drones and loitering munitions. China is also pursuing other armaments to counter drones.

One is the CS/SS2A land-based close-in weapon station, a self-propelled PLB-625E anti-aircraft gun, and an 8x8 truck that boasts a high-energy microwave weapon system.

Elsewhere, other land systems from state-owned Norinco also appeared at Zhuhai Air Show 2024. Based on a common 8x8 chassis is a variety of new vehicles.

The SH16A is a 155mm self-propelled howitzer variant, while the VN23 is an 8x8 fire support vehicle armed with a 125mm cannon in a turret. The VN22B is a 6x6 vehicle armed with a 105mm cannon.

China has enjoyed a lot of success selling

armoured vehicles, particularly to Asia, Africa and the Middle East, and Iraq was recently confirmed as a buyer of the VN22 6x6 armoured personnel carrier.

Whilst on the topic of artillery, Norinco showed a new 8x8 truck-mounted multiple rocket launcher. It features two pods, each with five 300mm long-range rockets.

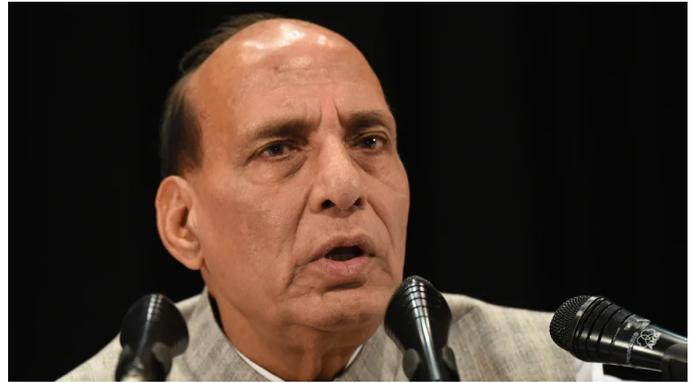
Summarizing the event in Zhuhai, Joe commented, "Overall, we are seeing the usual pattern where the aircraft and systems they display at Zhuhai are ones that we have mostly known about for a while and/or are either in service for a while or on the cusp of entering service."

However, that does not diminish the unique chance at Zhuhai to get close up to new in-service PLA equipment as well as future technology, in a country that jealously guards military secrets and displays a sense of paranoia when it comes to revealing its latest defence equipment. (ANI)

India's Successful Test of Hypersonic Missile Puts it Among Elite Group

17 November 2024

Source: [CNN](https://edition.cnn.com/2024/11/17/india/india-hypersonic-missile-test-intl-hnk/index.html) | <https://edition.cnn.com/2024/11/17/india/india-hypersonic-missile-test-intl-hnk/index.html>



Defence Minister Rajnath Singh speaks at a meeting in 2017 when he was the then Union Minister of Home Affairs. Debajyoti Chakraborty/NurPhoto/Getty Images

New Delhi (Reuters) - India has successfully tested a domestically developed long-range hypersonic missile, it said on Sunday, attaining a key milestone in military development that puts it in a small group of nations possessing the advanced technology.

The global push for hypersonic weapons figures in the efforts of some countries, such as India, which is striving to develop advanced long-range missiles, along with China, Russia and the United States.

The Indian missile, developed by the state-run Defence Research and Development Organisation and industry partners, is designed to carry payloads for ranges exceeding 1,500 km (930 miles) for the armed forces, the government said in a statement.

“The flight data confirmed the successful

terminal maneuvers and impact with high degree of accuracy,” it added.

The test-firing took place from Dr APJ Abdul Kalam island off the eastern coast of Odisha state on Saturday, it said.

Defense Minister Rajnath Singh called the test a “historic achievement” in a post on X, adding that it placed India among a select group of nations possessing such critical and advanced technologies.

Russia Launches Massive Drone and Missile Strike on Ukraine, Cripples Power Infra

Dhruv Yadav | 18 November 2024

Source: Bharat Shakti | <https://bharatshakti.in/russia-launches-massive-drone-and-missile-strike-on-ukraine-cripples-power-infra/>



Smoke rises in the sky over the city after a Russian drone strike, amid Russia's attack on Ukraine, in Kyiv, Ukraine. REUTERS

Russia has unleashed its largest air strike on Ukraine in almost three months on Sunday, launching 120 missiles and 90 drones that killed at least seven people and caused severe damage to the power system of the war-ravaged

country.

Ukrainians had been bracing for weeks for a renewed Russian attack on an already hobbled energy system, fearing long winter blackouts and mounting psychological pressure almost 1,000 days after Russia launched its full-scale invasion.

The strikes, which caused numerous power cuts, came at a time when the impending U.S. presidency of Donald Trump, who has pledged to end the war without saying how, has raised the prospect of a push for negotiations.

Air defences could be heard engaging drones over the capital Kyiv in the night, and a series of powerful blasts boomed across the city centre during the missile attack. Residents huddled in underground metro stations, wrapped in winter coats.

“Severe damage to Ukraine’s energy system, including to DTEK power stations. These attacks again highlight Ukraine’s need for additional air defence systems from our allies,” said Maxim Timchenko, CEO of DTEK, Ukraine’s largest private power company.

The extent of the damage was hard to assess. After repeated Russian attacks on the power grid, officials reveal little detailed information about the outcome of strikes and the state of the network.

Officials confirmed damage to “critical infrastructure” or power cuts in regions from Volyn, Rivne, Lviv in the west to Dnipropetrovsk and Zaporizhzhia in the southeast.

DTEK imposed emergency power cuts in the southern Odesa region, but had lifted them in three other regions by late morning. Emergency work was ongoing in the Odesa, Rivne and Volyn regions, national grid operator Ukrenergo said.

Russia's defence ministry said it had launched a massive strike on energy facilities that supply Ukraine's military-industrial complex.

"The enemy's target was our energy infrastructure across Ukraine," President Volodymyr Zelenskiy said.

Kyiv's air force said it had destroyed 104 of the incoming 120 missiles and shot down 42 drones. Another 41 disappeared from radar, it said.

At least seven people were killed, in the regions of Lviv, Mykolaiv, Odesa and Dnipropetrovsk, authorities said.

Moldovan Deputy Prime Minister Mihai Popsoi said Russian missiles and drones had violated Moldovan airspace during the attack. NATO member Poland, which also borders Ukraine, said it had scrambled its air force as a precaution.

Russia last launched a major barrage at Kyiv on August 26, when officials said it had fired more than 200 drones and missiles at targets across Ukraine.

Its latest onslaught piles more pressure on Ukraine as Moscow's troops notch up their fastest battlefield gains in the east since 2022 in

their effort to seize the entire industrial Donbas region.

Ukrainian soldiers are meanwhile trying to hold the area that they seized in Russia's Kursk region in August, something Kyiv believes could one day be a bargaining chip.

Russia's Latest Missile Attack on Ukraine Carries Warheads without Explosives

27 November 2024

Source: *Tribune* | <https://tribune.com.pk/story/2512086/russias-latest-missile-attack-on-ukraine-carries-warheads-without-explosives>



Parts of a ballistic missile, which Russia used in a strike towards Dnipro city this week, are displayed, amid Russia's attack on Ukraine, at an undisclosed location in Ukraine November 24, 2024. PHOTO:

REUTERS

A new ballistic missile fired by Russia at the Ukrainian city of Dnipro last week carried multiple warheads but no explosives, and caused limited damage, two senior Ukrainian government sources said.

Their comments appeared to confirm the Kremlin's own description of the weapon's use last Thursday as a warning to the West after the

United States and Britain allowed Ukraine to fire their missiles into Russia.

The two sources provided more details about the new weapon as Western experts try to learn more about what US officials say was an experimental intermediate-range missile.

Intermediate-range ballistic missiles are typically meant to be used for long-range nuclear strikes on targets thousands of kilometres away.

One of the sources said the missile was carrying dummy warheads and described the damage caused as “quite small”.

The second source said: “In this case, (the missile) was without explosives...There were no types of explosions like we expected. There was something, but it was not huge.”

Russian President Vladimir Putin said the Oreshnik intermediate-range ballistic missile strike was a successful test and that it reached its target - a missile and defence enterprise in the Ukrainian city of Dnipro.

Ukraine has seldom disclosed information about airstrikes on military targets since Russia’s February 2022 invasion. Putin also said Russia would continue to test the Oreshnik in combat and that it had a stock ready for use. Kyiv has said Ukraine is already working to develop air systems to counter the weapon.

US officials have said Russia probably possesses only a handful of these missiles, which Western experts say appears to have been derived from the RS-26 intermediate-range ballistic missile.

Leaving out the explosives in a “reentry vehicle” - the heat-shielded part of the missile that carries the warhead - leaves room for instrumentation, which countries testing missile designs can use to measure performance, experts say.

It is not publicly known whether the Russian warheads carried such gear.

The RS-26 has a reported range of more than 5,000 km (3100 miles) although the missile that struck Ukraine from the Russian region of Astrakhan region flew only about 700 km.

“I would say this is an incredibly expensive way to deliver what is probably not that much destruction,” said Jeffrey Lewis, director of the East Asia Nonproliferation Program at the James Martin Center for Nonproliferation Studies at the Middlebury Institute of International Studies in California.

NATO Ambassadors Meet with Ukrainian Officials

NATO members on Tuesday reaffirmed their support for Ukraine during talks with the country’s officials held in response to Russia’s launch of an experimental intermediate-range ballistic missile last week.

Ambassadors representing NATO’s 32 member countries were briefed by senior Ukrainian officials after Kyiv called a meeting of the NATO-Ukraine Council, a forum for cooperation.

“The chief of the defence intelligence of Ukraine and acting commander of the air

force joined the meeting online and briefed the allies on the details of the attack and its possible consequences,” Nataliia Galibarenko, Ukraine’s ambassador to NATO, said in a statement.

Ukraine Takes Down Russian S-400 with ATACMS

Dhruv Yadav | 27 November 2024

[Source: Bharat Shakti | https://bharatshakti.in/ukraine-takes-down-russian-s-400-with-atacms/](https://bharatshakti.in/ukraine-takes-down-russian-s-400-with-atacms/)



Remains of U.S.-produced ATACMS missiles, fired by Ukrainian armed forces on November 25 at the Kursk-Vostochny airport (Khalino) in the Kursk region, Russia. via REUTERS

HELSINKI Ukraine hit Russia with U.S.-produced ATACMS missiles twice over the last three days and Russia is preparing retaliatory measures, Russia’s defence ministry said on Tuesday.

It said both strikes targeted Russian forces’ positions in the Kursk region. The first one took place on November 23, and two out of five missiles launched at a Russian S-400 air defence system hit the target, damaging its radar system.

In the second attack, on November 25, eight missiles were aimed at the Kursk-Vostochny airport, which also hosts a military airbase. One missile reached the target, wounding two soldiers, the ministry said in a statement.

“The ministry... is in control of the situation, and retaliatory measures are being prepared,” it said.

Two Ukrainian missiles and 27 drones were destroyed over Russia’s Kursk region, the governor of the embattled Kursk region that borders Ukraine said on Sunday. Ukrainian troops stormed across Russia’s western border into Kursk on August 6 and seized a chunk of territory.

It was not immediately clear what missiles were destroyed. Kursk regional governor Alexei Smirnov did not provide further details in a post on social media.

The Ukrainian military claims that it had destroyed a Russian S-400 anti-aircraft missile system in Kursk.

Moscow launched waves of counter-assaults and has retaken at least 40% of the captured territory, in Kursk, since then, but Kyiv still controls about 800 square kilometres of the region, a senior Ukrainian military source said on Sunday.

Russians have been able to achieve the results without having committed North Korean troops to battle. Most of the North Korean troops sent to the Kursk region in support of Russia remain in training as of now.

Simultaneously, Russian forces make threatening advances towards Kurakhove in eastern Ukraine's Donetsk region.

Ukraine seeks to disrupt Russian supply lines with strikes deep inside Russia enabled by easing of curbs on the use of Western-supplied missiles.

The source, who is on Ukraine's General Staff, said Russia had deployed some 59,000 troops to the Kursk region since Kyiv's forces swept in and advanced swiftly, catching Moscow unprepared 2-1/2 years into its full-scale invasion of Ukraine.

Space

SpaceX's Falcon-9 Places India's GSAT-20 in Orbit; Satellite to Boost Communications Infrastructure

Chethan Kumar | 19 November 2024

[Source: Times of India | https://timesofindia.indiatimes.com/india/spacex-falcon-9-lifts-off-with-indias-gsat-20/articleshow/115426181.cms](https://timesofindia.indiatimes.com/india/spacex-falcon-9-lifts-off-with-indias-gsat-20/articleshow/115426181.cms)

BENGALURU: SpaceX's Falcon-9 rocket early Tuesday lifted off smoothly from Cape Canaveral Space Force Station in Florida, and placed India's Gsat-20 or Gsat-N2, a high-throughput satellite that is designed to elevate communication infrastructure into a desired orbit.

The launch happened at 12.01 as planned, the satellite separated some 34 minutes thereafter, and was then placed in the orbit.

Weighing 4,700kg and engineered for a 14-year mission, the Gsat-20 represents a significant leap in satellite communication technology and as per Isro, the cutting-edge Ka-band high-throughput satellite is designed to transform broadband and in-flight connectivity across the region.

TOI had reported in the first week of Jan that India's Space PSU NewSpace India Limited (NSIL) will launch Gsat-20 on Elon Musk's SpaceX rocket later this year.

This is NSIL's second demand-driven communications satellite and is primarily aimed at meeting India's growing broadband connectivity needs.

NSIL will fully own, operate and fund the satellite, which can provide up to 48Gbps of capacity across 32 beams covering all of India including the Andaman, Nicobar, and Lakshadweep Islands.

NSIL CMD Radhakrishnan D had told TOI earlier: "SpaceX was selected against an RFP we had floated last year. There were other bidders too. This marks a new beginning as we launch on a US rocket from their soil. The present agreement is only for this launch and we will look at future requirements as and when we need."

This is the first time that NSIL used a US launcher. The PSU has earlier made use of the services of France's Arianespace. NSIL looks for services abroad when the weight of the satellite is higher than the capacity of Indian launch vehicles.

As part of the Indian govt's space sector reforms announced in 2020, NSIL is mandated to build, launch, own and operate satellites that address service needs on demand.

In June 2022, NSIL successfully launched its first demand-driven satellite mission, GSAT-24 (now called GSAT-N1), which is fully leased by TataPlay. "While this is also a dedicated satellite, it is not meant for a single company. There are multiple players in the fray," an official told TOI.

New Space Law Draft Ready, to Open for Consultations by March

Shouvik Das | 06 November 2024

Source: [Live Mint | https://www.livemint.com/industry/space-law-pawan-goenka-in-space-policy-isro-satellite-launch-startups-agnikul-cosmos-skyroot-aerospace-11730896706798.html](https://www.livemint.com/industry/space-law-pawan-goenka-in-space-policy-isro-satellite-launch-startups-agnikul-cosmos-skyroot-aerospace-11730896706798.html)



Pawan Goenka, chairman of nodal space regulator In-Space.

New Delhi: A fresh draft of India's first dedicated space law is ready, said Pawan Goenka, chairman of nodal space regulator Indian National Space Promotions and Authorization Centre (In-Space), a move that could make foreign investments easier in the nascent sector.

The absence of a space law has hobbled investments into the industry, crimping its ability to grow beyond the current estimated \$9 billion. Investment applications currently need to go through the tiny space department, causing a backlog.

The new draft comes six years after the government came out with the first one. All that India has at the moment in the form of an official document is a four-page policy published in 2023.

The latest draft, prepared by the Department of Space, is expected to be thrown open for industry stakeholder consultations by March next year, Goenka said in an interaction with Mint on Wednesday.

"The new draft is completely different from what an initial version prepared six years ago had laid out. This new comprehensive law will open up for industry stakeholder consultations by March next year, if not by the end of this year itself. Further to the consultation process, the law will then undergo requisite changes, and be submitted for approval with the minister of state for space—before being tabled in Parliament," Goenka said.

However, the official did not offer a timeline for when the law might be notified, pointing out that the lawmaking process may undergo multiple iterations and discussions, as per the norm.

Once notified, it is expected to give legal powers to In-Space, which remains a regulatory body in appointment by the Centre, but without punitive powers for the time being.

Industry stakeholders said the law has been needed for a while now, and could play a crucial role in order for India to meet its target of generating \$44 billion from the industry by 2033, as per In-Space.

“India’s space policy, published last year, was an ‘intent document’. The space law being framed will be more comprehensive in terms of defining clear roles of the Indian Space Research Organisation (Isro) as a scientific organization, and the Department of Space as a ministerial body. This can help clearly define which body should handle foreign investment paperwork, regulatory conflicts and the overall commercial space economy of India—which currently remains missing from India’s space industry,” said Anupam Shukla, partner at law firm Pioneer Legal.

However, Shukla cautioned about taking a prudent approach to framing the law in fear of over-regulating a nascent sector. “The US still doesn’t have any dedicated law just for the space industry—this may raise the question of whether such a regulatory approach is even required,” he added.

Also in the works, Goenka added, is a framework for the ₹1,000 crore venture capital fund for space startups, along with appointing a “professional fund manager.”

“More details on the fund, including how it will work and become operational, is likely to take place by the first quarter of FY26,” the executive said.

Goenka remained confident about achieving the \$44 billion valuation target he has set for

India’s space economy in the In-Space decadal vision outline published last year.

“Most of this demand is expected to be generated from outside India, which is why a concerted push to promote the industry is further required. We’re already seeing multiple startups cater to various areas of the space industry, including small satellite and small rocket manufacturing, space applications, situational awareness, high-resolution space imaging, and more. If you would have asked me when I took on this role as to if we would have achieved everything that we have in the space domain so far, I wouldn’t have been able to tell you most of it,” he said.

The domestic space industry is also on track to seeing up to 40 rocket launches taking place from Indian soil in the immediate future, Goenka said.

“We’re expecting up to 12 launches from Isro in one year. Subsequently, we have a privatized Small Satellite Launch Vehicle (SSLV), as well as the two startups, Agnikul Cosmos and Skyroot Aerospace, which can generate a cumulative total of 25 launches per year. By the end of this decade, we should see 35-40 rocket launches per year taking everything into account.”

New Joint Force Space Doctrine Clarifies Space Command's 'Offensive', 'Defensive' Ops

Theresa Hitchens | 27 October 2024

Source: [Breaking Defense](https://breakingdefense.com/2023/10/exclusive-new-joint-force-space-doctrine-clarifies-space-commands-offensive-defensive-ops/) | <https://breakingdefense.com/2023/10/exclusive-new-joint-force-space-doctrine-clarifies-space-commands-offensive-defensive-ops/>



The US Space Command Joint Operations Center is the commander's strategic-level command and control node. (Photo credit: Christopher DeWitt / SPACECOM)

WASHINGTON — The latest revision to the doctrine guiding Joint Force operations in space, obtained by Breaking Defense, is a major overhaul — codifying US Space Command's (SPACECOM) scope of action as well as clarifying US military space missions and how they are to be undertaken.

This includes more clearly establishing the fact that SPACECOM and the other combatant commands will conduct “offensive and defensive space operations” during conflict, using “direct or enabling” capabilities against adversary space assets — that is, spacecraft on orbit, terrestrial control stations and/or the data links between them. It also details SPACECOM's area of responsibility (AOR) in joint operations.

The Aug. 23 update to Joint Publication 3-14 (JP 3-14): Joint Space Operations is one of the most far-reaching in its history, according to Lt. Gen. John Shaw, at the time deputy SPACECOM commander.

“I'm pretty proud of the latest 3-dash-14. I've seen a lot of versions of it over the years, right? This is the most different I think from all those,” he told the Space Force Association earlier this month.

The first version was published in 2002, and until now each update has been unclassified and available to the public via the Joint Staff's online doctrine hub. This year, however, the Joint Staff decided that the document should be a “limited distribution publication” available only “within” the Defense Department, a Joint Staff spokesperson said — even though it is not classified, or marked as controlled unclassified information (CUI) or with any other stamp that would prevent dissemination.

The role of Joint Staff doctrine is to set the foundational principles to guide military forces working together in each domain as they pursue national security objectives, as well as to establish agreed concepts and terms to prescribe the manner in which they will fight. There are various levels of doctrine, with that crafted by the Joint Staff to guide joint force operations at the top of the food chain. Each military service then writes its own hierarchy of doctrinal papers covering specific roles and missions. (Space Force, for example, is currently crafting its own doctrine, with its first “operational” volume published in August.)

This new rewrite of JP 3-14, first published

in 2002, was led by Space Command, working in tandem with the Space Force and the Joint Staff. A key attribute of the new document is that it focuses on aligning space operations doctrine with the Unified Command Plan, which sets out combatant command roles and responsibilities, as well as the doctrinal terms and concepts used by joint forces in domains. The primary goal was to “normalize” space as just another domain of warfare, something that the Defense Department has been working on as a matter of policy.

From Geographic to ‘Astrographic’: Defining SPACECOM’s AOR

The new JP 3-14 introduces the term “astrographic” to describe SPACECOM’s area of responsibility, which starts at 100 kilometers (54 nautical miles) above mean sea level.

The publication explains that the boundary between SPACECOM’s AOR and that of other combatant commands surrounds the Earth and is “defined by altitudes rather than a nations’ borders or latitude/longitudinal coordinates.” Further, JP 3-14 for the first time explicitly states that SPACECOM’s patch stretches into “exgeosynchronous” orbit — that is, beyond about 36,000 kilometers (about 19,000 nautical miles) — to include cislunar space, lunar orbit and the Earth-Moon Lagrange points.

Shaw said redefining SPACECOM’s remit is important conceptually for understanding its future space operations.

“Now that we are assigning a responsibility, and we have missions within that area of responsibility, we now are responsible

for protecting, defending activities and/or capabilities and things that are happening in that AOR,” he said in his SFA talk. “And that has implications for supporting and supportive relationships [among combatant commands], for prioritization of resources, for synchronizing operations in our AOR with the terrestrial AOR in a broader global engagement. And so, we I think we’re still unpacking all that, what that’s going to mean for us in the future.”

‘Direct and Enabling Capabilities’

The new JP 3-14 also provides much more clarity than previous versions of how the Pentagon sees combat operations in space, a subject about which the Pentagon is very deliberate. For one, it for the first time embeds the military concepts of “direct and enabling capabilities” into space operations in a new way, according to a explanatory slide deck put together by SPACECOM and the Space Force to accompany the main document. The slides explain:

“Direct capabilities are fires which impact an adversary. Enabling capabilities do not inflict harm but serve as a force multiplier for friendly forces and support the potential of other instruments of national power. ... The key discriminator between direct and enabling capabilities is whether it can impose a cost or not. If it does, it is a direct capability.”

The new JP 3-14 further lays out US military “space mission areas” for joint actions: “space domain awareness; offensive and defensive space operations; positioning, navigation, and timing; intelligence, surveillance, and reconnaissance; satellite communications;

environmental monitoring; missile warning; nuclear detonation detection; spacecraft operations; and spacelift.” (Interestingly, it doesn’t break out electronic warfare as a separate mission area, as Space Force chief Gen. Chance Saltzman did in his recent announcement of new “Integrated Mission Deltas.”)

The document then maps of each to the type of capability — direct or enabling — that support it, providing a degrees of transparency into planned space combat that earlier versions did not. For example, the “satellite communications” mission area is “primarily supported by enabling capabilities”; whereas “offensive and defensive space operations” are supported primarily by “direct capabilities.”

Limiting Expectations of Space Dominance

In particular, Shaw pointed to the document’s new formulation of offensive space operations as aimed at the “suppression of enemy space capabilities” — a parallel to the Air Force’s “suppression of enemy air defenses” concept.

He explained that as the team worked on defining the term “space superiority,” they realized that determining when that goal is achieved is a complex task and one without a static answer.

“We really, really struggled to to be able to measure when you think you have space superiority,” Shaw said. “And we realized that ... if the president ever said, ‘So, do you have space superiority?’ we’d have a hard time answering that question.”

Instead, the “new term” of “suppression of

enemy space capabilities” was coined to allow commanders to measure “incremental progress against an adversary in the domain,” he said.

Indeed, what the new JP 3-14 acknowledges is that it is going to be impossible for the US military to overcome everything the enemy throws at US space assets, everywhere in the vast realm of the heavens at the same time. Instead, the goal should be achieving “a relative degree of control” of the operational environment when needed.

Shaw explained: “I think what it does is it realizes you’re not probably ever going to have dominance in all parts of the Earth-Moon system, in the electromagnetic arena as well as the physical arena, at all times. But we might be able to deprive an adversary of just enough of this, and just enough of that, and just enough of this — and we can measure that. And then we can say we’ve suppressed their space capabilities to a proper threshold that allows us to now have freedom of maneuver in the domain and in the terrestrial domains.”

Goodbye to Euphemisms

To underscore this more nuanced view of space combat and provide more transparency, the new JP 3-14 actually abandons the long-controversial terms “space control” and “counterspace” — both of which over many years have been used as code for offensive space operations and the weaponry to support them. The explanatory slide deck also acknowledged that space control “implies ownership,” which could be read as counter to the 1967 Outer Space Treaty.

The term “negation,” which formerly was defined as measures to deceive, disrupt, degrade, deny or destroy enemy space assets, also went into the metaphorical garbage can.

ISRO Gears up for Multiple Launches; Spadex to Demonstrate Space Docking on December 20

Chethan Kumar | 24 November 2024

Source: *Times of India* | <https://timesofindia.indiatimes.com/city/bengaluru/isro-gears-up-for-multiple-launches-spandex-to-demonstrate-space-docking-on-december-20/articleshow/115623777.cms>



Artistic impression of the Proba-3 (Credit: ESA)

BENGALURU: The Indian Space Research Organisation (ISRO) is set for a busy end to 2024, with multiple high-profile missions lined up, including the crucial Space Docking Experiment (Spadex) scheduled for Dec 20. The mission will demonstrate crucial technologies for India's future human spaceflight programmes and space station ambitions.

“Our current date for Spadex is Dec 20,” Somanath confirmed to TOI. In an earlier exclusive interview, he had said “docking was an integral part of Chandrayaan-4 and Spadex was a precursor being planned for mid-Dec launch”.

As part of the mission, ISRO will be splitting up a satellite and then re-uniting it in space. While the technology Isro is aiming to eventually have is one that will allow it to transfer humans from one vehicle or spacecraft to another, the immediate goal is to enable refuelling of spacecraft to give them a longer life and also transfer other crucial systems to an existing spacecraft, by transporting another to space.

The satellite we will launch will have two components. It will be separated into two pieces and then they will get docked into a single piece. This single unit will then function as a full-fledged satellite. This is a very crucial technology.

A successful SPADEX experiment will also give Isro data on space rendezvous technology — capabilities wherein two spacecraft can find each other and remain in the same orbit — advancements which are critical if India wants to have its own space station built in the future.

Proba launch by Dec 4-5

Another significant mission in Isro's immediate pipeline is the launch of the European Space Agency's Proba-3 mission aboard a Polar Satellite Launch Vehicle (PSLV). This dedicated mission will demonstrate precision formation flying between two satellites to create an artificial eclipse, enabling new observations of the Sun's corona.

While ISRO was gearing up for a Dec 4 launch, recent weather predictions could see the launch be pushed by a day or two.

Proba-3 consists of two small satellites — a Coronagraph spacecraft and a solar-disc-shaped Occulter spacecraft. ESA said that by flying in tight formation about 150 metres apart, the Occulter will precisely cast its shadow onto the Coronagraph's telescope, blocking the Sun's direct light. This will allow the Coronagraph to image the faint solar corona in visible, ultraviolet and polarised light for many hours at a time.

“Through exquisite, millimetre-scale, formation flying, the dual satellites making up Proba-3 will accomplish what was previously a space mission impossible: Cast a precisely held shadow from one platform to the other, in the process blocking out the fiery Sun to observe its ghostly surrounding atmosphere on a prolonged basis,” ESA said.

Scientists hope Proba-3's unique vantage point will provide new insights into the origins of coronal mass ejections (CMEs) — eruptions of solar material that can disrupt satellites and power grids on Earth. The mission will also measure total solar irradiance, tracking changes in the Sun's energy output that may influence Earth's climate.

GSLV Mission by Dec 31?

Somanath said that a third launch, that of a GSLV, carrying India's navigation satellite NVS-2, is being targeted for Dec 31.

“This GSLV was originally for Nisar. It was supposed to be launched and we couldn't make the launch so then we got the NVS-2 NavIC satellite ready. It's almost completed now. We need to complete this mission before

building another GSLV for Nisar, which is now scheduled for next year. We are aiming for Dec 31 (NavIC mission), but we'll take a call a bit later on this. It could even be Jan,” Somanath said.

Gaganyaan's Unmanned Mission Likely in March Next Year; ISRO to Track from Pacific, Atlantic Oceans

25 November 2024

Source: Live Mint | <https://www.livemint.com/science/news/gaganyaans-unmanned-mission-likely-in-march-next-year-isro-to-track-from-pacific-atlantic-oceans-11732513720158.html>



Gaganyaan Mission: ISRO successfully launches Test Flight Abort Mission (ISRO Twitter)

Gaganyaan's unmanned mission is likely to begin as early as March next year to prepare for India's most ambitious space project, its manned mission in 2026.

According to a CNN-News18 report, the Indian Space Research Organisation (ISRO) will send ships carrying scientists to be stationed at observation points in the Pacific and North Atlantic Oceans to monitor the unmanned mission.

The success of this unmanned mission would mark a milestone in India's history and could

determine the launch of Gaganyaan's manned mission in 2026. Four astronauts are currently in training for a three-day mission during which they will travel to space, orbit at an altitude of 400 km, and then return to Earth, culminating with a landing in Indian territorial waters.

"ISRO under Government of India is scheduling a scientific experiment tentatively during the period between 1 March 2025 and 31 August 2025. Tentative schedule of mission is slated as 1 March 2025," the documents accessed by CNN-News18 state referring to 'Gaganyaan G1 Mission', described as an unmanned mission from Sriharikota.

Eight ISRO scientists will be on board each of these ships, which could sail for at least two weeks to reach their locations.

How will the Gaganyaan Unmanned Mission work?

According to the report, two ships, one each from the Pacific Ocean and North Atlantic Ocean, will be deployed with full equipment to support crew operations. ISRO is set to establish hybrid communication circuits linking ships with MOX-ISTRAC and SCC-ISTRAC in Bengaluru, both pivotal in the Chandrayaan-3 mission.

A shipment including a shipborne terminal (SBT), electronic equipment, MV-SAT antennas, and related subsystems will be dispatched from ISTRAC for installation on chartered vessels.

"This scientific experiment, being a new development and considering the system

readiness, the date of experiment is scheduled between the above period of 1 March 2025 and 31 August 2025," CNN-News18 reported citing the documents.

The ISRO ISTRAC consignment will be dispatched to an observation point in the North Atlantic Ocean from the closest Indian port, heading to a port in New York via cargo shipment.

Following this, a chartered vessel will embark from New York to the designated location in the North Atlantic Ocean, a distance of 3,000 km, with an estimated journey time of 13 to 14 days, according to the documents accessed by the media outlet.

An ISRO team comprising eight officials will board the vessel in New York and proceed to the observation point. The mission's tracking activities are scheduled to last no more than three days.

CNN-News18 also said that all ISRO's equipment will be set up on the vessel's deck, overseen by a team of scientists. This team will accompany the equipment on the chartered boat, providing support for the mission and potentially operating the equipment daily en route to the observation point.

The vessel is scheduled to arrive at the observation point in both the North Atlantic and Pacific Oceans at least two days prior to the mission's start date.

It will remain at the observation point for three days, and throughout the mission support period, the dynamic positioning system will

be activated for several sessions, totaling a maximum of approximately 15 hours.

ISRO's Shukrayaan Mission Approved: All about India's Venus Orbiter Mission

Sudeep Singh Rawat | 26 November 24

Source: Business Standard | https://www.business-standard.com/world-news/isro-s-shukrayaan-mission-approved-all-about-india-s-venus-orbiter-mission-nc-124112600892_1.html



ISRO Rocket Launch (Photo: Shutterstock)

ISRO's Shukrayaan mission: The director of the Indian Space Research Organisation (ISRO), Nilesh Desai, revealed that the Venus Orbiting satellite project, Shukrayaan, has received government approval and is set to launch in 2028.

He also stated that Chandrayaan 4, the follow-up mission of Chandrayaan 3, has also been proposed which will not only land on the moon but will also return with soil and rock samples.

Chandrayaan-4 will be a Joint Mission

The next Chandrayaan mission will be a joint project between India and Japan. Revealing the space agency's Chandrayaan 4 ambitions,

Desai said that it will consist of two missions. The top Isro official said that the mission will involve India and Japan collaborating to land on the moon's south pole at 90 degrees south as compared to its last attempt which was 69.3 degrees south.

"We have not yet received the government's approval for the mission. The rover as a part of the mission will weigh 350 kg, which is 12 times heavier than the previous rover. If we get the government's nod, we will be able to execute the mission by 2030," Desai was quoted as saying by the Times of India.

He also talked about the ongoing discussions going on about the sensors and satellites which will be launched as part of the INSAT 4 series. Desai mentioned that the world is one generation ahead of us and we need to catch up with these new sensors which help in improving forecasts as well as the new meteorological and oceanographic sensors.

Desai on Gaganyaan Mission

The ISRO Director also talked about Mars exploration plans. The Indian scientists are not only planning to put satellites in Mars orbit but will attempt to land on its surface with Gaganyaan set to launch in two years. "It will be an unmanned flight after which we will launch a manned flight. The government has also approved to construct India's space station. It will not be as big as the ISS but will have five modules. We will launch the first module in 2028 and India's space station will be ready by 2035. As a part of the Prime Minister Narendra Modi's call to land on the moon by 2040, our space station will function as a transit facility

en route," Desai added.

What is the Venus Orbiter Mission?

Shukrayaan is scheduled to investigate Venus which is believed to be similar to Earth in many aspects. The investigation will reveal the surface of the planet, its atmosphere and geological structure. To be inserted in orbit around Venus, the spacecraft will attempt to gather essential information about the planet's weather patterns, potential geological activities, and atmospheric elements. The spacecraft will utilise advanced scientific equipment for these observations.

This mission will help scientists to further understand Venus's dense cloud cover that is made up of carbon dioxide and sulfuric acid. It will also check for evidence of volcanic formations.

To study Venus's ionosphere, the satellite is equipped with synthetic aperture radar, infrared and ultraviolet imaging devices, and other specialised equipment.

Though NASA denies the probability of life on Venus, it also maintains the possibility of microscopic organisms existing in the upper atmospheric layers of Venus, where the pressure is similar to Earth's surface condition. Currently, the Shukrayaan-1 is under development, and Isro is yet to announce the specific launch timing and mission specifications.

What's special about ISRO's Shukrayaan-1 mission?

Emphasising on the importance of

Shukrayaan-1, ISRO said the earlier missions to Venus had limited and narrow spatial coverage in either South-polar region or equatorial belt. "Hence it is difficult to build global maps of many phenomena, including winds, waves, and chemical abundances. Venus Orbiter Mission would provide uniform coverage of Venus, thus providing a unique global dataset for future science missions," says ISRO website.

The data received from the Venus Orbiter Mission will be received, processed and archived at the Indian Space Science Data Center (ISSDC) for dissemination and use by the scientific community in India and abroad.

Venus Orbiter is planned to be launched in March 2028 and will cost approximately Rs 1,236 crore, claims ISRO. The space agency said it had identified LVM-3 as the candidate launch vehicle which will place the spacecraft in an Elliptical Parking Orbit (EPO) of 170 km x 36000 km.

Global Aerospace Industry

Indian Air Force Looks to Issue Fresh Procurement Tender for 114 Jets

Inder Singh Bisht | 04 November 2024

Source: [The Defense Post](https://thedefensepost.com/2024/11/04/indian-air-force-procurement/) | <https://thedefensepost.com/2024/11/04/indian-air-force-procurement/>



(Representative image only.) An Indian Air Force's Rafale aircraft taking off. Photo: AFP

The Indian Air Force (IAF) is mulling issuing an “open tender” for the procurement of 114 medium-role fighter aircraft (MRFA), with production taking place at home.

This will be a departure from the previous procurement process wherein 36 Rafale fighter jets were bought from France under a government-to-government deal in 2016.

According to Asian News International, the Indian government wants to avoid “controversy” that trailed the estimated 7.87-billion euro (\$8.56 billion) deal with allegations of corruption.

The deal, in turn, was initiated to break the logjam with Rafale manufacturer Dassault over disagreements with the purchase of 126 aircraft for the IAF under the original procurement

competition.

The negotiations for the purchase dragged on from 2012 to 2015, resulting in the deal being called off.

“Last time, the government came out with a solution to the MMRCA (Medium Multi-Role Combat Aircraft) tender, stuck for years, by going in for a government-to-government contract for 36 Rafale. But a political slugfest erupted,” The Print quoted a source as saying.

“Officers presented themselves in the Supreme Court and documents concerning vital national interest had to be shared. It became a political hot potato.”

Open Tender

The Indian government issued a request for proposals for the MRFA in 2018, receiving responses from six companies: Boeing, Dassault, the Eurofighter consortium, Lockheed Martin, Mikoyan, and Saab.

Most of the companies have already participated in the MMRCA competition, which was clinched by Rafale after beating the Eurofighter Typhoon on price.

Rafale’s naval version was also later selected for the Indian Navy’s two aircraft carriers as a replacement for its aging MiG-29s.

Fresh Trials

A new competition for the MRFA risks further prolonging the procurement process at a time when the IAF’s squadron strength is down to 31 against a sanctioned strength of 42, with

two more squadrons set to retire next year.

However, having “limited trials” of the aircraft to fast-track the process is not an option as the jets have undergone “multiple upgrades” since the last time they were evaluated by the IAF in 2010-11, *The Print* wrote, citing sources.

The aircraft that participated in the MMRC competition were Boeing’s F/A-18E/F Super Hornet, Dassault’s Rafale, the Eurofighter Typhoon, Saab’s Gripen, the Mikoyan MiG-35, and Lockheed Martin’s F-16.

Lockheed Martin has replaced the F-16 with an India-specific F-21 for the new competition, while Boeing is pitching an additional option in the form of its F-15EX.

Rafale’s Huge Backlog

Another reason New Delhi is looking for a fresh procurement process is Dassault’s perceived inability to supply the Rafale in a short-to-medium time frame due to a huge backlog of orders from other countries, according to Asian News International.

The outlet said that the Rafale’s order book would not allow Dassault to commence the supply of the aircraft to India in under 10 years.

Domestic Production

Meanwhile, the Indian government is also considering stipulating the requirement of “full production” of the aircraft in India in a joint venture with a local partner, according to *The New Indian Express*.

Aircraft components are already being

produced in India as part of purchase agreements. However, full aircraft production would be a significant development.

Accompanying it is the need to transfer technology, which Dassault is not keen to do, according to the outlet.

Russian 'White Swan' Back on Radar; will India Pick Tu-160M Strategic Bomber?

Girish Linganna | 12 November 2024

Source: Mathrubhumi | <https://english.mathrubhumi.com/news/world/russia-offers-india-tu-160m-bombers-strategic-air-power-1.10070884>



A Tu-160M strategic bomber takes-off from an airfield in Kazan, Russia. (Photo: AP/PTI)

Eager to strengthen its defense relationship with India, Russia has offered to supply advanced strategic bombers to the latter. This aircraft could greatly improve India's air power and military strength.

Recently, Russia has also agreed to provide important metal supplies to help India upgrade and modernize its fleet of Sukhoi-30MKI fighter jets.

Media reports mention that Russia has renewed its proposal to India, offering its strategic heavy bombers, including the Tu-22M3 and the upgraded Tu-160, often called the 'White Swan'.

Around 20 years ago, the Tu-22M3 was offered to the Indian Navy, but the deal fell through because the cost of leasing and upgrading the aircraft was too high.

Russia's latest offer now includes the Tu-160M, an upgraded version of the original Tu-160, which could greatly boost India's ability to carry out long-range strikes.

The Tu-160M, often called the 'White Swan', is a large strategic bomber with an impressive ability to fly up to 12,000 kilometers without needing to refuel. This makes it highly capable of covering long distances during missions.

Designed by the Tupolev Design Bureau in the 1970s during the Soviet era, the Tu-160M is still the largest and heaviest combat aircraft in the world. It can also fly at supersonic speeds, making it extremely powerful and fast.

Supersonic speed refers to traveling faster than the speed of sound, which is about 1,236 kilometers per hour (767 miles per hour) in air. It allows aircraft to move extremely quickly.

The Tu-160M has special wings that can change their angle, known as variable-sweep wings. This feature helps the plane adjust to different speeds and types of missions, making it the fastest bomber currently in service.

Variable-sweep wings allow the aircraft to fly efficiently at both low and high speeds by changing the shape of the wings during flight.

The Tu-160M uses advanced NK-32-02 engines, which are known for being easier to maintain, offering better performance, and lasting longer. Each aircraft costs around 15 billion Roubles, or about \$163 million.

India has typically prioritized multirole fighter jets over heavy bombers and, as of now, it does not have any strategic bombers in its entire fleet.

Adding the Tu-160M to its fleet could give the Indian Air Force the ability to carry out strong deterrence missions and long-range strikes throughout the Indo-Pacific region and beyond.

If the Tu-160M deal goes through, it would greatly boost India's strategic air power and further strengthen defense cooperation between India and Russia. This could help deepen their partnership in advanced military technology.

The Tu-160M, operated by a crew of four, can carry up to 12 cruise missiles or 12 short-range nuclear missiles. The Tu-160M can reach a top speed of 2,220 kilometers per hour and can fly at altitudes of up to 16,000 meters.

Govt Imposes Fine on US Firm Over Delays in Delivery of Tejas Mk1 Engines

Prateek Shukla | 04 November 2024

Source: [Business Standard](https://www.business-standard.com/industry/news/govt-imposes-fine-on-us-firm-over-delays-in-delivery-of-tejas-mk1-engines-124110400621_1.html) | https://www.business-standard.com/industry/news/govt-imposes-fine-on-us-firm-over-delays-in-delivery-of-tejas-mk1-engines-124110400621_1.html



Delivery delays impact India's indigenisation efforts and its collaboration with GE Aerospace. | File Photo

The central government has imposed financial penalties on US-based GE Aerospace, according to a report in The Financial Express. The move comes after a two-year delay in delivering F404-IN20 engines for the Light Combat Aircraft (LCA) Mk1, also known as Tejas, produced by Hindustan Aeronautics Limited (HAL). The amount has not been revealed.

This delay impacts India's indigenisation efforts and its collaboration with GE Aerospace, a key partner in advancing India's domestic aerospace manufacturing capabilities.

Delivery Delays

Initially, GE Aerospace was expected to begin engine deliveries in March 2023 to support HAL's production of Tejas Mk1, a vital

component of India's aerial defence strategy. However, the first batch of engines is now anticipated to arrive only by April 2025, raising concerns over delays in the programme's timeline.

In response, the Ministry of Defence has penalised GE for breaching contract terms, reaffirming India's stance on enforcing accountability in critical defence procurements as it seeks to reduce dependency on foreign arms and strengthen indigenous production.

A spokesperson for GE Aerospace told The Financial Express, "We are working with our partner HAL and suppliers to resolve constraints and deliver F404-IN20 engines for the LCA Mk1 programme." While GE has not detailed these constraints, sources suggest that pandemic-related supply chain issues, component shortages, and logistical challenges are contributing factors.

Implications for Defence Partnerships

This delay and the subsequent penalties come amid growing strategic cooperation between India and the United States, especially in the defence and technology sectors. The GE-HAL partnership holds significant value as India works to transform itself into a self-sufficient defence manufacturing hub. The LCA Tejas programme, part of the 'Make in India' initiative, symbolises India's aim to develop domestically manufactured fighter jets that not only enhance the country's technological capabilities but also support its economy.

The penalties on GE underscore India's emphasis on meeting contractual commitments,

a stance that government sources describe as standard rather than politically influenced. They affirm that these measures aim to ensure timely progress in crucial defence projects, regardless of external pressures.

Future Outlook

As GE Aerospace and HAL address logistical challenges, the delay raises broader questions regarding the impact on other indigenous fighter programmes like the Tejas Mk2 and Advanced Medium Combat Aircraft (AMCA).

The F404-IN20 engine delays may prompt India to reassess its defence agreements and enforce stricter contractual safeguards against supply chain risks. India has been diversifying its defence procurement partnerships, working with countries including France, Israel, Russia, and the United States, to build a resilient supplier network.

Meeting the revised April 2025 deadline is now critical for GE Aerospace, not only to regain the confidence of Indian authorities but also to secure its strategic position within India's defence industry. The outcome of this delay will likely shape the future of US-India defence relations and influence India's approach to managing defence collaborations in a multipolar, security-conscious Indo-Pacific environment.

India's Aerospace Industry

India Ships First Akash Air Defence Missile System Battery to Armenia

Mayank Singh | 12 November 2024

Source: *New India Express* | <https://www.newindianexpress.com/nation/2024/Nov/12/india-ships-first-akash-air-defence-missile-system-battery-to-armenia>



Medium-range mobile surface-to-air missile defence system Akash at an airbase (File Photo)

NEW DELHI: India marks another milestone in its defence export as it shipped the first Akash weapon system battery to Armenia. This is the second missile system to have been exported.

The Akash system, developed by the Defence Research and Development Organization is a surface-to-air missile (SAM) which can hit targets like fighter jets, missiles (cruise, air-to-surface), drones and other aerial assets to a range of 25km.

Manufactured by Bharat Electronics Limited (BEL), each battery of Akash weapon system is accompanied by a single Rajendra 3D passive electronically scanned array radar and four launchers with three missiles each, all of which are interlinked.

Secretary Defence Production in the ministry of Defence, Sanjeev Kumar “flagged off the 1st Akash Weapon System Battery to a Friendly Foreign Country.”

“This event reflects India’s growing capabilities in defence technology and manufacturing,” Bharat Electronics Limited (BEL) said on Monday.

As the TNIE reported the Union Cabinet approved the export of the Akash Missile System in December 2020.

Defence Minister Rajnath Singh had said, however, the missile version of Akash to be exported will be different from the system introduced into the Indian armed forces. Defence Minister Singh highlighted that the missile system has over 96 per cent indigenous components.

The missile was inducted into the Indian Air Force in 2014 and in the Indian Army in 2015.

In 2022, Armenia inked a deal with India to procure 15 Akash missile systems worth around Rs 6,000 crore. It must be noted that Armenia has become the first foreign country to buy this missile system.

Also, in 2022, India had announced another major defence export deal with the Philippines for the supply of the BrahMos supersonic cruise missile, making it the country's first major defence export order.

As first reported by TNIE, the Philippines received the first batch of BrahMos supersonic

cruise missiles in April this year, marking the culmination of India's first major defence export deal.

The Akash Missile system is highly mobile and can be deployed on both wheeled and tracked vehicles.

The BEL said it “contributed to this achievement by providing key Ground Support Equipment, including Surveillance Radars, Missile Guidance Radars, and C4I systems,”.

Countries like Vietnam, Egypt and the Philippines have evinced interest in the Akash weapon system.

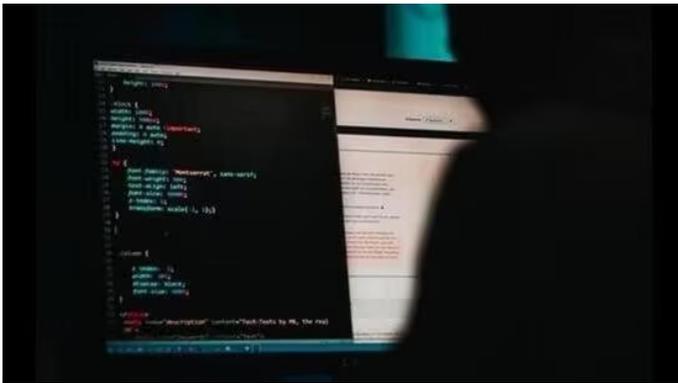
Russia has been the major supplier of arms and ammunition to Armenia over the past decade, accounting for 94 percent of Yerevan’s arms imports from 2011 to 2020.

Armenia and Azerbaijan are in talks to strike peace. Meanwhile both countries have been acquiring weapons and systems.

Hoax Calls: the New Threat to the Aviation Industry

Sabu Sivaraman | 04 November 2024

Source: [Hindustan Times](https://www.hindustantimes.com/ht-insight/international-affairs/hoax-calls-the-new-threat-to-the-aviation-industry-101730703758598.html) | <https://www.hindustantimes.com/ht-insight/international-affairs/hoax-calls-the-new-threat-to-the-aviation-industry-101730703758598.html>



The aviation sector was hit with this spate of hoax bomb threats last Monday. (Representational image)

In the recent past, hundreds of Indian air carriers were subject to hoax bomb threats which necessitated the diversion of many of these flights. In some cases, even fighter jets were scrambled to escort the aircraft to their destinations. Needless to say, this caused immense hardship to the travelling public and severe financial damage to the airlines concerned, besides the embarrassment to the government. This form of attack was something which the industry was not prepared for, and it took everyone by surprise. After the initial shock, many proposals were put forward, some bordering on the bizarre, like the threat to put hoax callers on the No-Fly list, whereas their rightful place should be behind the bars.

One of the objectives of terrorism is to undermine society, causing chaos and a loss of confidence in the government's ability to protect its citizens and to damage the economy. Aviation is always perceived by terrorists as an attractive target. For example, after the raids

on Rome and Vienna airport in 1985, lakhs of American tourists cancelled their holiday trips to Europe thereby damaging both the tourism industry in Europe and the airline industry in America.

Airlines become targets when the countries that they belong to become the target of terrorists. And the method of terrorists keeps changing. Hijacking by terror groups started in the late 60s with the first recorded one in 1968. Now some terror groups have discovered that for attacks not connected with demands like the release of prisoners in an exchange or ransom money, a hijacking or destruction of aircraft is not required. They are able to threaten and cause damage to their 'enemy' without taking the trouble of a hijacking which could prove risky to the hijackers too, in case they fail. From the perspective of the terrorists, they have achieved their goals; to cause harm to their opponent. By disrupting the travel plans of thousands, they are not only damaging the tourism industry but also the Indian carriers who are carrying them.

There are a number of ways in which civil aviation can be damaged. Each method demands preventive measures designed exclusively to deter a particular type of attack. A one size fits all approach is not going to serve as a deterrent to those whose sinister design is to wreak havoc on the system. Deploying more sky marshals on flights or threatening to put hoax callers on the No-Fly list is not going to deter someone who has discovered this novel method of inflicting damage to the system. And the presence of sky marshals is not enough deterrent when there are terrorists who are prepared to die.

The faith of the travelling public can only

be assuaged by the use of better detection technology, more stringent screening of personnel, better control of passengers and luggage and improved training needed for safeguarding civil aviation facilities. The aim should be to provide security without compromising passenger convenience and efficiency.

A combination of computed tomography (CT) X-ray technology and advanced threat detection algorithms should be deployed to improve the screening process and make it foolproof. In the United States, the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) have been conducting trials on a next generation baggage screening system. The two systems are the existing CT X-ray and the newer X-Ray diffraction (XRD) system. The XRD provides more information about the types of materials in carry-on bags than CT X-ray and, in some cases, can identify what objects are made of. Together the two systems allow security officers to view a 3D image of a bag, identify the materials and any potential threats inside, all without opening the bag. Similarly, sophisticated imaging can be used to scan shoes for explosive materials. A step-on shoe scanner can rapidly form high-contrast images of footwear for analysis by computers to recognise threats. Any shoes flagged with areas of concern can then undergo secondary screening.

The development of countermeasures should adapt with the changing techniques of terror groups. We have to affect changes in strategy to cope with this new form of warfare. Terrorist organisations have the advantage in choosing their methodologies and comprehensive

intelligence is the key to prevent attacks. For example, till September 11, 2001 the world did not realise or recognise that terrorists would use hijacked aircraft to wreak destruction. Like any dynamic organisation, terrorism will change every day and terrorists will adopt new tactics to counter the steps taken by the security agencies or airlines. We must be on the lookout for weak spots in our aviation security system and correct them immediately. The goal should be to be proactive and not just reactive. Not only should we develop new techniques to adapt to new threats, but we must continuously update them.

Technology is available to prevent explosive devices from making their way to an aircraft. But there are a number of obstacles to achieving the goal of complete prevention, like cost of equipment, terminal space, training of personnel and passenger convenience. While designing and building airports, passenger handling is normally the only consideration--there is hardly any security input in the design. Shortfalls of this nature enabled the shoe bomber Robert Reid to fashion his shoes to carry explosives and board an aircraft. When he tried to ignite them over the Atlantic Ocean, an alert cabin crew confronted him and with the help of passengers subdued him. So, it was the human element that brought the incident to a safe conclusion and not technology. It is imperative that more attention be paid to the training of the human element as they are the final goal keepers in the entire system.

The latest attacks have only exposed chinks in our armour and the best way to counter is to examine the flaws in our system and take remedial measures. The first step in this direction is to

improve the training of all personnel involved. The Bureau of Civil Aviation Security (BCAS) mandates that all personnel employed in the aviation industry should undergo a mandatory course in aviation security. The latest incident proves how woefully inadequate the course content is. The whole industry was totally unprepared for such kind of an attack as the course only deals with handling conventional means of attack. The course content is purely theoretical in nature and contains topics like the history of BCAS, the organisational structure of BCAS, venues and dates of various ICAO conventions and names of officers occupying key positions in BCAS. How knowledge of these topics will equip someone to prevent a terror attack is something which only BCAS can explain. There is hardly any case study on this. It is high time that BCAS review their course material and involve those who have an in-depth understanding of aviation security to rearrange their aviation security training.

EndureAir Systems Delivers Advanced Logistics Drone – Sabal to Indian Army

28 October 2024

Source: [India Strategic](https://www.indiastrategic.in/endureair-systems-delivers-advanced-logistics-drone-sabal-to-indian-army/) | <https://www.indiastrategic.in/endureair-systems-delivers-advanced-logistics-drone-sabal-to-indian-army/>



Sabal 20 Logistics Drone

New Delhi, November 27. EndureAir, a leading drone manufacturer in unmanned aerial vehicle (UAV) technology, proudly announces the successful delivery of one of its kind Sabal 20 Logistics Drone to the Indian Army in Eastern theatre, marking a significant milestone in enhancing logistics capabilities for defence forces operating in challenging terrains.

Sabal 20 is an electric unmanned helicopter based on variable pitch technology, designed specifically for aerial logistics, capable of carrying payloads of up to 20 kilograms, equivalent to 50% of its own weight, with scalable options for future requirements. Building on the legacy of the Chinook helicopter, Sabal 20 features high efficiency of large rotors and the exceptional load-carrying capability of a tandem rotor configuration. This design ensures remarkable stability, superior high-altitude performance, minimized turbulence risk, and outstanding lifting capacity across diverse terrains.

Sabal 20 is engineered to meet rigorous operational demands, supporting missions such as long-range deliveries, high-altitude operations, and precision logistics. Its advanced VTOL technology enables seamless operations in confined and rugged terrains, while its low RPM design minimizes noise with a low aural signature, enhancing stealth in sensitive missions. Additionally, it offers cutting-edge autonomous flight capabilities and user-friendly controls that simplify complex tasks, ensuring reliable performance even in BVLOS conditions.

This delivery underscores EndureAir's dedication to supporting India's defence sector through 'Make in India' and "Atmanirbhar Bharat" initiatives, fostering self-reliance and advancing UAV manufacturing. Sabal 20 reflects the company's vision of blending innovation with purpose to address real-world challenges.

About EndureAir

EndureAir Systems is an unmanned aviation technology company. Incubated in the corridors of IIT Kanpur in 2018, with the objective to provide world-class Drone Technology, that is best suited both defence and civilian applications. Their autonomous electric unmanned helicopters are specifically designed for high-altitude logistics, offering improved speed, range, and gust handling. Unlike imported solutions, they provide cost-effective, tailored support and robust long-term post-sales service, ensuring reliable supply restocking even in challenging mountainous terrains. Our products offer the industry's best combination of features capable of carrying

heavy payloads, long range operations with high endurance.

'Make in India'

Speaking on the occasion, Dr. Abhishek, Director and Co-founder of EndureAir, said, "We are honoured to contribute towards the progress of the Indian Army modernizing its logistics capabilities. With EndureAir's Sabal 20, we reaffirm our commitment to providing indigenous, innovative UAV solutions that empower our armed forces and support their mission-critical needs in diverse environment, ensuring operational excellence."

IAF to Outsource Some MRO Facilities to Industry for the First Time

Dalip Singh | 01 November 2024

Source: The Hindu Business Line | <https://www.thehindubusinessline.com/economy/logistics/iaf-to-outsource-some-mro-facilities-to-industry-for-the-first-time/article68814837.ece>



For the first time, the Indian Air Force (IAF) is moving ahead with a plan to outsource some of its maintenance and overhaul facilities to the indigenous industry. This would include incubating private players to impart the know-how on managing back shops and offering

aircraft body paint shop infrastructure at one of its Base Repair Depots (BRD) to reduce dependence on foreign equipment manufacturers (OEMs).

The steps IAF has initiated to handhold the industry are designed to make the country self-reliant and tap into the global Maintenance, Repair and Overhaul (MRO) business which was worth \$49.1 billion in 2023 and is projected to reach \$66.2 billion by 2030.

The Indian MRO industry was \$1.7 billion in 2021 and the market is expected to grow to \$4 billion by 2031, as per a NITI Aayog report of October 2022.

Speaking exclusively to businessline, Air Marshal CR Mohan, who retired on October 31 as Air Officer-in-Charge Maintenance of the IAF, said: “We are looking at partnering with the Indian industry in an interesting way. Wherever it’s combat sensitive and, we need it, we will do it on our own. Wherever, it’s not combat sensitive, we can partner with the industry.”

The IAF has identified different levels of engagements for outsourcing the MRO facility. Air Marshal (Retired) Mohan said it signals coming together of the armed forces and the Indian industry.

The industry is not very enthusiastic in doing the military maintenance and overhaul services independently because volumes are less, the variety is high and then there are certification overheads, he pointed out.

To fill that void, the IAF has chipped in with

its core competence to the stakeholders in the market. “We have the technology. We have the facilities. We can initially start by augmenting capacity, by incubating the industry in our system where we already have the technology,” the former Air Officer-in-Charge Maintenance stated.

While the industry can use the outsourcing opportunities to do the civilian MRO business, they will have to do the IAF job on a suitable commercial arrangement when required.

Approximately 80 cases of outsourcing certain MRO facilities of the IAF are at various stages of approvals since the process began in 2022, he stated.

Last year, the IAF floated Request for Information (RFI) to dual purpose its heavy aircraft maintenance facilities at Hindon Air Base in Ghaziabad which can help private airlines to get their aircrafts repainted here rather than flying abroad for availing that MRO facility.

“Eleven industries have already come forward, shown interest and we have managed to get some responses from them to move our case. We are now in the process of issuing Request For Proposals (RFPs). In next four to six months, we should be in a position to hand over the contract,” Mohan elaborated.

The successful bidder can earn money out of it and provide those services to the IAF with suitable commercial arrangements to paint aircraft and helicopters, he said.

Mohan, however, stressed that it is not a

revenue generating model but the IAF is hoping to benefit monetarily due to the cost advantage for indigenous partners.

Of the 80 cases, RFPs were floated for industry engagement for maintenance and overhaul of six cases of Mi 17 series helicopters, two cases of MiG29 fighter jets and one case of AN32 transport aircraft. These cases are at various stages from tendering to TEC approvals.

All RFPs are for incubating Indian industries for repair and overhaul, refurbishment and replacement of sub components, he said.

According to the senior former IAF officer, the incubation programme has already gone ahead. For instance, “9 BRD” at Pune has signed contracts, he specified.

The low hanging fruit the IAF is immediately ready to offer are maintenance of ground equipment such as different varieties of trolleys, and managing supply chain.

IAF Moving Towards Automation of Aircraft Maintenance

Dalip Singh | 03 November 2024

Source: [The Hindu Business Line](https://www.thehindubusinessline.com/news/national/iaf-moving-towards-automation-of-aircraft-maintenance/article68825791.ece) | <https://www.thehindubusinessline.com/news/national/iaf-moving-towards-automation-of-aircraft-maintenance/article68825791.ece>



Driven by the motto of ‘minimal human intervention, maximum combat potential’, the Indian Air Force (IAF) is moving towards automation of certain levels of maintenance and overhaul of fighter jets and copters by using Artificial Intelligence (AI) and robotics.

This would help IAF take inventory management to the next level and scale up capacity utilisation of machines and weapons so that the armed force is ready 24x7 in case of a war.

The IAF has reached out to IIT Mumbai and IIT Jodhpur for the use of AI and robotics in aircraft and helicopter maintenance respectively, guided by the strategy to replace men with machine in times ahead.

AI can help secure a 3-D model of any part and find out what kind of material it is.. To exploit AI, the IAF has launched a project for characterising 10,000 parts at a time. One of the challenges in maintaining a variety of fleets

is that the same part has different part numbers for different fleet, Air Marshal CR Mohan told businessline about the in-house automation drive before he retired as Air Officer-in-Charge Maintenance on October 31.

“If you have a database of a data lake of 10,000 drawings, an AI algorithm scans these and finds out that drawing number 1,900 and 1,000 are actually the same part. So, even though the part numbers are different, we could optimise our inventory. It can result in tremendous amount of savings. Now, the trouble with aviation parts is that the same material composition treated differently will have different properties. So it’s not just geometry and material composition,” explained Air Marshal CR Mohan (Retd).

However, there is no need for a physical model. There are unsupervised learning methods in which you pump in all the engines’ data into a data lake. And there is a learning algorithm which can actually obtain insights for us. This is a project we are working on with IIT Mumbai, he noted.

The project is at a pre-financial approval stage. The specialists come up with proposals and the forces try to fund them. The industry is invited at the production stage.

Use of Robots

The IAF is also resorting to AI for Maintenance, Repair, and Overhaul (MRO) of the aircraft.

Explaining its usage, Air Marshal Mohan (Retd) said that it is akin to a body camera on a technician looking at the airframe. If the smart

glass points red at a place, you know that, for example, the panel is open or a rivet is popping up, and it can be fixed, he said.

The IAF is looking to start automation from the first stage, also called ‘Operating (O) level’, of maintenance and overhaul, which is done on the tarmac or field to ensure the aircraft is prepared for flying.

The project is at the finance clearance level. The remaining process of acquisition would involve, among others, getting a prototype of the project and scaling it up for production.

The varied possibilities that automation can bring include placing a robot instead of a person at the work spot, deploying small ball robots or snake robots inside the aircraft for inspection, he said.

In case of civilian aircraft, small tools are already in use.

Robots for refuelling, driverless ‘supply mules’ for supply of weapons and other stuff for O-level maintenance, and towbarless tugs to tow aircraft are some other options available, as per the former senior IAF officer.

“Particularly for weapons production, weapons and production lines have to be automated. Today we know that a war is constrained by the number of designs you can make. We need industry 4.0.,” Mohan advocated.

According to him, the IAF is starting to discuss the usage of robotics with IIT Jodhpur.

India's First Reusable Hybrid Rocket RHUMI 1 Launched by a Start-Up

Hitanshi Kothari | 22 November 2024

[Source: Marksmendaily | https://marksmendaily.com/technology/indias-first-reusable-hybrid-rocket-rhumi-1-launched/](https://marksmendaily.com/technology/indias-first-reusable-hybrid-rocket-rhumi-1-launched/)



Representational Image

In a groundbreaking milestone for Indian space exploration, Tamil Nadu-based start-up Space Zone India successfully launched the country's first reusable hybrid rocket, RHUMI 1. The historic event took place from a mobile platform in Thiruvudanthai, Chennai, marking a significant leap in India's efforts toward sustainable and cost-effective space technology.

The RHUMI 1 rocket, designed with a hybrid motor powered by a generic fuel, is equipped with an electrically triggered parachute deployer, making it reusable for future missions. The launch was part of Mission RHUMI 2024, which aims to advance research on global warming and climate change. and climate change.

Mission Highlights

The rocket carried an impressive payload of three CUBE satellites and 50 Pico satellites, designed to monitor and gather critical data on atmospheric conditions.

CUBE Satellites: Focused on measuring cosmic radiation intensity, UV radiation levels, and air quality.

Pico Satellites: Deployed to investigate various atmospheric factors, including accelerometer readings, altitude, and ozone levels, providing valuable insights into environmental dynamics.

Mission RHUMI 2024 is led by Anand Megalingam, founder of Space Zone India, with guidance from Mylswamy Annadurai, the former Director of ISRO Satellite Centre (ISAC) and Project Director of India's iconic Chandrayaan Moon Mission.

Space Zone India, headquartered in Chennai, specializes in aerospace technology, delivering cost-efficient and sustainable solutions for the space sector. The mission received corporate support from The Martin Group of Companies, which contributed through its Corporate Social Responsibility (CSR) initiative.

India is rapidly solidifying its position as a global leader in space innovation. The successful launch of RHUMI 1 underscores the country's dedication to pushing technological boundaries while addressing environmental concerns.

By introducing reusable hybrid rocket technology, Space Zone India has taken a critical step toward reducing the financial and environmental costs of space exploration. This mission not only makes space technology more accessible but also highlights India's commitment to sustainability in one of the world's most dynamic industries.

Technology and Innovation

Analakshya, India's Defence Game Changer

Ajai Shukla | 28 November 2024

Source: [Rediff](https://www.rediff.com/news/report/anlakshya-indias-defence-game-changer/20241128.htm) | <https://www.rediff.com/news/report/anlakshya-indias-defence-game-changer/20241128.htm>



IMAGE: At the unveiling of Analakshya

IIT Kanpur has announced a breakthrough in stealth technology, which would make tanks and fighter aircraft invisible, or near-invisible to enemy radar.

High-technology cooperation between indigenous defence industry and academia has begun yielding results.

On Tuesday, November 26, 2024, the Indian Institute of Technology Kanpur (IIT-K) announced a breakthrough in stealth technology, which would make combat systems like tanks and fighter aircraft invisible, or near-invisible to enemy radar.

Designated a 'meta-material surface cloaking system' (MSCS), this has been named the Anālakṣhya by its inventors in IIT-K.

It is of major interest to the Defence Research & Development Organisation in its

development of the Advanced Medium Combat Aircraft (AMCA) -- a 'stealth fighter' that is being engineered to be near-invisible to the enemy's air defence radar.

The technology has undergone extensive laboratory and field testing between 2019 and 2024, proving its efficacy across diverse conditions.

The system is currently under acquisition by the Indian armed forces, signalling its strategic importance to national security.

According to a statement, 90 per cent of the Anālakṣhya MSCS is sourced indigenously.

In a significant move towards industrial production, the technology has been licensed to a private company Meta Tattva Systems, which will oversee its manufacturing and deployment.

Stealth systems avoid detection by enemy radar through two devices.

First, by engineering its external surface with small jagged panels that scatter radar waves, rather than large flat surfaces that reflect back radar waves to be detected by enemy radar antennae.

The second device that renders battlefield systems such as stealth fighters hard to detect is their surface composition.

Flat, metallic surfaces enable detection by reflecting radar waves. In contrast, absorptive surfaces absorb a high percentage of the synthetic aperture radar (SAR) waves.

'This textile-based, broadband, meta-

material microwave absorber offers near-perfect wave absorption across a broad spectrum, significantly enhancing stealth capabilities against SAR imaging,' IIT-K said on Tuesday.

Developed by a team of IIT-K researchers, this system sets a new benchmark in multispectral stealth capabilities, offering transformative applications in defence, national security, and specialised industries.

The Anālakṣhya MSCS not only offers wave absorption across a broad spectrum, it also provides effective protection from missiles that use radar guidance.

Further Reading

1. Bad news for Pakistan and China as Russia offers war-tested Kh-69 missile to Indian Air Force, its range is...- <https://www.india.com/news/world/bad-news-for-pakistan-and-china-as-russia-offers-war-tested-kh-69-missile-to-indian-air-force-its-range-is-7421690/>
2. Indian Air Force should not perceive China as a rival: experts - <https://www.globaltimes.cn/page/202410/1320788.shtml>
3. ISix decades since the Thumba launch, a slew of private cos prep for flight - <https://www.thehindu.com/sci-tech/science/six-decades-since-thumba-launch-slew-of-private-cos-prep-for-flight/article68913328.ece>
4. Elon Musk slams F-35, calls for drone replacements - <https://defence-blog.com/elon-musk-slams-f-35-calls-for-drone-replacements/>
5. New Report: China Cuts Pilot Training Time, Aims to Modernize by 2030 - <https://www.airandspaceforces.com/new-report-china-pilot-training-time/>
6. Russian President Putin Approves New Nuclear Doctrine, Warns West - <https://bharatshakti.in/russian-president-putin-approves-new-nuclear-doctrine-warns-west/>
7. Trump's second term could push Space Force to take bolder stance - <https://spacenews.com/trumps-second-term-could-push-space-force-to-take-bolder-stance/>

“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 Vice Marshal Anil Golani (Retd).

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