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“Whoever controls the air generally controls the surface. If we lose the war in the air, we lose the war and we lose it quickly”

– Field Marshal Bernard Montgomery

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Opinions and Analysis

Why is Avro aircraft replacement and C-295 aircraft induction critical for the IAF?

Dinakar Peri | 09 September 2021

Source: *The Hindu* | <https://www.thehindu.com/news/national/avro-aircraft-replacement-and-c-295-aircraft-induction-critical-for-the-iaf/article36376175.ece>



A C-295MW transport aircraft

The procurement of 56 C-295MW transport aircraft from Airbus Defence and Space S.A., Spain approved by the Cabinet Committee on Security on Wednesday marks the culmination of a decade-long process by the Indian Air Force (IAF) to replace the ageing Avro aircraft in service, pending signing of the formal contract.

This is the first project of its kind in which a military aircraft will be manufactured in India under technology transfer by a private company and is expected to cost close to \$3bn.

“Sixteen aircraft will be delivered in flyaway

condition from Spain within 48 months of signing of the contract and 40 aircraft will be manufactured in India by Tata Consortium within 10 years of signing of the contract,” a Defence Ministry statement said.

The deal has become even more critical for the IAF as a separate project to jointly co-develop and produce a Medium Transport Aircraft (MTA) of 20 tonnes with Russia to replace the An-32s in service was scrapped after initial design discussions.

The IAF has 56 Avro transport aircraft procured in the 1960s and in urgent need of replacement. The Request For Proposal (RFP) was issued to global firms in May 2013 and the sole bid by Airbus and Tata Group with the C-295 aircraft was approved by the Defence Acquisition Council (DAC) in May 2015. However, the final deal has been repeatedly delayed.

“This is some development!! The ‘Avro model’, as this procurement has come to be labelled, is unique in many respects and could be used in other large scale projects. It started in 2010, when I was Assistant Chief of Air Staff (ACAS) Operations! 11 years for approval - still

This is the first project of its kind in which a military aircraft will be manufactured in India under technology transfer by a private company.

many to go before first aircraft comes in,” said Air Vice Marshal Manmohan Bahadur (Retd.) on Twitter.

The Avros once inducted could be deployed on the sea routes replacing the An-32s in those sectors.

5-10 tonne capacity

The C-295MW is a transport aircraft of 5-10 tonne capacity and has a rear ramp door for quick reaction and para dropping of troops and cargo. It is powered by Pratt & Whitney PW127 engines, part of the PW100 family. All 56 aircraft will be installed with indigenous Electronic Warfare Suite.

The project would give a boost to aerospace ecosystem in India wherein several Micro, Small and Medium Enterprises spread over the country would be involved in manufacturing of parts of the aircraft, the Ministry statement said.

On the project spread, the Ministry said that a large number of detail parts, sub-assemblies and major component assemblies of aero structure were scheduled to be manufactured in India. The programme would act as a catalyst in employment generation in the aerospace ecosystem of the country and was expected to generate 600 highly skilled jobs directly, over 3,000 indirect jobs and an additional 3,000 medium skill employment opportunities with more than 42.5 lakh man hours of work within the aerospace and defence sector of India, the statement said.

During the process of manufacturing in India, it is expected that all the suppliers of Tata Consortium who will be involved in special processes will gain and maintain globally recognised National Aerospace and Defence Contractors Accreditation Program accreditation,

according to the statement. “It will involve development of specialised infrastructure in form of hangars, buildings, aprons and taxiway.”

Recent defence deals have been successful only because they were made through unconventional means, circumventing the long and tedious procurement processes.

Stating that before completion of deliveries, ‘D’ Level servicing facility (MRO) for C-295MW aircraft were scheduled to be setup in India, the Ministry added, “It is expected that this facility will act as a regional MRO hub for various variants of C-295 aircraft.”

Rafale, S-400 or C-295, all came from out-of-the-box thinking. India should do it more often

Snehash Alex Philio | 10 September 2021

Source: The Print | <https://theprint.in/opinion/brahmastra/rafale-s-400-or-c-295-all-came-from-out-of-the-box-thinking-india-should-do-it-more-often/731118/>



The first of five Rafale fighter jets, travelling from France, touches down at Ambala air base in Haryana | PTI

Over the last one month, a number of contracts under the fast track procurement route have been inked by the defence ministry as part of the much-needed modernisation of the three Services. Most of these contracts, each valuing between Rs 100 crore and Rs 150 crore, are for drones, loitering

munitions, counter-drone systems and special sights.

Though the cost involved is not huge, considering the billion-dollar deals that the defence industry is known for, these contracts bring about a welcome change — not just because they have been inked faster but also because they are the starting point for introduction of niche technology for modern warfare.

Another welcome change is that all these contracts have gone to Indian startups and or India-based joint ventures between a local firm and a foreign Original Equipment Manufacturer (OEM).

Besides these small contracts, a big contract has also been cleared. The Cabinet Committee on Security (CCS) Wednesday cleared the \$3-billion-deal for procuring 56 C-295MW transport aircraft for the Indian Air Force (IAF). The aircraft that will be manufactured in India jointly by Airbus and Tata, will replace the ageing IAF fleet of Avro 748 transport aircraft that first flew in 1961.

If we were to name two big defence deals in the recent past, they would be the S-400 air defence system purchase from Russia, and Rafale.

Small revolution in defence procurement

The genesis of the recent contracts given to Indian startups for drones by the armed forces can be traced back to a 2018 competition organised by the IAF — Mehar Baba Swarm Drone Competition. It was unique because the IAF had said the winners could bag a defence contract for swarm drones worth about Rs 100 crore.

This procurement route bypassed the conventional process of issuing Requests for Proposals (RFP), conducting trials, cost negotiation and finally contract signing. The IAF had used the Buy Indian (designed, developed and manufactured) category that was introduced in the Defence Procurement Procedure 2016. This was also unconventional because the IAF was handholding the firms and extending help in raising the bar in every round.

The end result was that two of the five firms that topped the competition — Bengaluru-based NewSpace Research and Tech, and Noida-based Raphe mPhibr Pvt Ltd — bagged contracts from the Army.

While Raphe along with NewSpace got contract for swarm drones, the former also bagged two separate contracts from the Army for supplying 48 Medium Altitude Logistics Drones and one from the Navy for 10 High Endurance payload carrying drones.

Now the two manufacturers, along with three others who were part of the top five — Veda Defence Systems Pvt Ltd, Dhaksha Unmanned Systems Pvt Ltd and Flaire Unmanned Systems Pvt Ltd — will soon be competing for a larger IAF contract.

Similarly, the deals for S-400, Rafale and the C-295 were also unconventional. In the case of C-295, it will be the first time when local private industry would be making a military plane in India. The fact that the cost negotiations committee (CNC) was headed by an IAF officer, unlike a

bureaucrat from the defence ministry, also added to the uniqueness of the deal. Similarly, the CNCs for both the S-400 and the Rafale were also led by IAF officers. The net result was that decisions were taken faster because the officers knew how critical the systems were.

With the original procurement process hanging in balance, Prime Minister Narendra Modi decided to go in for the purchase of 36 Rafale jets rather than just waiting endlessly for the bigger deal to happen. His decision came under severe criticism. But then the IAF was happy.

Even in the case of the long pending deal with Russia to jointly manufacture AK-203 rifles in India, a non-conventional approach is being attempted. Major General Sanjeev Sengar has been appointed as CEO for four years, of the rifle factory in Amethi. This is the first time in decades that a uniformed officer will head an ordnance factory. This move was initiated because the Army had concerns regarding the quality and delivery of products from ordnance factories.

The defence sector needs more such out-of-the-box thinking because India's forces are in desperate need for modernisation and faster procurement. To circumvent the long delays, the government has now given more autonomy to the Service chiefs for procurement, both through capital as well as revenue route. But then these are for smaller deals and stop gap arrangements.

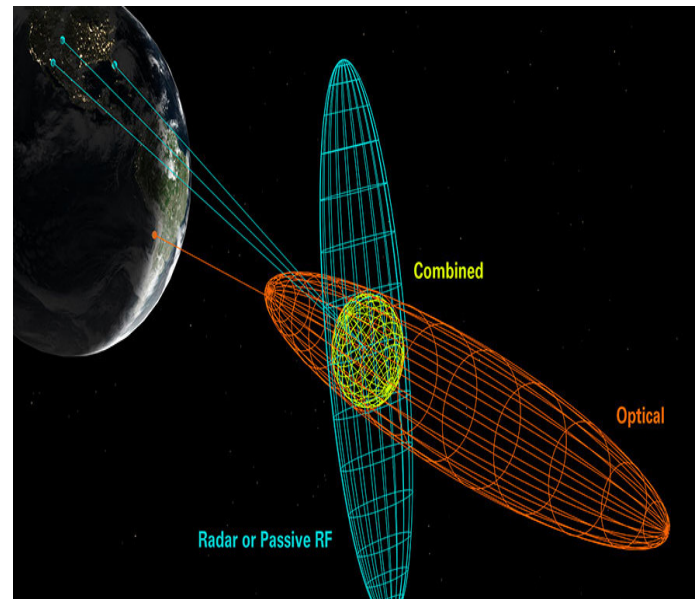
What is needed is the will to think out of the box and the will to take decisions on a regular basis. As Army chief Gen M. M. Naravne said,

India needs revolution in bureaucratic affairs.

Satellite operators need more accurate SSA data

Jeff Foust | 16 September 2021

Source: *Space News* | <https://spacenews.com/satellite-operators-need-more-accurate-ssa-data/>



Operators need to combine SSA data from multiple sources in order to get a level of accuracy high enough to make useful decisions on whether to maneuver to avoid potential collisions. Credit: AGI

The WAILEA, Hawaii — Space situational awareness data used by satellite operators isn't accurate enough to support the decisions they need to make on whether and how to maneuver their spacecraft to avoid potential collisions.

In a paper presented at the Advanced Maui Optical and Space Surveillance Technologies, or AMOS, Conference here Sept. 15, officials with the COMSPOC Corporation, which specializes in commercial space situational awareness (SSA), looked at the various approaches satellite operators used to determine if they need to make a collision avoidance maneuver and compared it to the accuracy

of the data they use to base “go/no-go” decisions for those maneuvers.

Dan Oltrogge, director of integrated operations and research at COMSPOC, said in an interview that a survey of members of the Space Data Association, a group of satellite operators, revealed no consensus in the criteria they used to determine what is a “high-interest” close approach in either low Earth orbit or geostationary orbit. GEO operators, for example, use a threshold of a projected miss distance ranging from 1,000 to 15,000 meters, and a probability of collision ranging from 1 in 10,000 to 1 in 1 billion.

“The criteria and the thresholds they were using are all over the map,” he said. “Maybe it’s unrealistic to expect that they wouldn’t be different because each operator has varying levels of sophistication and varying levels of resources and SSA data they have access to. But, it was striking for us just how different these things are.”

With an understanding of those wildly varying thresholds, COMSPOC then analyzed how well existing SSA data supports those operators’ decision-making processes. “Typical data is not meeting their needs. It’s not accurate enough to use it in the manner that it’s being used,” Oltrogge said.

A solution COMSPOC proposes is “data fusion,” where the freely available SSA data like that from the U.S. government is combined with other data, such as the operator’s own knowledge of its satellites as well as commercial SSA data. “By blending all those together and factoring in the operator’s planned maneuvers and the operator’s spacecraft dimensions, we were able to get a

much better picture of what’s going on,” he said. “We can get very close to meeting those accuracy requirements.”

That requires some change in thinking by operators. “We have a heritage here of using best available data and assuming that’s all we have, so let’s be happy with it,” he said. “Instead, I urge us as a community to figure out what accuracies we need, and then figure out what we need to meet those requirements.”

There are signs that operators are willing to share SSA data, Oltrogge said. “If you can bring that into a comprehensive data fusion system where it’s blended with government SSA observations and commercial SSA observations, that’s when you can really get accurate and actionable SSA products.”

Growing Chorus for an ASAT Test Ban Treaty

Gp Capt T H Anand Rao | 16 September 2021

Source: Centre for Air Power Studies | <https://capsindia.org/files/documents/72814290-f177-440a-bb21-30b25d46e7ca.pdf>

Testing of Anti-Satellite Weapons (ASAT) in outer space has become a menace in recent years. The after effects are irreversible – the most profound effect being that of thousands of debris pieces created due to the impact of explosion. In a new initiative, the Outer Space Institute based at Canada, has initiated an international open letter to urge the United Nations General Assembly (UNGA) to consider introduction of a ‘kinetic ASAT test ban treaty’. The necessity for such a treaty is driven by the rapid growth in number of

satellites in orbit and the growing threat scenario in outer space. Debris from these tests often ends up in useful orbits posing a threat to orbital assets of multiple nations. There are chances that even a single debris from such a test may collide with a satellite and cause a fragmentation event, which could lead to additional events - like further fragmentations, satellite failures, or service disruptions - affecting all states.

There is a growing support from the global space community on favoring a zero tolerance on any debris creating anthropogenic events. Russian Foreign Minister Sergey Lavrov, called for talks on a legally binding treaty to prohibit weapons in space in a statement on April 12, 2021, a day the world marks the International Day of Human Space Flight. UNGA in December 2020 adopted its Resolution 75/36 on 'Reducing space threats through norms, rules and principles of responsible behaviour'. This resolution also seeks the views of member states on reducing space threats which was to be submitted as a report to the UNGA at its seventy-sixth session which commenced on September 14, 2021. In responses submitted by member states, Russia has suggested an embargo on ASAT testing through a ban on weapon systems designed to destroy objects in outer space. China too espouses the same views. It may be recalled that China and Russia jointly submitted to the Conference of Disarmament (CD) a draft treaty on the Prevention of the Placement of Weapons in Outer Space (PPWT) in 2008 and its updated text in 2014, which could have provided a good basis for negotiations. The PPWT, however, could not gather a consensus amongst member states. On the other hand, United States opined that kinetic ASAT tests could be viewed as a category of

conduct in space that could be addressed during deliberations and implementation of universal guidelines evolved following UNGA Resolution 75/36, thus being non-committal and leaving a scope for further deliberations. In responses received from about 40 member states and organisations, there is a strong acceptance for placing binding restrictions on kinetic ASAT tests. India too has given a categorical reply stating that – "India's focus is on the use of space for 'welfare' and not for 'warfare'. India is opposed to the weaponisation of outer space and India has not and will not, resort to arms race in outer space." India too favours a treaty within the multilateral framework of the UN which includes transparency, sustainability and equity of member states.

Efforts in maintaining a safe access to earth orbit date back to the incorporation of the 'OuterSpace Treaty' of 1967 – a framework treaty for outer space utilisation - which prohibits placing nuclear weapons or weapons of mass destruction in orbit. However, a major flaw of the treaty which has gained prominence is the silence on the use of other forms of weapons in outer space. Incidentally, the treaty banning nuclear weapon tests in the atmosphere, in outer space and under water was incorporated in 1963. The Conference of Disarmament under UN General Assembly has been deliberating the issue to prevent weaponisation of space since many years. A Group of Government Experts (GGE) was appointed by the UN secretary general in 2011 to examine and report on methods for improving stability and sustainability in space. The Transparency and Confidence Building Measures (TCBM) recommended by the GGE in 2013

gathered widespread global support, however, they could not achieve the desired objectives as the recommended mechanisms were voluntary in nature and suggested guidelines were non-binding.

The experiences of exploring space governance mechanisms and treaties to achieve stability and sustainability in outer space have clearly been ineffective. The UN along with its representatives like the CD and Committee on Peaceful Uses of Outer Space (COPUOS) need to strategise on implementing a rule based order in outer space. The need of the hour is hence, to gather consensus on evolving a treaty which is binding and punitive in nature. Transparency in space activity will necessarily be the bedrock of any such treaty.

Earth orbits are becoming congested at an unimaginable pace. The number of satellites in orbit is about 7520 of which about 4600 are active satellites⁹. Surprisingly, there were only 1033 active satellites a decade ago in 2011 and there is a projected addition of as many as 100,000 active satellites within the next ten years. The numbers of catalogued and tracked space debris objects has also risen to around 29240 from around 25000 five years ago. The recorded events of break-ups, explosions, collisions, or anomalous events resulting in fragmentation are estimated to be more than 570. These figures are alarming. This rapid exponential growth in satellites and debris is worrisome as it would not only be crowding Earth orbits in an irreversible manner, but would create an imminent threat of collisions resulting in an ever increasing count of debris due to the Kessler's syndrome. The debris caused by Kinetic ASAT tests would only worsen the

outer space environment to a point which would make space unusable by future generations. The environmental impact on the Earth's atmosphere would be worse. Thus, a ban treaty for kinetic ASATs should be put in place without any further delay.

An option available to every space capable nation was to conduct Kinetic ASAT tests at lower altitudes which could limit the orbital life of debris. Thus, imposing a limiting altitude restriction of Kinetic ASAT tests can also be considered. However, this has not found much favour amongst the space community. The argument against such a restriction is that debris may eventually get kicked up to higher orbits, even as high as 1000 km as the projectiles velocity, energy and impact angles cannot be accurately determined in a random target situation in a hostile environment.

India's kinetic ASAT test in March 2019, named 'Mission Shakti' was conducted at a low altitude of 282 km, with due diligence to prevent stagnant debris, unlike the Chinese ASAT test of 2007, which produced a debris field of some 3,000 objects at an altitude of 865 kilometers which still remain in orbit. Despite the deliberate low altitude and efforts to minimise debris, there are still chances that some debris would have reached higher altitudes, due to the high impact velocity and impact angles. Whether the Indian ASAT test achieved its objectives or not is debatable. However, the ability to replicate a similar feat in a hostile environment against an adversary's satellite is doubtful, owing to the deficiencies in India's Space Situational Awareness infrastructure.

Recent developments in soft weapons technology like Directed Energy Weapons, Radio

Frequency Interference and intrusions in the Cyberspace have shown similar results as the kinetic ASAT, with the added benefits of denying attributability, lower costs, and most importantly, preventing a debris trail in space. Moreover, in this age of satellite constellations, destroying a single or a few satellites by kinetic ASATs would serve no useful purpose, as redundancy is inbuilt in a constellation, and the smaller satellites used can be replaced with responsive launch capabilities. Hence, Kinetic ASATs are beginning to see the end and should be phased out. They serve no purpose beyond deterrence. The stage is not far for kinetic ASAT weapons becoming unusable.

Misadventures in space are clearly a thing of the past. New regulations have to be put in place for a safe and sustainable use of space. The current growth rate of space traffic demands a change in the way we access space. Creating additional debris intentionally by kinetic ASATs is ill afforded in the prevailing scenario. It is time for the UNGA to ban the kinetic testing of ASAT weapons, lest we live with the consequences of not doing so.

The primacy of Passive Air Defence (PAD)

Brandon Morgan | 06 September 2021

Source: Mordern War Institute | <https://mwi.usma.edu/the-primacy-of-passive-air-defense/>



On a distant Pacific Island battlefield, a section of US Army air defenders mans its perimeter on a relatively quiet night. The war, if you could call it that, had carried on for years. The US government continued to slog through painful negotiations with an adversary determined to leverage the American public's growing disdain for the conflict against the diplomats and senior military officers. The air defenders, observing no threats on their state-of-the-art radar, turn their conversation to the upcoming baseball season. One soldier, tired of the banter, turns the radio to his favorite broadcast for a moment of solitude. Like the rest of his section, he is entirely unaware that a cheap, low-tech biplane is rumbling toward the air defenders' position, flying so low that the highly advanced American radars cannot distinguish the enemy plane from the surrounding ground clutter. Without warning, a tremendous blast throws him across his entrenchment—his right side numb and seemingly dysfunctional—

but he is the lucky one. On the other side of their firing position, his fellow soldiers lie dead, with their gun emplacement twisted, disfigured, and completely destroyed.

This story embodies many of the anticipated characteristics of future warfare. But it is not an imagined one, set in 2043 or 2033. It is the story of real events that took place on April 15, 1953. It is the story of the last successful enemy aircraft attack against US soldiers. In this case, the culprit was likely a Soviet-built, North Korean-operated Polikarpov Po-2 biplane. Rather than attempt to outfly and outcompete the advanced US Air Force jet fighters head to head, the North Koreans resorted to asymmetric tactics, using cheap, easily operated aircraft to terrorize US ground forces with psychological ramifications stretching much farther than the relatively limited tactical ones. Since that moment, the US Air Force and Army air defense capabilities have protected ground forces with a perfect record: not a single servicemember on the ground has been killed by an enemy aircraft since that day.

Unfortunately, the future does not look promising. Both peer and irregular adversary forces continue to grow a massive arsenal of armed and kamikaze-style aerial drones—capable of inflicting far more than just psychological damage to US ground forces. From battlefields stretching across the Caucasus, Saudi Arabia, Ukraine, Syria, and elsewhere, the proliferation of advanced drones and accompanying tactics is almost certain to spell the end of US air dominance and nearly guaranteed protection for ground forces. While the Army is developing much-needed active air defense modernizations, adversaries will almost certainly continue producing and

proliferating drones and aerial threats far faster than the Army can hope to defend against. This is why passive air defense, or measures to minimize the effectiveness of hostile air defense (without attempting to destroy the threat), will continue to serve as the most important countermeasure for the majority of Army units. Passive air defense measures include detection, warning, camouflage, concealment, deception, dispersion, and sheltering. Before employing any of these techniques, however, units must begin by getting one thing right.

Intelligence Preparation: The Key First Step to Passive Air Defense

While it may sound cliché, the best passive air defense begins with robust mission analysis and intelligence preparation of the battlefield. In the same manner that tactical units prepare to defend against enemy artillery and tanks by understanding composition, disposition, strength, capabilities, and course of action, so too must staffs plan and prepare for the plethora of unmanned and manned aerial threats. By understanding how the enemy intends to employ its reconnaissance and kinetic-strike unmanned aircraft systems (UAS) in addition to manned rotary- and fixed-wing capabilities, staffs arm their commanders with information required to protect their forces. Commanders can then, for example, request appropriate digging assets for protecting their forces while maneuvering their units accordingly.

Detection and Warning

By producing a detailed scheme of protection and corresponding Annex E to an operations order—which covers protection—a battalion staff enables company commanders to prepare their units to detect incoming aerial threats.

Soldiers who understand the threat are prepared to observe and detect them using long-range optics or audible signature. This provides the company (and perhaps the battalion) with the early warning required to either move into prepared fighting positions or cease movement and report to higher headquarters. From here, the higher headquarters may be able to employ active air defense measures to destroy the threat.

Camouflage and Concealment

Camouflage and concealment degrade the enemy's ability to accurately assess friendly composition and course of action, complicating the enemy targeting process. While enemy sensors may be able to detect the presence of camouflaged friendly forces, many UAV operators, especially using the smaller and less capable Group 1 and 2 equivalents (categories of aircraft weighing less than fifty-five pounds and flying lower than 3,500 feet above the ground), will have a difficult time identifying the friendly asset with absolute certainty. In a world of limited munitions for targeting, this matters. This may mean the difference between the enemy decision to conduct a kinetic air or indirect fire strike, or to completely bypass an uncertain target in search of more certain ones.

Deception

Deception operations mislead enemy forces so they take specific actions (or inactions) that enable friendly units to accomplish the mission. As part of combined arms maneuver, deception is critical to protecting against enemy aerial threats. Field Manual 3-13.4, Army Support to Military Deception, provides an overview of how units can plan to deceive enemy forces through ambiguity increasing or decreasing operations. The former

makes the enemy less certain of friendly intent, whereas the latter guides the enemy toward incorrect beliefs about friendly actions and intent, thus bringing the wrong assets into play, or focusing operations at the wrong place or wrong time. In terms of defending against modern unmanned or manned air threats, both methods reduce the enemy's ability to accurately detect and target friendly forces. With the growing worldwide proliferation of unmanned aircraft, using decoy radio signals, constructing makeshift decoy assets, and positioning real assets for deceptive effects can have a significant impact on enemy decision making, thus protecting friendly forces from above.

Dispersion and Sheltering

All soldiers, no matter their military occupational specialties, learn the value of dispersion during basic training road marches. By maintaining five meters of separation from one another, a well-thrown enemy grenade may wreak havoc for an unlucky soldier or two, but the squad will remain intact and capable as a unit. This principle applies with equal validity to passive air defense. By adhering to doctrinal principles of dispersion, units reduce the likelihood that they will be targeted—and even if they are, they will at least ensure they remain mission capable in the aftermath. Sheltering, either through individual or vehicular fighting positions, or even simply using adjacent terrain, remains a time-honored and increasingly urgent method of protection against increasing aerial threats. Combining both dispersion and sheltering is, of course, the optimal action. In a sense, if China can combine these methods to protect its newly discovered missile silos against nuclear weapons, then US Army

units can do the same against more conventional airborne threats.

Training

Like many principles, applying those of passive air defense is easier said than done. US Army units must actively train to counter the growing threat of enemy unmanned and manned aircraft. But rather than include this training as an additional requirement, units should instead incorporate it into preplanned events such as collective gunnery and other field exercises. At the battalion level, units must deliberately plan against a realistic enemy air threat. By doing so, staffs can plan to emplace their command posts in terrain that minimizes detection and produce orders that inform subordinate companies of the realistic threat. Companies should incorporate unmanned aerial vehicles into vehicle identification drills that previously focused on legacy ground and manned enemy air threats. Company commanders should also use their organic UAS at every practical opportunity. This accomplishes two objectives: (1) training their own operators for offensive and defensive operations, and (2) training subordinate platoons to defend against Group 1 UAS. By training rigorously at home station now, units will arrive better prepared against the myriad of threats at major training centers and, if called upon, in combat.

In the race between adversarial airpower and active air defense, the proliferation of kinetic, kamikaze, and potentially swarming unmanned aircraft portends a growing dominance by the former. Regardless, no matter how lethal or prolific enemy aerial capabilities may become, passive air defense principles will be vital for Army units. Unlike standalone Navy vessels and

concentrated or target-rich Air Force facilities, Army ground forces are already the most difficult to destroy given a limited number of munitions. But whereas air and naval assets can remain in the fight even with added standoff distance to protect themselves, ground forces have no such luxury. Passive air defenses are thus key to remaining difficult to target from above. Units that rigorously train on employing passive air defense techniques maximize their survivability on the modern battlefield.

Air Power

IAF to bolster fighter fleet with 24 second-hand Mirages

Shishir Gupta | 17 September 2021

Source: *Hindustan Times* | <https://www.hindustantimes.com/india-news/iaf-to-bolster-fighter-fleet-with-24-second-hand-mirages-101631836620386.html>



Out of the 24 Mirage fighters, 13 are in complete condition with engine and airframe intact with eight of them ready to fly after servicing. (File Photo)

The Indian Air Force (IAF) is set to acquire 24 second-hand Mirage 2000 fighters, made by Dassault Aviation, in an attempt to strengthen its ageing fleet of the fourth-generation fighters and also secure parts for its two existing squadrons of the aircraft, people familiar with the matter said on condition of anonymity. IAF has initialled a contract worth 27 million euros to buy the fighters, eight of which are in ready-to-fly condition, the people cited above added. That works out to a per-aircraft acquisition cost of 1.125 million euros. The people cited above said the aircraft will soon be shipped to India in containers.

IAF's 35-year old Mirage fleet, which

performed exceptionally during the 2019 Balakot operation, is undergoing a mid-life upgrade, the people said – with the trigger for the acquisition of the second-hand aircraft being the immediate need for 300 critical spares. The aircraft is becoming obsolete in France, they added, and IAF chief Air Chief Marshal RKS Bhaduarua decided to go in for the purchase.

Out of the 24 fighters, 13 are in complete condition with engine and airframe intact with eight of them (nearly half a squadron) ready to fly after servicing. The remaining 11 fighters are partially complete but with fuel tanks and ejection seats, which will be scavenged to secure parts for IAF's two existing squadrons of the fighter.

IAF purchased around 50 fourth-generation Mirage 2000 C and B fighters way back in 1985 with a maintenance contract that expired in 2005. It signed another contract in 2015-2016 with the French original equipment manufacturer.

The purchase highlights the importance of shifting spare parts and engine supply chains to India for future acquisitions as fighters abroad reach obsolescence much faster than in India. Until the Narendra Modi government took the decision of acquiring the 4.5 generation Rafale fighters (also from Dassault), the Mirage 2000 was India's front-line fighter, a position it has held since the Kargil war. The new Aatmanirbhar Bharat campaign should ensure that original equipment and spares are now manufactured in India so that there is no shortage of spares till the time the fighter is decommissioned, the people cited above said.

The other issue that flows out of this last-minute

IAF's 35-year old Mirage fleet, which performed exceptionally during the 2019 Balakot operation, is undergoing a mid-life upgrade.

acquisition is that the IAF and the Indian Navy should plan their fighter acquisition so that there is synergy between the two forces and coherence is maintained in the supply of spare parts, experts said. It also points to the need for the defence ministry to accelerate decisions on replenishing the country's fighter fleet, especially because China has already moved to fifth-generation fighters and armed drones.

The “retired” F-117s are ideal surrogates for cruise missiles, which have small target signatures and threaten the U.S. and its interests abroad.

Stealthy F-117 Nighthawks Have Been Masquerading As Cruise Missiles

Joseph Trevithick | 23 September 2021

Source: *The Drive* | <https://www.thedrive.com/the-war-zone/42498/stealthy-f-117-nighthawks-have-been-masquerading-as-cruise-missiles-air-force-confirms>



The head of the Air National Guard, Air Force Lieutenant General Michael Loh, says that F-117 Nighthawk stealth combat jets have been supporting training exercises, in part, by serving as surrogates for incoming cruise missiles. The Air Force only publicly acknowledged that some of the remaining fleet of F-117s, which were officially retired in 2008, were being used for any kind of training for the first time earlier this month, despite clear evidence that this has been the case

for some time now. The War Zone was first to report on this latest deployment of Nighthawks to Fresno-Yosemite International Airport in California for dissimilar air combat training with F-15C/D Eagles from the California Air National Guard's 144th Fighter Wing.



An F-117, with its drag chute deployed, after landing at Fresno-Yosemite International Airport on Sept. 13, 2021.

Lieutenant General Loh offered this new detail about the F-117's new lease on life in response to a question from one of Aviation Week's reporters during the Air Force Association's annual Air, Space, and Cyber Conference, which concluded yesterday. The War Zone's own Tyler Rogoway has highlighted repeatedly how the remaining flyable F-117s would be useful cruise missile surrogates since it first became apparent many years ago that at least some of the Nighthawks have been enjoying a very active “retirement.”

“When you look at 117s that come and land and do that stuff, they're a stealth platform, right?” Loh said. “Early days of stealth, but they're still a stealthy platform.”

“So they can simulate things out there like cruise missiles that we would actually face,” he

continued. “So are they a perfect platform for a cruise missile defense exercise? Absolutely.”

Broadly, cruise missiles — especially newer designs being developed and fielded by America’s potential near-peer adversaries, China and Russia — present significant threats to American forces abroad, as well as to the U.S. homeland and outlying American territories. U.S. military officials have been increasingly sounding the alarm about the possibility of land-attack cruise missile strikes on the United States, including weapons that could be launched from submarines lurking offshore. In addition, there has long been a fear that hostile parties, including non-state actors, might be able to carry out similar attacks from other types of vessels, including innocuous cargo ships, using purpose-built containerized systems or improvised ones. New and improved anti-ship cruise missiles, some of which have very small radar and infrared signatures, are also of particular concern to the U.S. Navy.

Cruise missiles, in general, typically fly very low amongst the ground and surface clutter and are relatively small, inherently giving them small radar cross-sections and infrared signatures. This, in turn, means they can be very difficult to detect and then engage. Many modern threat cruise missiles, such as Russia’s air-launched Kh-101, and its nuclear-armed Kh-102 variant, also have stealthy features of their own, which only makes them harder to spot and track. Russian and Chinese efforts to develop new designs capable of flying at hypersonic speeds only add more complexity to this overall threat picture.

Lower-end cruise missiles can still be very real threats, too. Anti-ship and land-attack designs of various types are steadily proliferating around the

world, including among smaller military forces and even non-state actors.

All told, it would make perfect sense that F-117s have been flying, at least in part, as mock cruise missiles during training engagements with Air Force units, as well as other elements of the U.S. military. Nighthawks could also be useful stand-ins for cruise missiles to support the research and development and test and evaluation of new weapons, sensors, and other systems.

The Air National Guard, in particular, is a key line of defense against potential cruise missile strikes on the homeland, and the Air Force has been looking to expand the capabilities of its F-15C/Ds, as well as its F-16C/D Viper fighter jets, to respond to these threats. The Eagles, such as the ones assigned to 144th Fighter Wing that trained with the F-117s earlier this month, have benefited from the addition of new active electronically scanned array (AESA) radars that are better able to spot and track threats with smaller radar cross-sections, as well as Sniper Advanced Targeting Pods, which give the jets an alternative means of visually identifying targets, even at night, at extended ranges. The Sniper pod can be slaved to the aircraft’s radar, and vice versa, allowing the sensors to be used in a directly complementary way to rapidly detect, identify, and track potential threats.

The addition of AESA radars to many of the service’s F-15C/Ds was largely spurred by the cruise missile threat. Now, some of the USAF’s F-16s, especially those belonging to guard units that watch over high-threat areas, like Washington, D.C., are also now getting AESA radars, as well as new tactics and weapons to deal with the cruise missile threat.

With Loh's new comments about how the F-117s have been being employed, it only seems more likely that the Nighthawks have been acting in this role during their engagements with other services, as well. Some of the jets were notably spotted taking part in a Composite Unit Training Exercise (COMPUTEX) centered on the Nimitz Carrier Strike Group (CSG) off the coast of southern California last year, where the jets could very well have acted as mock anti-ship cruise missiles, among other roles. Non-stealthy aggressors are often used in exactly the same way to support naval training exercises.

F-117s have also been spotted flying very low, which could reflect a mock cruise missile flight profile, during Air Force Red Flag exercises and while working with elements of that service's prestigious Weapons School. The Weapons school is located at Nellis Air Force Base in Nevada, which is also the main hub for Red Flag drills.

Of course, playing the role of cruise missiles is only one of the F-117's jobs today. As Lieutenant General Loh noted, despite the age of their stealth technology, these jets are still stealthy and are unlike anything most Air Force pilots or any personnel they are working with at sea or on the ground down below are likely to have encountered in any other context. This all means the Nighthawk, which celebrated the 40th anniversary of its first flight this year, remains a very valuable asset for all kinds of dissimilar aerial combat training, as well as various test purposes.

"Although officially retired, many F-117s remain airworthy and are used to support limited research and training missions based on overall cost-effectiveness and their ability to offer unique

capabilities," an official Air Force news item about the Nighthawks training with the 144th Fight Wing also noted. The Air Force still has dozens of these jets in storage at the Tonopah Test Range Airport in Nevada, the F-117's first operational home and where the aircraft still flying today are based, which can serve as a key source of spare parts. That the Nighthawks are seen as relatively low-cost for the capabilities they offer is also a testament to its original design, which leveraged components from various existing U.S. military combat jets.

With the Air Force now clearly opening up more and more to talking about what its remaining F-117s are still up to today, we may now start to get even more details about exactly how these jets are being utilized nearly a decade and a half after they were officially retired. In their role as cruise missile surrogates, we could also soon see them show up to train with all four of the Air National Guard units equipped with F-15C/D fighters that are tasked with protecting America's maritime borders, as well as the F-16s whose mission is to guard the highly sensitive airspace over the nation's capital in Washington, D.C.

US spy planes deployed to Russia and Taiwan as Putin and Xi hold massive war games fuelling WW3 fears

Tariq Tahir | 23 September 2021

Source: *The Sun* | <https://www.thesun.co.uk/news/16224494/us-spy-planes-russia-taiwan-putin-xi-war-games/>

US SPYPLANES DEPLOY TO RUSSIA AND TAIWAN

RC-135 aircraft sent to monitor war games being held by Putin and Xi Jinping



The RC-135 aircraft have been monitoring massive missile firing drills in the Black Sea and a sizable Chinese air force incursion into Taiwan's airspace.

Russia's navy practised firing at targets in the Black Sea off the coast of annexed Crimea using its Bastion coastal missile defence system, an advanced mobile anti-ship and surface-to-surface defence system.

A radar app showed a pair US Air Force RC-135 flying across the Black Sea and then round off the coast of the Crimea.

The drill came as Ukraine held joint military exercises with the United States, which are set to run until the end of the month.

Vladimir Putin's forces were shown carrying out strikes with truck-mounted missiles in video footage released by the Defence Ministry. Crews fired from concealed positions and used drones to track a simulated enemy group of ships, it said.

Russia annexed the Crimean peninsula from Ukraine in 2014 and backed pro-Russian separatists in Ukraine's Donbass region. The seven-year conflict with separatists has killed more than 13,000 people.

Meanwhile, Taiwan's air force scrambled on Thursday to warn off the Chinese aircraft which entered its air defence zone, its defence ministry said.

The incursion came as China voiced opposition on Thursday to Taiwan joining a major trans-Pacific trade deal. The 24 Chinese aircraft included 12 J-16 fighters and two nuclear-capable H-6 bombers, the ministry said.

The US also sent an RC-135 close to the route the Chinese warplanes took to and from Taiwan's air defence identification zone (ADIZ).

It comes just days after China flew 10 fighter jets into Taiwan airspace after sending planes over 15 times in two weeks.

Beijing has sent different aircrafts including fighter jets, spotter planes and bombers into Taiwan's ADIZ every day this month, except for September 2.

China regards Taiwan as part of its territory

"US spy planes have been deployed to Russia and Taiwan as Vladimir Putin and Xi Jinping's forces stage war games."

and has long threatened to use force to bring it under its control.

“We firmly oppose any country having official exchanges with Taiwan and firmly oppose the Taiwan region’s accession to any official treaties or organisations,” said Chinese foreign ministry spokesman Zhao Lijian told reporters.

Taiwan responded by saying China has no right to decide who can join the trade pact given it is not itself yet a member.

‘CHINESE BULLY’

“The Chinese government, with its deeds of just wanting to bully Taiwan in the international community, is the culprit for heightened cross-strait hostilities,” Taipei’s foreign ministry said in a statement.

China often sends military aircraft into Taiwan’s air defence zone to display displeasure but Thursday’s incursion was the biggest since June 15.

Negotiations for the sweeping trade deal were initially led by the United States as a way to increase its influence in the Asia-Pacific region.

China regards Taiwan as part of its territory and has long threatened to use force to bring it under its control.

Former Chinese president Chiang Kai-shek and his supporters fled to the island in 1949 following the Chinese Communist Party victory in the country’s civil war.

The island of 25 million people has since developed its own democratic identity and party of current President Tsai Ing-wen supports moves

towards full independence – which Beijing says will trigger war.

US Air Force Adopts Augmented Reality To Train Its Fighter Pilots ‘Dogfight’ Chinese, Russian Jets

23 September 2021

Source: The EurAsian Times | <https://eurasiantimes.com/to-dogfight-chinese-russian-jets-us-air-force-adopts-high-tech-system-to-train-its-fighter-pilots/>



A fighter pilot using an AR system. (via Twitter)

Despite its \$1.7 billion annual training budget, the USAF has been facing a resource crunch. Training and retaining enough pilots can’t be done even with the force’s humongous budget. After all, training with actual jets where a red team is playing the role of enemies is not just time-taking but also expensive.

Besides, the adversaries American pilots have to confront have shifted from guerilla insurgents of Taliban to rival pilots from Russia and China. This means that training has to be more extensive. However, the pilots that the USAF is able to train aren’t receiving the

“The US Air Force (USAF) has been experimenting with integrating high-tech solutions into its pilot training.”

necessary quantity or quality of mock combat hours.

This lack of preparedness among Air Force squadrons can prove to be lethal, especially at a time when the possibility of a confrontation with rivals is always buzzing around the corner.

There is an immediate need for a cheaper method of training that doesn't compromise on quality. USAF is hoping that a young startup's augmented reality technology will help.

Red 6's Augmented Reality

Red 6 was founded in 2018 by Daniel Robinson, a former Royal Air Force pilot. The company has developed Airborne Tactical Augmented Reality System (ATARS) that enables Augmented reality (AR) to function in dynamic, high-speed environments.

This piece of technology allows virtual and constructive elements of air combat training to be projected in the real world, in real-time. The system can facilitate within visual range (WVR) maneuvering against synthetic threats.

ATARS can provide a dedicated "Red Air" training resource to every squadron. They can obtain unlimited synthetic training against hyperrealistic projections of near-peer adversaries. It is time-saving, cost-effective, and can cater to more squadrons than traditional training methods.

This system comprises a custom, full-color AR headset that has been designed to be worn

with a standard HGU-55 helmet. The HGU-55 is used by F-15 and F-16 pilots.

Unlike virtual reality (VR) environment where everything users view is simulated, AR actually blends virtual simulations with the landscape outside the cockpit.

Thus, instead of simulating the sky and the adversary jet, Red 6's system shows the simulated enemy fighter in the actual sky. This allows the pilots to practice fighting during live flights. The simulation even adjusts as the user moves.

The system isn't limited to fighter jets alone. It can be applied to any type of training and is also upgradeable to keep pace with the US' evolving enemies.



The USAF Deal

Realizing the merit of the ATARS, the USAF inked a couple of contracts with Red-6, providing it substantial cooperation and financial backing. The Air Force's AFWERX innovation hub had earlier awarded the company Small Business Innovation Research (SBIR) Phase I and Phase II contracts. Its latest one,

inked in August this year, is an SBIR Phase III contract.

This deal, worth up to \$70 million, is to fit the USAF T-38 Talon with the AR training system that will enable it to dogfight against simulated Russian and Chinese fighters. These simulations will be projected inside the pilot's helmet.

The Northrop Grumman-produced T-38 is used to train fighter pilots. Following the Talon,

the ATARS will be integrated with a fourth-generation jet. Daniel Robinson told Defense News that a T-38 equipped with the ATARS system could be ready to begin flight tests between 6-12 months from the time of signing the deal.

Red 6's improvements to their novel system have continued even after the contract was finalized. There has been some progress in the development of the software and hardware that comprise the AI-powered ATARS. The system now has a demonstrated ability to conduct training sorties that set a real pilot up against several simulated adversaries at once.

In addition to enemy jets, the company is now also able to add surface-to-air missiles into the augmented training environment. This has made the AR training setup more realistic than ever before.

Beyond adversaries, and beyond one-on-one engagements, the improved system also allows the pilot to work with a friendly virtual AI-driven wingman against a single mock threat in a two-on-one engagement.

The synthetic training already featured simulated friendly aircraft and tankers. However, pilots were only able to carry out general flight maneuvers in relation to them.

Red 6 plans on inserting even more air and land-based assets into this AR-reliant training system. The virtual frontiers for military training are definitely being pushed forward quite swiftly, and the USAF seems to be one of the first entities to reap its benefits.

Agni-V: First user trial of nuclear-capable Intercontinental Ballistic Missile soon

23 September 2021

Source: Times Now Digital | <https://www.timesnownews.com/india/article/agni-v-first-user-trial-of-nuclear-capable-intercontinental-ballistic-missile-soon/815839>

New Delhi: In what is sure to ring in alarm bells in the Chinese and Pakistani establishment, India is expected to undertake the first user trial of its indigenous nuclear-rich Intercontinental Ballistic Missile Agni-V soon. The missile has a strike range of 5,000 kms and can hit targets deep inside China, entire Asia and Europe and parts of Africa. Reports suggest that the Strategic Forces Command of the Indian Army has made elaborate preparation at a defence facility off the Odisha coast for the mission.

The Agni-V missile has a strike range of 5,000 kms and can hit targets deep inside China, entire Asia and Europe and parts of Africa.

Defence Research and Development Organization (DRDO) and Bharat Dynamics Limited (BDL) have developed the Agni-V Intercontinental Ballistic Missile. The Agni V missile can carry a nuclear payload of 1,500 kg.

The country had planned to induct Intercontinental Ballistic Missile Agni-V in 2020 after the hat-trick pre-induction trials in 2018, however, the COVID-19 pandemic forced India to postpone the induction

Besides India, only seven countries, including the US, UK, Russia, China, France, Israel and North Korea possess Intercontinental Ballistic Missiles in their defence arsenal.

Meanwhile, China questioned India's plan to conduct the trial of an intercontinental-range ballistic missile, citing the United Nations Security Council Resolution 1172.

"As to whether India can develop ballistic missiles capable of carrying nuclear weapons, the UN Security Council Resolution 1172 has made clear provisions. Maintaining peace, security and stability in South Asia is in the common interest of all parties, and China hopes all parties will make constructive efforts to this end," Zhao Lijian, a spokesperson of Chinese Foreign Ministry, said on September 16, 2021.

India has a series of Agni missiles in its armoury. Agni-1 has a range of 700 km, Agni-2 with a range of 2,000 km, Agni-3 and Agni-4 can strike targets between 2,500 km and 3,500 km.

New generation Agni P Ballistic Missile successfully flight tested

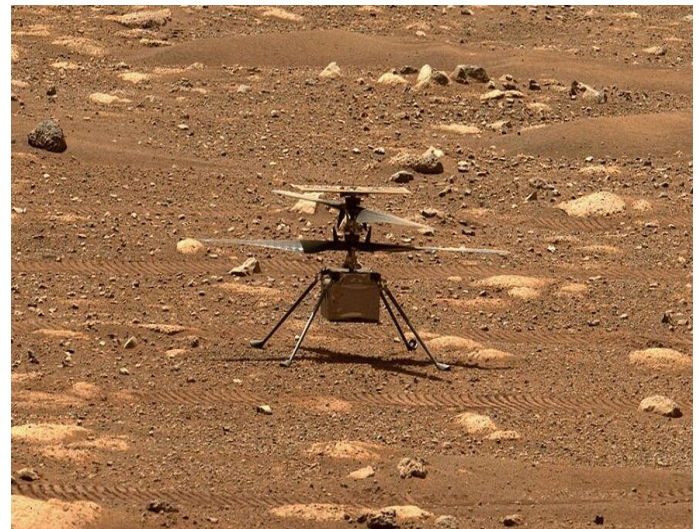
Notably, DRDO successfully flight tested the new generation Agni P Ballistic Missile on June 28, 2021. Agni P is a new generation advanced variant of Agni class of missiles. It is a canisterised missile with a range capability between 1,000 and 2,000 kms.

Space Power

China is developing its own Mars helicopter

Andrew Jones | 01 September 2021

Source: Space News | <https://spacenews.com/china-is-developing-its-own-mars-helicopter/>



NASA's Ingenuity, imaged by the Perseverance rover April 7.
China has now developed its own prototype Mars rotorcraft

Credit: NASA/JPL-Caltech

HELSINKI — China is looking at ways of expanding its space exploration capabilities including through a vehicle similar in appearance to NASA's Ingenuity helicopter.

A prototype of "Mars surface cruise drone" passed a final acceptance review Aug. 20, the National Space Science Center (NSSC) under the Chinese Academy of Sciences (CAS) announced Wednesday.

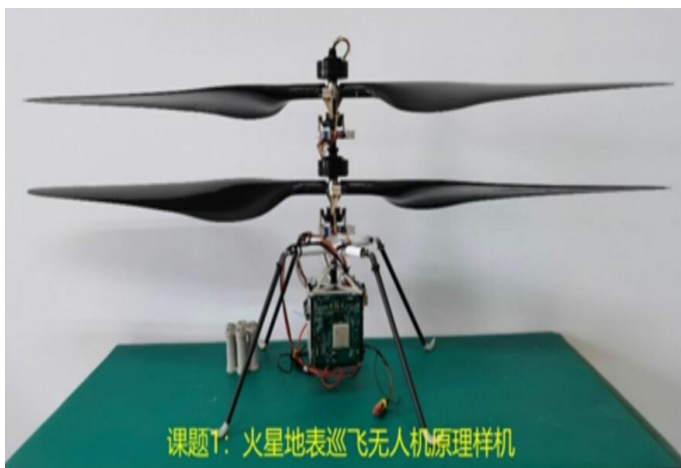
The rotorcraft was one of three projects in a technology cultivation program promoted by the NSSC. The vehicle project was led by Bian Chunjiang of the NSSC and features a micro spectrometer.

The concept could be considered for future Chinese Mars exploration but the NSSC did not

identify a mission on which the drone may fly.

China's first Mars mission, Tianwen-1, entered orbit around the Red Planet in February. This feat was followed by a successful landing of the roughly 240-kilogram, solar-powered Zhurong rover in May. China's next Mars mission is currently listed as a sample return mission, launching in the 2028 or 2030 launch windows.

The China Academy of Launch Vehicle Technology (CALT) in June outlined a study of propulsion needed for future, long term crewed expeditions to Mars, including precursor robotic missions. The study identified favorable launch windows but did not provide a timeline for either the crewed or uncrewed missions.



The Mars surface cruise drone prototype developed by China's NSSC. Credit: NSSC/CAS

The concept of flying a craft on Mars has recently been verified by NASA. The Perseverance rover landed on Mars in February, carrying with it the 1.8-kilogram Ingenuity helicopter. The vehicle made the first powered flight by an aircraft on another world in April and conducted its 12th and most recent flight Aug. 16, covering a horizontal distance of 450 meters across 169.5 seconds of flight.

NASA is now examining concepts for larger, more capable rotorcraft for future missions. The

agency will in 2027 launch the Dragonfly drone to Titan, the largest moon of Saturn, arriving in 2034. Dragonfly was selected as a New Frontiers planetary science mission.

China's own pursuit of flying an aircraft in the thin Martian atmosphere is not new. A concept from the Qian Xuesen Laboratory of Space Technology was considered for the country's 2020 Mars mission. As well as a rover, the ambitious proposal included three ground penetrators, to be released during descent, and an aerostat which would operate at an altitude of between 1 and 5 kilometers for one week. The objective would have been to obtain "three-dimensional, multi-layer and multi-source information" with one landing.

Entities including the Beijing Institute of Spacecraft System Engineering and Shenzhen Aerospace DFH HIT Satellite Ltd., both under the China Academy of Space Technology (CAST), and Beihang University have been embarked on work on concept architectures for Mars exploration.

The first is a winged drone, a design chosen over a helicopter due to the challenges of high rotation speed and requirements for an ultralight structure and high efficiency power system posed by the latter. The drone would lift off vertically from the surface of Mars before pitching and deploying its wings. The vehicle would have a range of tens of kilometers, collecting and potentially analyzing atmosphere and surface samples. It would also be capable of entering otherwise prohibitive environments such as canyons and craters.

The group also put forward a balloon concept, carrying a tethered 2U CubeSat. The system would seek to take atmospheric samples at various

altitudes for analysis, while also returning high-resolution imagery and other data.

China's Tianwen-1 mission carried surprises in the form of an ejected deep space camera and a rover-deployed camera to allow a joint rover-landing platform photo. With innovative and newly-proven concepts already being developed, competition for a place aboard future Chinese exploration missions is likely to be strong.

Firefly Alpha explodes during first launch

Jeff Foust | 02 September 2021

Source: Space News | <https://spacenews.com/firefly-alpha-explodes-during-first-launch/>



Firefly Aerospace's Alpha rocket explodes about two minutes after liftoff Sept. 2 from Vandenberg Space Force Base in California. Credit: SpaceNews/Jeff Foust

VANDENBERG SPACE FORCE BASE, Calif. — Firefly Aerospace's first launch of its Alpha rocket ended in failure when the rocket exploded two and a half minutes after liftoff Sept. 2

The Alpha rocket lifted off from Space Launch Complex 2 here at 9:59 p.m. Eastern. A first launch attempt at 9 p.m. Eastern was aborted in the final seconds of the countdown for unspecified technical reasons, but launch controllers reset the countdown for a second launch attempt.

About two and a half minutes after liftoff, the rocket appeared to tumble and then explode. "Alpha experienced an anomaly during first stage ascent that resulted in the loss of the vehicle," Firefly tweeted.

"While it's too early to draw conclusions as to the root cause, we will be diligent in our investigation, in partnership with the FAA and Vandenberg Space Force Base," the company said in a later statement. "While we did not meet all of our mission objectives, we did achieve a number of them: successful first stage ignition, liftoff of the pad, progression to supersonic speed, and we obtained a substantial amount of flight data."

In a separate statement, Space Launch Delta 30 at Vandenberg said it terminated the launch. Both the company and the Space force said there were no injuries, although there are eyewitness accounts of debris from the rocket falling in the town of Orcutt, California, just north of Vandenberg.

The rocket's first stage may have been underperforming. According to a mission overview distributed by Firefly before the launch, the vehicle was supposed to reach the speed of Mach 1.67 seconds after liftoff, followed by maximum dynamic pressure nine seconds later. However, launch controllers did not report that the vehicle was supersonic until 2 minutes and 20 seconds after liftoff, about 10 seconds before the vehicle exploded.

Company executives emphasized before the launch that the flight was primarily a test. “Our really big goal is to get Alpha to space. If we can get to orbit, even better,” said Lauren Lyons, chief operating officer of Firefly, during a Sept. 1 tour of the company’s launch control center. “Our goals are to collect as much data as we possibly can and take Alpha as far as it can go.”

The Alpha was carrying about 92 kilograms of payloads on what it called the Dedicated Research and Educational Accelerator Mission (DREAM). That included several cubesats, technology demonstrations of a plasma thruster and drag deorbit sail, and “non-technical” payloads like photos and memorabilia.

The mission was designed to fly to the west, rather than to the south as is typical for polar-orbit launches from Vandenberg. While that reduced the payload performance for the mission, it made range safety simpler for an untried rocket.

“If we were flying due south, we’d have a very tight corridor we’d have to go down through,” said Tom Markusic, chief executive of Firefly, in a Sept. 1 interview at the pad. “Here, we have a very wide corridor so that, if the vehicle’s not tracking quite right, it gives us an opportunity to get back on track without having to terminate the mission.”

“It’s a flight test, so getting data is success,” he said. “The more data we get, the better.”

India-France Agree on Space Security Dialogue

Rajeswari Pillai Rajagopalan | 03 September 2021

Source: *The Diplomat* | <https://thediplomat.com/2021/09/india-france-agree-on-space-security-dialogue/>



According to media reports, India and France have agreed to start a bilateral space security dialogue. This will be the third country with which India will be engaged in a space security dialogue. The other two countries are the United States and Japan, with such dialogues beginning in 2015 and 2019, respectively. For France, India will be the first Asian country with which it will have such a dialogue.

The idea of a space security dialogue between India and France comes as no surprise for a couple of reasons. First, France has remained one of India’s oldest and steadiest partners in the area of space and other strategic technologies. Cooperation between New Delhi and Paris across space and nuclear domains reflect the confidence and trust the two enjoy with each other. Second, the space security dialogue between the two countries is a sign of the worsening space security environment and a number of like-minded countries are coming together to brainstorm ways

to address the growing challenges and threats in outer space.

The proposal to have a space security dialogue between India and France was reportedly lofted during the visit of French Foreign Minister Jean-Yves Le Drian to India in April and the visit of the head of France's Space Command, Michel Friedling in March this year. Although no dates have been provided as to when the space security dialogue will happen, it is still significant. That India has such engagements with only the U.S. and Japan, and now France, reflect new Indo-Pacific strategic dynamics and India's own comfort in discussing space security issues with its strategic partners.

According to Indian media reports, one key area that will be part of the dialogue is ways and means to protect space assets. The rapid growth of counter-space capabilities by China is a serious development that India, France, Japan, and the U.S. have been grappling with. China's growing inventory of counter-space capabilities is something the Indo-Pacific powers can no longer ignore. Although China has repeatedly reiterated that its space program is purely peaceful, India as well as other Indo-Pacific space powers remain concerned about China's recent advances in outer space because of the inherent strategic and security risks. The social, economic, and security stakes of China's counter-space capabilities are sufficiently challenging for India and France as well as other space players to come together and develop a shared sense of gaps and vulnerabilities that they may be exposed to. This competition and risks are only likely to grow in the coming years as outer space is increasingly caught up in the changing geopolitics and major power

competition.

Of course, China is not the only country that is developing counter-space capabilities. Russia, the United States, and India are also developing these capabilities, albeit to varying degrees. But China's growing counter-space capabilities along with its aggressive military posturing and use of force against powers both big and small in the Indo-Pacific have triggered alarms in many regional capitals.

There are also more countries developing dedicated military space institutions. In July 2019, French President Emmanuel Macron started the process of creating a space command. The French Space Command came into existence on September 3, 2019. The command, based in Toulouse, has a staff of 220 engaged in the development of capabilities to protect military satellites that might be approached by space threats from foreign powers. In March this year, France conducted its first multinational military space exercise, ASTERX. The exercise included Germany, Italy, and the U.S. in an effort to augment their armed forces and operations to respond to more contemporary space threats. General Michel Friedling, head of the French Space Command, called it a "stress test" for France's new space command.

China's establishment of the PLA Strategic Support Force (PLASSF) in 2015 was a reflection of the growing importance of space in Beijing's military thinking. The creation of the PLASSF concerned other space powers because it integrated the PLA's space, cyber, and electronic warfare capabilities. This brought together several potent capabilities in an effort to deny other players any advantage they may accrue

from the use of space assets. Russia has also undertaken such institutional advancements with the Russian Space Forces set up in 2011 as part of the Russian Aerospace Defense Forces meant to focus on military space developments. India, too, is making institutional changes to reflect the new realities of military space developments. The establishment of the U.S. Space Force in 2019 by President Donald Trump received a lot of attention in part due to his unique personal politics.

The reality is that more countries are likely to go down this path because of the increasing sense of competition and failing multilateral discussions. At the same time, the competition is bringing together a number of like-minded partners to work together in maintaining the sanctity of outer space, though they may not be entirely successful in their efforts.

The India-France space security dialogue is also an indication of India's changing space orientation. India's civil space cooperation engagements with different countries have evolved to focus more on space security. India also hopes to arrive at a common multilateral understanding of the emerging space environment and the possible threats to the safe, secure, sustainable, and continued access to outer space.

The inaugural edition of space security dialogue between India and Japan, for instance, addressed global navigation satellite system, space situational awareness (SSA), space security, and space-related norms, apart from bilateral space cooperation, which has been broadened in recent times. The Indian dialogue with the U.S., too, has been driven by similar sets of issues, including "long-term security and sustainability of the outer space environment, including space

situational awareness and collision avoidance in outer space." The two countries have concluded three rounds of space security dialogue and the third edition looked at the changing trends in space threats, their national space priorities, and opportunities for cooperation both in the bilateral context and in multilateral platforms.

Developing a common and shared understanding of the space security environment and developing appropriate means to counter them, along with some forward path on future global governance, will be a useful step indeed. It is likely that India will begin such conversations with other like-minded partners beyond France, too, including Australia and the United Kingdom, which could also give India a prominent leadership role in global governance.

U.S. generals planning for a space war they see as all but inevitable

Sandra Erwin | 17 September 2021

Source: *Space News* | <https://spacenews.com/u-s-generals-planning-for-a-space-war-they-see-as-all-but-inevitable/>



The Pentagon has declared space is a warfighting domain. Generals and executives in the space industry are preparing to defend the ultimate high ground.

Credit: Adobe stock

A ship in the Pacific Ocean carrying a high-power laser takes aim at a U.S. spy satellite, blinding its sensors and denying the United States critical eyes in the sky.

This is one scenario that military officials and civilian leaders fear could lead to escalation and wider conflict as rival nations like China and Russia step up development and deployments of anti-satellite weapons.

If a satellite came under attack, depending on the circumstances, “the appropriate measures can be taken,” said Lt. Gen. John Shaw, deputy commander of U.S. Space Command.

The space battlefield is not science fiction and anti-satellite weapons are going to be a reality in

future armed conflicts, Shaw said at the recent 36th Space Symposium in Colorado Springs.

U.S. Space Command is responsible for military operations in the space domain, which starts at the Kármán line, some 100 kilometers (62 miles) above the Earth’s surface. This puts Space Command in charge of protecting U.S. satellites from attacks and figuring out how to respond if hostile acts do occur.

Military space assets like satellites and ground systems typically have been considered “support” equipment that provide valuable services such as communications, navigation data and early warning of missile launches. But as the Pentagon has grown increasingly dependent on space, satellites are becoming strategic assets and coveted targets for adversaries.

“It is impossible to overstate the importance of space-based systems to national security,” Air Force Secretary Frank Kendall said in a keynote speech at the symposium.

Shaw noted that Gen. John Hyten, the vice chairman of the Joint Chiefs of Staff, “likes to talk about satellites as being ‘big fat juicy targets.’”

“I agree with that,” said Shaw. “But how do we change that? How do we make it more difficult for a potential adversary to think they could succeed in depriving us of our space capabilities?”

Those questions are now being debated as Space Command develops what Shaw describes as “space warfighting doctrine.” A laser blinding a satellite is just an example of the types of attacks the U.S. has to prepare for, said Shaw. If that happened, the Defense Department would have to decide how to respond to that threat. Conceivably, naval or aerial forces would be

called upon to take retaliatory action.

“[W]e are only starting to grapple with... what space warfighting really means,” Shaw said.

U.S. in a ‘long-term strategic competition’

A competition for space dominance between the United States and rival powers China and Russia prompted the Trump administration and Congress in 2019 to re-establish U.S. Space Command — which had been deactivated since 2002 — and create the U.S. Space Force as an independent service branch.

Kendall, who was sworn in late July as the civilian leader of the Air Force and the Space Force, said the United States is in a “long-term strategic competition” with China. The implications for space are significant, he said, as “China has moved aggressively to weaponize space.”

The Space Force will invest in new capabilities to deter and win if deterrence fails, Kendall said. Any type of escalation can result in miscalculations and human errors which is why a space war is a “conflict that no one wants,” he said.

The U.S. military’s space weapons that presumably would deter China from firing the first shot against a satellite are classified. In a rare disclosure, the Space Force last year said it deployed an advanced ground-based communications jammer made by L3Harris that could be used as an “offensive weapon” to disrupt enemies’ satellite transmissions.

Chris Kubasik, L3Harris vice chairman and CEO, said there should be more awareness of the risks of an attack against a satellite precipitating a broader conflict.

“I think it’s the biggest threat facing our

nation,” Kubasik said at the Space Symposium. A war in space would be “detrimental to society” because satellites play such a central role in everyday life for most people. “If you think of the impact of a war in space and how it impacts something as simple as our cellphones, navigation, supply chain, logistics, healthcare. I think it is a serious issue. And I think we have to continue to talk about it.”

Public awareness and education about the nation’s dependence on space are needed to help DoD “get the funding to make sure that we deter or defeat our adversaries in space,” he said.

Unlike conflicts on Earth, a space war is not easy to visualize. “I call it an invisible war with invisible hardware that people can’t see, it’s a little different than being here on the ground,” said Kubasik.

First shot could be against satcom

The military’s reliance on commercial satellites for communications makes these systems one of the most likely targets of enemy jammers and cyber disruptions, said Travis Langster, vice president and general manager of Comspoc, a company that monitors space traffic and tracks orbital activities.

“Given the plethora of commercial space, based on the observations and activities we’ve seen at Comspoc, the target of that first shot is likely to be a commercial satellite,” Langster said during a Space Symposium panel discussion. By launching an electronic or cyberattack against a commercial satellite that is used by DoD for military operations, an enemy would be “trying to send a very specific message” that it does not draw a line between commercial and military

space assets.

The most likely scenario is a “reversible attack,” meaning some temporary loss of a space-based service, said Langster. “In this day and age, the first shot will likely be a cyberattack.”

Carey Smith, CEO of defense and cybersecurity contractor Parsons, said space-based networks already are under attack.

“Jamming is occurring today; there’s obviously cyber attacks that are occurring across the infrastructure,” she said. And there have been many documented attempts to interfere with communications signals in war zones where U.S. forces operate.

But the question is whether these activities will escalate and lead to broader conflict. “I think the path to war in space is really based upon a space arms race, and we’ve been fortunate that we’ve been able to delay it up until this point, but it is perhaps imminent,” she added.

A key reason why the space race is accelerating is that technology is advancing so rapidly, Smith said. A second reason is the absence of “binding commitments on what the operating norms are going to be in space,” she said. “And without that, we’re very likely to have a space war.”

The only foundation of international space law that currently exists, the 1967 Outer Space Treaty, is outdated and doesn’t address most space security issues that could set off a war, Smith noted.

The treaty bans the stationing of weapons of mass destruction in outer space, prohibits military activities on celestial bodies and contains legally binding rules governing the peaceful exploration and use of space. But a new set of rules is needed

for the current space age, Smith said. “We really haven’t addressed some of the very difficult questions. Can a nation tailgate another nation’s satellite? Is preemptive self defense going to be permissible? Are we going to ban any form of weapons in space?”

Frank Backes, senior vice president of space and defense contractor Kratos, echoed that sentiment.

“We’ve seen very intentional interference within regional conflicts to take military systems offline,” he said. Of particular concern to the Pentagon are disruptions to satellite communications networks that are used to operate unmanned surveillance aircraft. Drones rely on GPS and satellite communications systems to track and strike targets.

“Those types of reversible effects have already entered into the space layer, but I agree with Carrie Smith. It is the space race that is turning space into a warfighting domain,” said Backes. “What that looks like going forward definitely could be devastating to our commercial and international use of space.”

DoD wants resilient space architecture

Experts point out that there are increasingly more ways to permanently or temporarily damage satellites so it would be virtually impossible for DoD to defend against a multitude of weapons.

China and Russia, for example, have direct-ascent weapons that are launched on a sub-orbital trajectory to strike a satellite in orbit. They also have co-orbital weapons that are placed into orbit and then later maneuvered toward their intended target.

Additionally, China and Russia are deploying

non-kinetic space weapons, according to the Center for Strategic and International Studies. These include lasers that can be used to temporarily dazzle or permanently blind sensors on satellites, and jamming devices that interfere with the communications to or from satellites by generating noise in the same radio frequencies.

In the face of these threats, the United States aims to make space networks more resilient by using a diversity of satellites in different orbits, complicating an adversary's ability to launch an effective attack.

Kendall said resiliency "isn't just about the individual satellite, it's about the architecture."

DoD's Space Development Agency is looking to demonstrate what it hopes will be a more resilient space architecture. The agency is working to deploy a proliferated constellation of small satellites in low Earth orbit as an alternative to the traditional large, expensive spacecraft that DoD has traditionally flown in higher orbits but much smaller numbers.

"We're getting away from 'juicy targets'," said SDA Director Derek Tournear. The idea of a proliferated architecture is to have enough satellites in orbit that "we can handle some attrition."

ISRO to experiment vertical landing of rockets, aims to make GSLV Mk3 reusable

Sidharth MP | 16 September 2021

Source: Zee News | <https://zeenews.india.com/india/isro-to-experiment-vertical-landing-of-rockets-aims-to-make-gslv-mk3-reusable-2394455.html>



Chennai: The Indian Space Research Organisation (ISRO) is conducting studies and mini-projects to enable the vertical landing of its rockets. According to senior officials, this possibility is being explored primarily with regards to the heavy-lift rocket GSLV Mk3, which is powered by three stages of engines - solid-fuel, liquid-fuel and cryogenic fuel.

ISRO is aiming to recover the first two rocket stages of the GSLV Mk3 as this would imply a huge cost-advantage and savings, owing to reusability.

At present, all of ISRO's rockets are expendable, which means that the rocket stages separate from the vehicle and fall into the sea after their stipulated burn time. Reusability involves recovering the rocket's stages at sea or on land (vertical landing) and refurbishing, servicing, testing and qualifying them before flying again.

Dr. VT Baskar, Project Director of ISRO's GSLV Mk3 had outlined the work on reusable rocket projects during an interaction helmed by Dr. S. Unnikrishnan Nair, Director of ISRO's Human Spaceflight Centre. Themed 'Human Spaceflight and Space exploration missions', this session was part of a 3-day virtual conference organised by the Confederation of Indian Industry and ISRO.

On the cost-cutting measures ISRO was undertaking with regards to rocket launches, Dr. Baskar said that recovering the first and second stages (S200 solid-fuel rocket boosters, and L-110 liquid-fuel stage respectively) would offer a lot of cost advantage.

"Studies and Centre-level mini-projects are approved for landing experiments. We have to develop enabling technologies such as the capability to safely land a winged-body or large-body," he said. More importantly, he added that the critical experiment to land rockets on their legs (vertical landing) would be carried out this year or in the next year (2022).

Elaborating on the major modifications that are in store for the GSLV Mk3 rocket, Dr. Baskar said that the vehicle's L110 stage would be replaced with a semi-cryogenic engine and its C25 cryogenic engine would be replaced by the C32 engine. Besides replacing the existing engines with powerful counterparts, ISRO would also be working on mini and microelectronics to reduce the avionics mass and also use high-strength composite materials for the rocket motor casing.

On the timelines for the upgrade, he said that mini electronics and C32 Cryo engine were

immediate targets, whereas the semi-cryogenic engine and composite material rocket casing were expected in 2-3 years.

Throwing light on ISRO's upcoming exploratory and science missions, Dr. S. Unnikrishnan Nair, Director, Human Spaceflight Centre said that two missions - Xposat and Aditya L1 were likely to be launched in the second and third quarter of 2022, respectively.

"Aditya L1 is a space-based observatory that

ISRO is aiming to recover the first two rocket stages of the GSLV Mk3 as this would imply a huge cost-advantage and savings, owing to reusability.

will be placed in a halo orbit near the Lagrange point which is an ideal place to observe the Universe being 1.5 million km from earth. Xposat is X-Ray

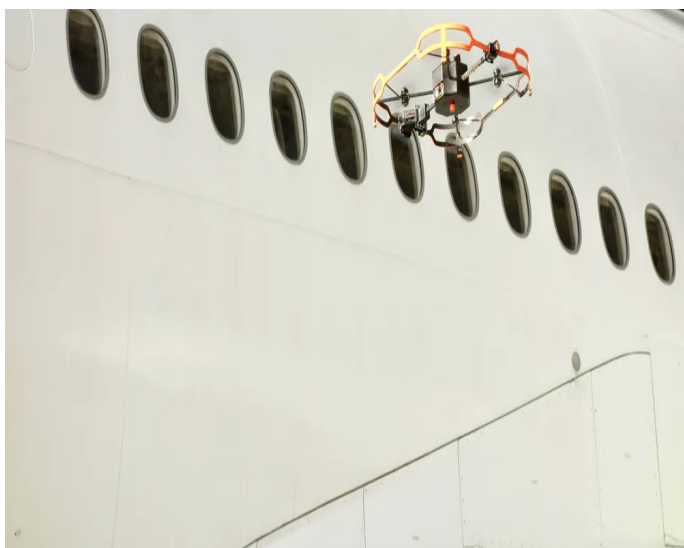
Polarimeter satellite to study the Polarization of Cosmic X-Rays. It is going to be launched by SSLV, which is a small rocket that will have a development flight by this year-end," he said. He added that Chandrayaan 3 - India's third Lunar mission - was also getting realised.

Global Aerospace Industry

AAR launches Donecle drone technology integration for MRO aircraft inspections

10 October 2019

Source: *Intelligent Aerospace* | <https://www.intelligent-aerospace.com/commercial/article/14068378/uas-drone-for-mro-inspections>



MIAMI, Fla., - AAR has announced the integration of Donecle drone technology into its maintenance, repair and overhaul (MRO) operations.

AAR's Miami MRO facility is the first in its global network to use the fully-automated drone technology to drive operational and cost efficiencies, where the pilot phase has yielded increases in speed and precision. With laser positioning, the drone can safely perform end-to-end visual inspections of B737 and A320 aircraft in under an hour.

Designed for MRO specifications, the drone is programmed to detect any aircraft structural damage, as well as assess paint quality, markings and signs of lightning strike. One complete scan by a drone covers the equivalent of several

maintenance tasks and personnel, conserving significant time and resources in the inspection and overall maintenance turnaround time.

AAR and Donecle have partnered on an initial 12-month technology agreement, and upon further assessment and results, will expand the platform to other MRO facilities. In compliance with Federal Aviation Administration (FAA) requirements, AAR performs manual aircraft inspections in addition to the drone inspections.

Virgin Orbit eyes growth in military 'responsive' launch

Sandra Erwin | 02 September 2021

Source: *SpacD News* | <https://spacenews.com/virgin-orbit-eyes-growth-in-military-responsive-launch/>



Virgin Orbit makes the air-launched LauncherOne system, which features a two-stage rocket dropped from a Boeing 747 aircraft. Credit: Virgin Orbit

WASHINGTON — After completing two successful missions this year, Virgin Orbit is looking to grow its military business by proving that rockets launched from airplanes in flight can be instruments of national security.

“Anywhere, anytime and unwarned,” is the tag line that Mark Baird uses to describes Virgin Orbit's launch service.

Baird, a retired U.S. Air Force brigadier general, was recently named president of VOX Space, a subsidiary of small satellite launch services provider Virgin Orbit. VOX was created in 2017 to focus on the national security market.

The Pentagon in its strategy for how to defend its space assets talks about “rapid reconstitution,” Baird said in an interview last week at the 36th Space Symposium in Colorado Springs.

Having the means to replace satellites in orbit quickly during a crisis is a capability that could help deter enemies from launching attacks against U.S. space systems, said Baird. “In a previous life when I was doing space superiority stuff, this is what I kept arguing that we need.”

DoD calls this “tactically responsive launch.” Congress has been keenly interested in this program and is pressing DoD to fund it.

The U.S. Space Force demonstrated tactically responsive launch in June in a mission named TacRL-2. A surveillance satellite developed in less than a year was launched to orbit on a Northrop Grumman Pegasus XL, a rocket deployed from a Lockheed L-1011 TriStar carrier aircraft. Northrop was given 21 days’ notice to get ready for the flight.

Mike Rokaw, vice president of operations at VOX Space, told SpaceNews that Virgin Orbit expects to compete for future Space Force TacRL launch contracts. A call for bids for TacRL-3 and TacRL-4 is expected in the coming months.

Virgin Orbit was not allowed to compete for TacRL-2 because at the time the request for bids came out the company had not yet completed its first launch, Rokaw said. TacRL 3 and 4 will require providers to launch with just 18 days’

notice. “That’s in our wheelhouse.”

Rokaw said LauncherOne will be competitive against the solid-fuel Pegasus because it’s cheaper and liquid-fueled, “which is a softer ride.”

The Space Force paid \$28 million for the TacRL-2 launch. Virgin Orbit advertises \$12 million per launch although there could be additional costs to meet specific military requirements.

“We think we bring to the table a good economic option for the government,” Rokaw said. “I think next time TacRL comes out, we’re competing.”

LauncherOne and Pegasus will compete for tactically responsive launches against vertically launched rockets like Rocket Lab’s Electron and others that also promise rapid response services.

Rokaw said Virgin Orbit hopes to demonstrate to the Space Force that air-launched rockets are the faster option. During his U.S. Air Force career, he said, Rokaw oversaw Global Positioning System satellite launches from Cape Canaveral, Florida.

“I hated launching out of Cape Canaveral in the summer between one and three o’clock with an 18 minute window,” he said. “Storms came rolling in. So we had to do it again tomorrow.”

‘Not range bound’

Virgin Orbit currently flies from the Mojave Air and Space Port in California, and expects to start flying from Guam’s Andersen Air Force Base next year once its license is approved, as well as from Spaceport Cornwall in the United Kingdom.

“The beauty of our system is that we’re not range bound,” said Rokaw. He recalled that

before the most recent launch at Mojave, “we were going to launch at 11 o’clock and the Navy was doing some fleet exercises. They asked if we could change your launch window to earlier in the morning ... I don’t think we can do that with fixed ranges.”

The next military launch for VOX will be this fall, a mission for the Defense Innovation Unit. Separately, the company last year won a \$35 million Space Force contract for three launches that will be scheduled over the next two years, said Rokaw.

Virgin Orbit’s factory in Long Beach, California, is sized to produce 20 rockets a year. The company only has one 747 carrier aircraft but plans to add more to the fleet once business ramps up, said Rokaw. “When we get to 18 to 20 launches a year, we will have multiple planes to handle that bandwidth.”

Pentagon taps industry for nuclear-powered propulsion for its satellites

Nathan Strout | 11 September 2021

Source: [c4isrnet](https://www.c4isrnet.com/battlefield-tech/space/2021/09/10/pentagon-taps-industry-for-nuclear-powered-propulsion-for-its-satellites/) | <https://www.c4isrnet.com/battlefield-tech/space/2021/09/10/pentagon-taps-industry-for-nuclear-powered-propulsion-for-its-satellites/>



DARPA believes that nuclear-powered propulsion could enable rapid maneuver in space — a capability that is difficult to achieve with current electric and chemical propulsion systems.

(Defense Advanced Research Projects Agency)

WASHINGTON — The Department of Defense is looking to industry for nuclear-powered propulsion technology to drive its spacecraft, freeing them from the low-energy limitations of current electric and solar-based propulsion systems.

Those traditional systems have largely served government space systems well. Once they reach their intended orbit, most satellites don’t need to move very much. Propulsion systems are generally used to readjust satellite positions when they drift out of their assigned position or to avoid collisions, while occasionally transporting those satellites to new orbits to continue their mission.

However, future U.S. military missions may require much more maneuverability and power.

Future U.S. missions will need more electrical power to more frequently change orbits, transfer other objects to new orbits and operate beyond Earth's orbit, according to a Sept. 9 solicitation from the Defense Innovation Unit, a DoD organization that helps match mature, commercial solutions to military needs.

Moreover, the shrinking size of many space systems driven by the increased capabilities of small satellites and cubesats imposes volume constraints on future propulsion systems. In other words, the military wants more power, but not by simply building bigger propulsion systems or adding more solar panels.

To that end, DIU's government customers are looking for lightweight, long-lasting commercial nuclear power solutions that can provide greater propulsion and electric power for small and medium-sized spacecraft. Interested companies that can show a plan for prototype development within three to five years could be awarded other transaction authority contracts to support laboratory-based prototyping of such systems, followed by a path to flight-based testing. Responses to the solicitation are due no later than 11:59 p.m. ET on Sept. 23.

This isn't the military's first time dipping its toe into developing nuclear-powered spacecraft. Most recently, the Defense Advanced Research Projects Agency issued contracts to three companies in April to design a nuclear thermal propulsion system for space. The program, known as the Demonstration Rocket for Agile Cislunar Operations, seeks to build nuclear thermal propulsion that can enable rapid maneuver in

space, particularly for cislunar operations.

General Atomics, Blue Origin and Lockheed Martin are the prime contractors on that effort.

Meanwhile, companies are beginning to offer commercial services that can refuel satellites or supplement them with their own propulsion systems. SpaceLogistics, for example, introduced a Mission Extension Vehicle that can latch onto a customer's satellite on orbit and then maneuver it around with its own propulsion system. Orbit Fab, which recently saw investments from Lockheed Martin and Northrop Grumman, is building gas stations on orbit. These efforts provide another option for getting more maneuverability and service life out of existing propulsion systems.

DARPA believes that nuclear-powered propulsion could enable rapid maneuver in space — a capability that is difficult to achieve with current electric and chemical propulsion systems.

Samad makes progress with eVTOL flight tests and a new cargo drone

Loz Blain | 08 September 2021

Source: News Atlas | <https://newatlas.com/aircraft/samad-aerospace-evtol-starling-progress/>



Samad Aerospace has announced a new unmanned cargo drone capable of taking 50-kg loads. Samad Aerospace

The UK's Samad Aerospace is making progress with half-scale prototypes of its E-Starling eVTOL aircraft, and has now started taking pre-orders for a smaller cargo drone using a similar design and semi-vectored thrust propulsion system.

Samad has come a fair way since we proclaimed the company a long shot about a year ago. For starters, it's built a 50-percent scale prototype of its proposed passenger aircraft, and has commenced flight testing.

Back in March, the half-scale E-Starling was shown in flight, albeit using conventional takeoff and landing with its forward two vertical lift fans blocked off.

A few days ago, a new video was released showing that the front lift fans are now operational. With the rear ones tilted to face downward, the aircraft has now demonstrated a stable multicopter-style takeoff, controlled hover and landing.

This prototype is big enough to seat a pilot, as shown in the video below, although it's unlikely that anyone was in it when it flew; tests are typically undertaken without the additional weight and risk of a pilot.

So far, so good – the transitions from vertical hover to horizontal flight and back again will be more challenging, but enough companies have demonstrated transitioning flight now that it's starting to look like less of a mountain to climb. The E-Starling's coaxial props seem quite loud at the moment, too, but this can doubtless be ironed out as the company progresses toward its full-size test aircraft.

On the other end of the scale, the company is also looking to use a similar design in an unmanned cargo drone, capable of remote-controlled or auto-piloted flight.

The Starling Cargo will cruise at 95 mph (153 km/h), at altitudes up to 10,000 feet. It'll fly up to 135 miles (217 km) on a charge, and carry decent-sized payloads up to 50 kg (110 lb). Samad has "started the certification process" for this cargo drone, and is taking pre-orders now with deliveries slated to begin in 2022.

The company says it's seen interest from a range of oil and gas companies, mining companies, medical logistics operations and emergency responders.

All in all, it's good to see some quick progress from this Milton Keynes company, and while they're not yet breathing down the necks of compatriots Vertical Aerospace, these guys have staked their own claim and have a good chance to make us eat our words.

Cobham SATCOM to build Thuraya 4-NGS ground system

Jason Rainbow | 09 September 2021

Source: *Space News* | <https://spacenews.com/cobham-satcom-to-build-thuraya-4-ngs-ground-system/>



Cobham SATCOM CEO Leif Ottosson (left) and Ali Al Hashemi, Yahsat's CEO, during a signing ceremony at Satellite 2021. Credit: Yahsat

TAMPA, Fla. — Emirati fleet operator Yahsat has picked private equity-owned Cobham SATCOM to build the ground system for its next-generation Thuraya 4-NGS satellite.

Airbus Defence and Space is building the satellite for Yahsat's Thuraya mobile voice and data connectivity subsidiary, with a launch on a SpaceX Falcon 9 slated for the second half of 2023.

Denmark-based Cobham SATCOM will develop Thuraya 4-NGS ground infrastructure and terminals for its narrowband mobility services.

Yahsat said Sept. 9 that Cobham SATCOM will also integrate end-to-end solutions to expand Thuraya's military, government and enterprise customer bases across land, maritime and aeronautical verticals.

Cobham SATCOM is owned by U.S.-based private equity firm Advent International, which acquired its parent group Cobham for about \$5 billion last year.

The Danish group also provides satellite communications equipment to U.K.-based Inmarsat and Iridium of the U.S., Thuraya's main competitors in the L-band mobile satellite services (MSS) market.

"Today is monumental for Cobham SATCOM," Cobham SATCOM CEO Leif Ottosson said in a statement. "It marks a new and innovative partnership with Yahsat, reinforces our position as a leading MSS infrastructure and terminal provider and will be critical to evolving satellite communications."

Yahsat pointed to data from Applied Market Research analysts in its announcement, which said the value of the global satellite data services market is on course to grow from \$5 billion to more than \$19 billion by 2027.

Publicly listed Yahsat recently said it expects Thuraya 4-NGS to generate \$47 million a year in revenue over its 15-year design life, after coming into service in 2024.

Thuraya 4-NGS will replace two Boeing-built L-band voice and data satellites that continue to be in service despite exceeding their design life.

Sister company expansion

Space-compatible electronics supplier CAES, which was also part of Advent's acquisition but was made a stand-alone U.S. company amid a push into the government market, has unveiled more expansion plans.

Arlington, Virginia-based CAES said it will add a dedicated 1700 square foot laboratory to

its Exeter, New Hampshire, facility next year to 3D-print waveguides and antenna designs licensed from Swissto12, the Switzerland-based additive manufacturing specialist.

In addition to satellites, the company said these 3D-printed waveguides can be used on the ground for electronic warfare applications.

CAES said it has received interest from national security customers for its 3D-printed offerings.

Commercial megaconstellations are also a target market for the 3D-printed wave form guides and antennas. CAES is supplying technology for OneWeb's megaconstellation, although this does not yet include the licensed Swissto12 designs.

CAES and Swissto12 forged an alliance in April to bring Switzerland's 3D-printed satellite RF technology to the U.S. market.

"CAES' investment in Additive Manufacturing is a direct response to our customers' next-generation design challenges for rugged, ever-smaller, and complex parts," CAES chief technology officer David Young said in a statement.

Argentina to purchase JF-17 'Thunder' jets from Pakistan

George Allison | 17 September 2021

Source: *UK Defence Journal* | <https://ukdefencejournal.org.uk/argentina-to-purchase-jf-17-thunder-jets-from-pakistan/>



Photo Shimin Gu, CC BY-SA 4.0 via Wikimedia Commons

"ARGENTINA SELECTS PAKISTAN'S THUNDER JET – The Government of Argentina has officially included \$664 Million in funding for the purchase of 12 PAC JF-17A Block III fighters from Pakistan in a draft budget for 2022 presented to its Parliament."

The two nations have had friendly relations for a while, Argentina has been part of the consensus in favor of the resolution put forward by Pakistan on the right to self-determination which is debated annually at the General Assembly of the United Nations.

Pakistan has voted in favor of the UN Resolution stipulating that "the continued existence of colonialism is incompatible with the ideal of universal peace held by the United Nations", which has relevance for the Falklands Islands issue. The chair of the Pakistan Senate has said of the relationship that "Pakistan and Argentina have very close cooperation in various fields and unanimity of views on international

issues”.

What is the JF-17?

The JF-17 Thunder is a single-engine multi-role combat aircraft developed jointly by the Pakistan Aeronautical Complex and the Chengdu Aircraft Corporation of China. The builders say that the JF-17 can be used for multiple roles, including interception, ground attack, anti-ship, and aerial reconnaissance.

58% of the JF-17 airframe, including its front fuselage, wings, and vertical stabiliser, is produced in Pakistan, whereas 42% is produced in China, with the final assembly taking place in Pakistan.

Didn't Argentina try and buy new jets recently?

Yes, the nation has attempted to buy jets a number of times from various places with the deals being stopped due to lack of funds or British objections. Most recently last year, Britain blocked the sale of South Korean fighter jets to Argentina.

Indian Aerospace Industry

Indian Army orders locally produced loitering munitions

Rahul Bedi | 06 September 2021

Source: JANES | <https://www.janes.com/defence-news/news-detail/indian-army-orders-locally-produced-loitering-munitions>



The IA has ordered a total of 200 locally produced loitering munitions, including 100 SkyStrikers (similar to this one), to meet urgent operational requirements.

(Elbit Systems)

The Indian Army (IA) has signed two contracts worth a combined INR2 billion (USD27.4 million) to acquire a total of 200 locally produced loitering munitions to meet urgent operational requirements.

The first contract, worth INR1 billion, was awarded on 31 August to a joint venture (JV) between local company Alpha Design Technologies Limited (ADTL) and Israel's Elbit Systems for the supply of 100 SkyStriker light munition systems.

Elbit Systems' SkyStriker is a precision-guided loitering munition designed to seek, locate, and acquire operator-marked targets and targets of opportunity in tactical-level engagements.

According to the company, the SkyStriker

can cover a distance of 20 km within 10 minutes. Upon reaching the target area, it can loiter and pursue the target for up to 2 hours when fitted with a 5 kg warhead and for up to one hour with a 10 kg warhead.

The system uses autonomous navigation for its cruising and loitering phases. When preparing to strike, it applies its electro-optical 'lock' on the target. The munition can be deployed as a standalone system or as part of a 'drone swarm'. The SkyStriker's operator can also initiate a 'strike abort' function up to two seconds before impact, re-engage or, if target engagement is not authorised, direct the loitering munition to safe recovery. The munition is retrieved via a parachute/airbed function.

The second contract, also worth INR1 billion, was awarded to Bangalore-based NewSpace Research and Technologies on 3 September for 100 locally developed 'swarm drone units' capable of also seeking, tracking, and striking enemy targets with a 5 kg or 10 kg warhead in tactical-level engagements.

India, US sign Air-Launched UAV Co-Development Project Agreement

Daryl Mayer | 03 September 2021

Source: *AF Mail* | <https://www.af.mil/News/Article-Display/Article/2764056/india-us-sign-air-launched-uav-co-development-project-agreement/>



Brig. Gen. Brian Bruckbauer hosts an office call in honor of his fellow cochair of the US-India Defense Technology and Trade Initiative Air Vice Marshal Narmdeshwar Tiwari in the Pentagon, Arlington, Va., July 16, 2021.

(U.S Air Force photo by Andy Morataya)

Air Vice Marshal Narmdeshwar Tiwari, Indian Air Force, Assistant Chief of Air Staff for Plans, and Brig. Gen. Brian R. Bruckbauer, Director of the Air Force Security Assistance and Cooperation (AFSAC) Directorate for the Air Force Life Cycle Management Center, signed a landmark agreement recently to co-develop air-launched Unmanned Aerial Vehicles (UAV).

The agreement is the inaugural co-development project under the U.S.- India Defense Technology and Trade Initiative, a bilateral defense cooperation mechanism that promotes collaborative technology exchange, strengthens cooperative research, and enables co-production/co-development of defense systems

for sustainment and modernization of military forces.

“The United States and India share a common vision of a free and open Indo-Pacific,” said Deputy Undersecretary of the Air Force, International Affairs, Kelli L. Seybolt. “This co-development agreement further operationalizes India’s status as a Major Defense Partner and builds upon our existing strong defense cooperation.”

The project is valued at more than \$22 million with costs shared equally, and marks the largest-ever defense Research, Development, Test and Evaluation collaboration between the United States and India. The objectives are the Design, Development, Demonstration, Test and Evaluation of technologies including physical hardware such as small UAVs, avionics, payload power, propulsion, and launch systems through prototyping that meet the operational requirements of the Indian and U.S. Air Forces. The co-development project will be carried out jointly between the U.S. Air Force Research Lab (AFRL) and India’s Defence Research and Development Organisation (DRDO).

“This important Project Agreement comes after many months invested by the AFSAC team, AFLCMC program offices, AFRL, Air Force International Affairs, the Office of the Under Secretary of Defense for Acquisition and Sustainment, as well as our Indian Air Force and DRDO counterparts working together, side-by-side, on common national security interests,” emphasized Bruckbauer. “I am proud of the dedicated teamwork and partnership this Project Agreement represents for both of our countries.”

Army Orders 100 Swarm Drones From Indian Startup

03 September 2021

Source: *Lifest Defence* | <https://www.lifestdefence.com/army-orders-100-swarm-drones-from-indian-startup/>



In a first of its kind procurement, the Indian Army has just awarded Bengaluru-based startup Newspace Research & Technologies a \$15 million contract to supply 100 swarm drone units. The contract was awarded under emergency procurement rules active since the India-China standoff in Ladakh began last year, forcing a slew of fast-track procurement initiatives.

Lifest learns the Army intends to use the 100 Newspace drones — a heterogeneous swarm comprising IC engine and battery powered types — to develop swarming concept of operations as well as explore technologies like manned unmanned teaming, with an emphasis on learning lessons to help design future swarming systems under. The demonstration of Chinese swarm drone capabilities are likely to have played a frontal role in compelling an emergency procurement.

The Army Design Bureau played a key

role in the evaluation and procurement of the Newspace drones. A larger capital acquisition of similar drones will likely be driven by lessons learnt from operation of these systems, which in themselves embrace autonomous and AI powered algorithms to mimic biological behaviour of animals and birds to saturate an area. While the drone hardware is crucial, it's the software that is key to the capability being contracted and looked at closely by the Army, since fine-tuning drone code will be key to tailoring the cooperative behaviour of drones in different settings, from the high altitudes of Ladakh to the desert and border sectors.

Bengaluru-based Newspace, a startup founded by an Indian Air Force veteran working with the armed forces, HAL and other agencies in a slew of unmanned system and artificial intelligence training programs, stood first in Army's swarm drone evaluation trials at Ahmednagar, Maharashtra earlier this year.

Newspace is among a raft of cutting edge new startups that have emerged in India's private sector aerospace and research ecosystem that are increasingly being looked at to deliver capabilities to the armed forces. Newspace, which joined hands in a technology partnership with HAL last February for unmanned systems and artificial intelligence, jointly unveiled a series of military unmanned systems at the Aero India show this year, including airpower teaming systems and air-launched cruise missiles.

The contract to Newspace, while small, holds huge significance, largely because it demonstrates that the armed forces are looking with alacrity at Indian private firms, including small startups, and are capable of closing the loop on procurements

that would be deemed impractically elusive just a few years ago. In January this year, the Indian Army awards a Rs 130 crore contract, it's largest for such systems, to Indian drone firm ideaForge for an unspecified number of its Switch surveillance drones, specifically for high altitude frontline units. You can read all about that procurement [here](#).

The contract award to Newspace is one of two that hugely significant deals signed by the Indian armed forces in the past week. The other is a contract to private firm Alpha Design for its SkyStriker loitering strike drones, being built in a collaboration with Israel's Elbit Systems. The Indian Air Force currently operates Harop loitering strike drones of Israeli origin.

In a separate development today, India & US today signed a project agreement to co-develop an Air-Launched Unmanned Aerial Vehicle. The DRDO-Air Force Research Laboratory (AFRL) air launched drone programs has been cleared under a bilateral air systems joint working group. Represented by the Aeronautical Development Establishment (ADE) from the India side, the DRDO and AFRL will now develop an air-launched drone system in seven years.

First Look At Indian Army's New Cargo Drones For Ladakh

08 September 2021

Source: *Livefist Defence* | <https://www.livefistdefence.com/first-look-at-indian-armys-new-cargo-drones-for-ladakh/>



An Raphe MPhibr MR-20 drone during trials in Leh, Ladakh

What you're looking at is the first public image of the Indian Army's new cargo drone type, an MR-20, developed by Indian firm Raphe Mphibr. Last week the company was awarded an emergency procurement contract for 48 MR-20 hexacopter drones capable of ferrying loads of up to 20 kg each. The image above is from high altitude trials of the drone in Ladakh this year, the primary are where the drones will be deployed once supplies begin. Livefist learns the company has already given the Indian Army a small number of the drones for training and readiness before the fleet arrives starting later this year.

The MR-20 drones will be capable of ferrying food, essential items, emergency medical aid, ammunition and weapons to troops deployed at heights in forward areas. The Indian Army has already begun formulating protocols for drone use in crucial last mile logistics operations in a

live operational theatre that has been active since May 2020 following en masse deployments by the Chinese Army along the Line of Actual Control in eastern Ladakh. While the Indian Army has, for a while now, been looking to put drones to work across a raft of tasks and functions for high altitude units, the emergency procurement is almost certain to have been triggered by China's own use of such a capability. Drones ferrying hot meets to Chinese soldiers in Aksai Chin was part of a much-viewed propaganda video by the Chinese Army last year, designed to highlight the lack of such a capability on the Indian side.

The contract to Raphe Mphibr, part of a slew of drone procurements awarded to Indian startups and private firms, also includes orders for 2 sets of homogeneous swarm drones and 10 high endurance payload carrying drones for the Indian Navy.

In a statement shared with Livefist, Raphe Mphibr said, "They can operate in high altitude Himalayan areas of Siachen, be launched & recovered from submarines, drop combat payloads, influence low intensity conflicts, lift 100kg stores and can also be launched from the palm of the user. The drone operations are backed by novel algorithms that include indigenously developed artificial intelligence and machine learning driven features such as swarming & in-flight fault management. Real time monitoring and mission planning is made possible by ground support set up comprising of ground control stations, remote video terminals and ultra long range communication equipment."

The company adds, "Raphe's team has developed over 169 patentable technologies to support their UAV platforms. Novel carbon fiber

composite materials developed at Raphe are light weight, robust and have superior thermal & electrical properties. The bio-inspired designs of airframes, high density electronics along with efficient and reliable software technologies render the Raphe's UAV platforms their best-in-class efficiency, robustness and payload carrying capabilities. The novel algorithms such as distributed swarming, target detection & tracking and optimal energy control broadens the scope of applications of the UAV platforms for the Indian security forces."

The military standoff with China a towering factor, 2021 has been a huge year for Indian drone firms. Things started big in January with the Indian Army handing a Rs 130 crore contract to drone pioneers ideaForge for their Switch tactical surveillance drones for Ladakh. The latest emergency procurement of swarm drones and cargo drones from Indian startups is a crucial foot in the door for small, tightly run companies functioning on the cutting edge of military software for drone operations. While the numbers ordered are small, they still represent a significant leap for a procurement ecosystem that's heavily loaded against small Indian firms beyond supply chain relationships.

LCA-Mk2 to roll out next year, first flight in 2023

Dinakar Peri | 12 September 2021

Source: *The Hindu* | <https://www.thehindu.com/news/national/lca-mk2-to-roll-out-next-year-first-flight-in-2023-says-scientist/article36419325.ece>



An LCA jet. The Mk2 will be heavier and much more capable than the current LCA variants. | Photo Credit:

MURALI KUMAR K

The configuration for the Light Combat Aircraft (LCA)-Mk2 has been frozen and steel cutting is expected to begin soon while configuration for the fifth-generation Advanced Medium Combat Aircraft (AMCA) has been frozen and preliminary design completed, a senior scientist from the Aeronautical Development Agency (ADA) has said.

"The detailed design is complete. In fact, we are in the critical design review stage and metal cutting should start very shortly. Roll-out of the aircraft (Mk2) is planned next year and the first flight in early 2023. We are well on track to achieve these goals," Girish S. Deodhare, Programme Director (Combat Aircraft) & Director, ADA, said at an event by the Centre for Air Power Studies and Society of Indian Defence Manufacturers.

Enhanced range

The aircraft features enhanced range and endurance including an onboard oxygen generation system, which is being integrated for the first time, Dr. Deodhare said.

Heavy weapons of the class of Scalp, Crystal Maze and Spice-2000 will also be integrated on the Mk2. The LCA-Mk2 will be a heavier and much more capable aircraft than the current LCA variants.

The Mk2 is 1,350 mm longer featuring canards and can carry a payload of 6,500 kg compared to 3,500 kg the LCA can carry.

In February, the Defence Ministry signed a ₹48,000-crore deal with Hindustan Aeronautics Ltd. (HAL) to supply 83 LCA-Mk1A to the Indian Air Force. In August, the HAL signed a \$716 million deal with GE Aviation of the U.S. for 99 F404 aircraft engines and support services to power the Mk-1A. The Mk2 will be powered by a more powerful GE-414 engine.

The Indian Air Force (IAF) has one squadron of the LCA in initial operational clearance and deliveries of the second squadron in final operational clearance configuration are under way.

The HAL has already set up a second assembly line to ramp up production from eight aircraft a year to 16. Order for 83 Mk-1A is expected to be completed by 2028-29, Dr. Deodhare said.

Stealth aircraft

Stating that the initial design of the AMCA was started way back in 2009, Dr. Deodhare said that it would be a twin engine stealth aircraft with an internal weapons bay and a diverterless supersonic intake, which has been developed for

the first time for which the design is complete.

It will be a 25-tonne aircraft with internal carriage of 1,500 kg of payload and 5,500-kg external payload with 6,500 kg of internal fuel.

On the current status of the AMCA, Dr. Deodhare said the configuration had been frozen, preliminary service quality requirements finalised and preliminary design review completed.

“We are moving to critical design review by the middle of next year with the roll-out planned in 2024 and first flight planned in 2025.”

The AMCA will have stealth and non-stealth configuration and will be developed in two phases, AMCA Mk1 with existing GE414 engine and an AMCA Mk2 with an advanced, more powerful engine to be developed later along with a foreign partner, Dr. Deodhare added.

The manufacturing and production of the aircraft will be through a special purpose vehicle, which will also have participation of private industry.

Simultaneously, the project for development of a twin-engine deck-based fighter jet meant to fly from the Navy's aircraft carriers is also making progress. On the various programmes under way, Dr. Deodhare said there was commonality of systems and technologies.

HAL project to build pseudo satellite set to get approval for govt funds

Aksheev Thakur | 20 September 2021

Source: Indian Express | <https://indianexpress.com/article/cities/bangalore/hal-project-pseudo-satellite-drone-defence-govt-funds-7519954/>



The project is being implemented by HAL in collaboration with a Bengaluru-based start-up and the

National Aerospace Laboratories

Public sector undertaking Hindustan Aeronautics Limited (HAL) is hoping to get approval soon for government funding to the tune of over Rs 700 crore for what is now a self-financed project to develop an indigenous High Altitude Pseudo Satellite (HAPS) as part of a drone warfare programme for the defence forces.

“We will get the approval sometime in October. First there will be a scaled prototype of about 70-foot wing span. The initial prototype may cost less than Rs 50 crore. It will take a minimum of 3-4 years to develop HAPS. We are already working on its design. Moreover, funds will be utilised over a long period of time,” an official working closely with the project said.

HAL chairman R Madhavan confirmed to The Indian Express that an institutional prototype will

be ready soon.

The project is being implemented by HAL in collaboration with a Bengaluru-based start-up and the National Aerospace Laboratories (NAL).

“I can confirm that we are far ahead in terms of development of HAPS. We have started this project as part of our unmanned drone warfare programme called Combined Air Teaming System (CATS. Soon an institutional prototype will be ready. The entire development of HAPS will take a few years. The initial investment which we required was Rs 700 crore, but this will be spent over the years,” R Madhavan said.

HAPS will weigh more than 500 kg and will utilise solar energy. It will be able to fly at a height of 70,000 feet and even stay there for months

The HAL plan to develop HAPS was revealed during the Aero India 2021 event. The aircraft are designed to act as a bridge between the Unmanned Aerial Vehicles (UAV) and conventional satellites, officials said.

The major applications of HAPS are in telecommunication and remote sensing sectors catering to both defence as well as civilian purposes.

Once aligned with the CATS unmanned warfare programme, HAPS could coordinate in strike missions providing versatile intelligence, surveillance and communication to troops with live video feeds and images. It can be used in Humanitarian Assistance Disaster Relief (HADR) operations as well.

Aerostructures of Boeing's F-15EX Eagle II to be built in India

IANS | 17 September 2021

Source: The Times of India | <https://timesofindia.indiatimes.com/india/aerostructures-of-boeings-f-15ex-eagle-ii-to-be-built-in-india/articleshow/86290392.cms>

NEW DELHI: Aerospace major Boeing has awarded a contract to India-based Dynamatic Technologies for manufacturing assemblies for its tactical fighter 'F-15EX Eagle II'.

According to the aerospace major, this is a first instance in which aerostructures for F-15EX Eagle II will be made in India.

Besides, the contract will give a boost to the 'Aatmanirbhar' programme and strengthens US-India collaboration on aerospace and defence industrialisation.

Accordingly, Dynamatic Technologies will supply the F-15EX aerostructure assembly requirements from FY22.

The company will manufacture these aerostructures from their manufacturing facility in Bengaluru, Karnataka.

According to Boeing India President Salil Gupte: "We see tremendous potential for India to contribute to the global aerospace industry as an industrial and technology partner."

"The award of aerostructure assemblies for the latest and most advanced version of the F-15 aircraft family is a reflection of Boeing's focus on Aatmanirbhar Bharat and a testimony to the world class capability of our industrial partners in India."

Technology Development

Boeing Unveils New Two-Stage Long-Range Air-To-Air Missile Concept

Joseph Trevithick | 20 September 2021

Source: The Drive | <https://www.thedrive.com/the-war-zone/42454/boeing-unveils-new-two-stage-long-range-air-to-air-missile-concept>



A model of Boeing's Long-Range Air-to-Air Missile Concept

Boeing has shown off a new long-range air-to-air missile design at the Air Force Association's annual Air, Space, and Cyber Conference, which opened today. The weapon, referred to as the Long-Range Air-to-Air Missile, or LRAAM, has a two-stage configuration with a "kill vehicle" attached to a booster section that falls away after it is burned out, something that has been seen in previous U.S. military air-to-air missile concepts.

A Boeing representative told The War Zone that the company had crafted the LRAAM design in response to a so-called Broad Area Announcement (BAA) from the U.S. Air Force Research Laboratory (AFRL) last year that asked companies to submit ideas to meet a host of advanced technologies desired for future long-range air-to-air missiles. AFRL said design

submissions could be based around single and multi-stage rocket motors, as well as air-breathing engines, such as ramjets. However, it added that it was particularly interested in, among other things, throttleable “multi-pulse solid rocket motors” and novel “propellants, grain configurations, cases, and liners” that would be able to deliver greater speeds, as well as ranges, compared to existing weapons, such as the AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM).

Boeing said that LRAAM, which is very much still in the conceptual stage of development, is focused mainly the “boosted” propulsion aspect of the design, in which the rear section, which has a body very similar to that of the kill vehicle attached in front, provides an initial burst of speed and carries the entire weapon out to a certain range, at which point it falls away. Another rocket motor in the front section would then ignite and propel it during the remainder of its flight.

The kill vehicle and booster bodies, which share what appears to be an identical core shape, are not directly based on any existing Boeing design, the company representative told us. Using the same basic body design for both sections would help give it a more uniform form factor and could help simplify production and keep costs down.

The weapon also leverages technology Boeing developed for separate projects and work on the concept has made use of new digital engineering and design techniques, which are becoming increasingly popular, in general, among American defense contractors and within the U.S. military itself.

Given the weapon’s early state of development, there is limited information about LRAAM’s

expected performance and other capabilities. However, the concept, overall, is supposed to provide a missile that has significant speed and range, as well as a high degree of maneuverability in the terminal stage of an engagement. The expected added ability to maneuver comes from using a separate kill vehicle, which reduces drag and weight compared to a similarly sized single-stage weapon throughout its flight.

The term “kill vehicle” here may also indicate a hit-to-kill design that uses the sheer force of impact to destroy the target, rather than a warhead. Not needing a warhead would allow Boeing to optimize the weapon’s fuel capacity and maneuverability, while also keeping the overall package relatively small.

It is also worth pointing out that this configuration opens up the possibility of using the front section by itself as a weapon for shorter-range engagements. Depending on the exact size of something like LRAAM’s kill vehicle, it might also be of interest as a compact missile that stealthy aircraft could carry internally in greater quantities than existing designs, such as the AIM-120. It’s not clear whether or not the design allows for more than one booster to be used in combination with a single kill vehicle.

Oxford's Evolito working on electric motors to transform aerospace industry

23 September 2021

Source: UKTECH | <https://www.uktech.news/news/oxford-evolito-electric-motors-20210923>



Oxford-based Evolito is a new company that develops and manufactures electric motors and power electronics for aerospace applications. The company has launched as a privately-owned business now. A spin-out of YASA, the world's leading pioneer of automotive axial-flux electric motors, this company intends to commercialise the next-generation electric motor technology of YASA and IP for the fast-growing aerospace market.

Revolutionary approach to aerospace

Building on YASA's IP, Evolito enables the aerospace industry to leave behind the legacy radial electric motor technology that has been holding the market back. Its axial-flux motor's unique segmented topology and novel cooling systems are more robust than other electric motors systems, thereby making them ideally suited to aerospace applications. Apparently, its axial-flux technology is said to be a revolutionary new approach in the aerospace industry.

"We're building the future of electric flight with motors that have the highest power and torque densities in class with the ability to manufacture at scale, whilst achieving efficiencies of over 98%," said Gareth Morris, Managing Director, Evolito.

Furthermore, its axial-flux technology is smarter, faster and lighter. It requires up to 75 percent less copper, less iron and less permanent magnets than competing solutions. Also, its ultra high-performance, low-weight axial-flux motors and power electronics are smaller, lighter and more robust than any other technologies. Currently, its products include YASA P400 and YASA 750 but it is focusing on expanding its portfolio with new products that will take the aerospace market to the next level.

Electric propulsion for EvTOL applications

Evolito provides the world's most advanced direct drive and in-direct drive electric propulsion solutions for Fixed-Wing and Electric Vertical Take-Off, and Landing (EvToL) applications. While it is estimated that Urban Air Mobility (UAM) market is likely to grow to \$100 billion by 2035, the market is still in the nascent stage and depends on the adoption of new technologies. Also, it has been revealed that currency technology used in electric flights are very old and there is little innovation left ahead.

Evolito's axial-flux electric motors and power electronics have the highest power densities and greatest efficiencies in class, making them ideally suited for new all-electric aerospace applications.

Already, this technology is established in the electric automotive market and deployed in series production by manufacturers including Mercedes-Benz and Ferrari. Notably, it was acquired by

Mercedes-Benz back in July this year. Evolito's lead investors are Waypoint Capital and Oxford Science Enterprises (OSE).

Gareth Morris, Managing Director, Evolito said, "Electrification in aerospace is some ten years behind that of the automotive industry, but the market potential is huge. Electric Vertical Take-off and Landing, Electric Helicopter, Fixed-Wing and Urban Air Mobility aircraft need high power density, low weight electric powertrains with inherently high safety factors – a combination of attributes that are unique to our axial-flux electric motor and power electronics. By leveraging YASA's unique IP in the aerospace market, Evolito will fast-track the commercialisation of electric flight and transform mobility as we know it."

Sustainable mobility!

Evolito is focusing on sustainable mobility with its aerospace technology. YASA lets them fast-track the adoption of electric propulsion in aerospace, accelerating the growth of the electric Urban Air Mobility market and general electric aviation.

"The electrification of flight is one of the most exciting market opportunities of our time. Realising this potential will require innovative new technology and an ability to scale to meet the fast-emerging demand. OSE is delighted to be supporting Evolito on its mission to accelerate the adoption of electric flight," said Alexis Zervoglos, Senior Partner, OSE.

Airbus completes first Wing of Tomorrow prototype

Ban Sampson | 23 September 2021

Source: Aerospace Testing International | <https://www.aerospacetestinginternational.com/news/structural-testing/airbus-completes-first-wing-of-tomorrow-prototype.html>



The composite wing cover, for the first prototype wing manufactured within the National Composite Centre in the UK prior to delivery to Airbus in Filton for sub-assembly (Image: Airbus)

The Wing of Tomorrow program will test the latest composite materials and new technologies in aerodynamics and wing architecture. It is also being used to explore how wing manufacturing and industrialization can be improved to meet future market demands as the aerospace sector emerges from the pandemic.

brought to you by Element Aerospace

Three full-size prototype wings will be manufactured in total: one will be used to understand systems integration; a second will be structurally tested to compare against computer modelling, while a third will be assembled to test scaling-up production and compare against industrial modelling.

Sub-assembly of the complex wing cover took place at Airbus' Filton site, England, having

been manufactured at the National Composite Centre in Bristol. The wing cover and a major component from GKN Aerospace – the fixed trailing edge – were delivered to the Advanced Manufacturing Research Centre (AMRC) Wales facility on Airbus' wing-production plant site in Broughton, Flintshire, for assembly.

The first wing demonstrator will be fully equipped and tested at the AMRC Wales site in Broughton. The second wing demonstrator will be transported to Airbus Filton near Bristol, where it will be structurally tested at Airbus' new AirTEC facility.

The three wing demonstrators will bring together more than 100 new technologies to explore manufacturing and assembly techniques with the goal of making aviation more sustainable.

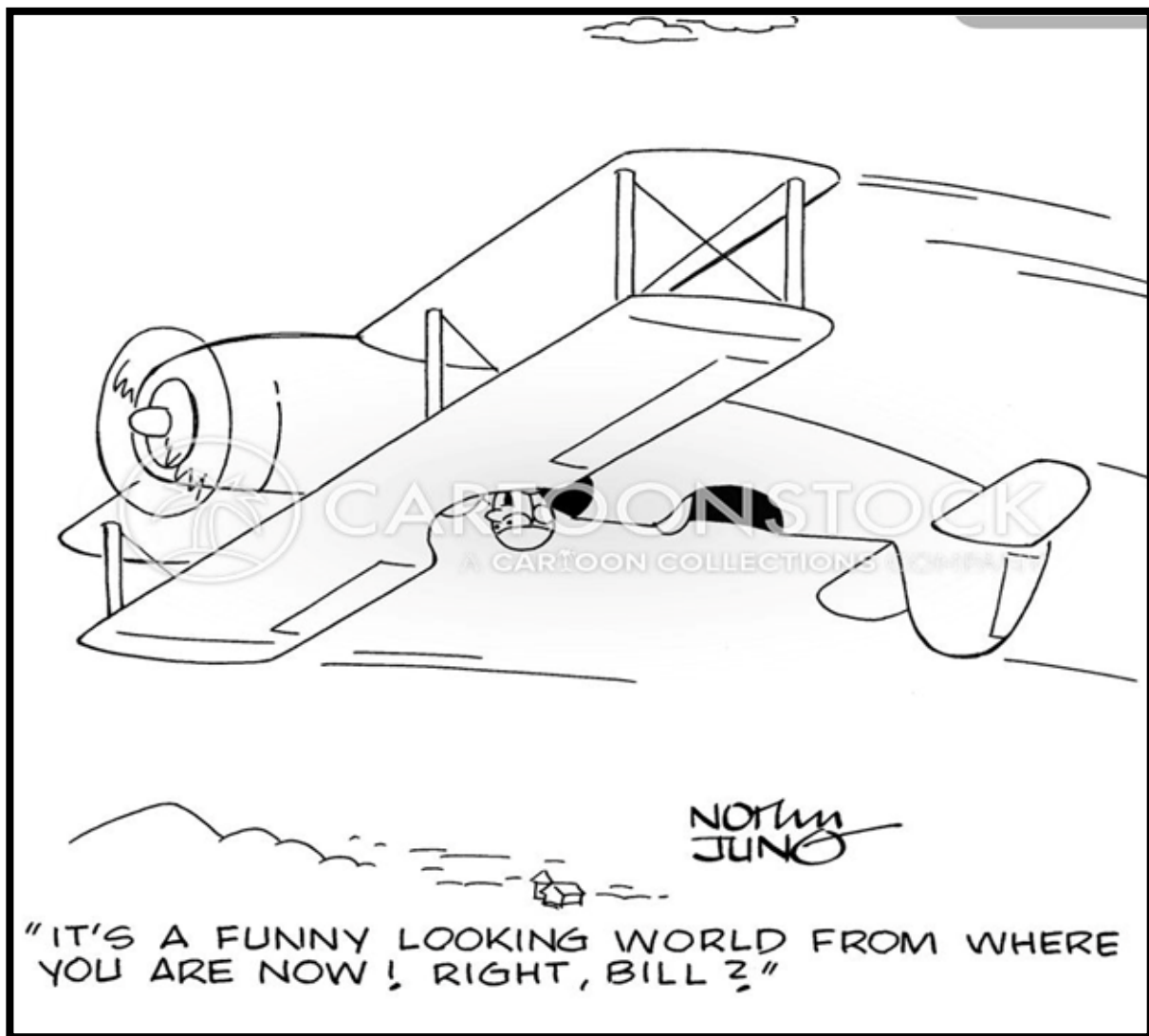
Sabine Klauke, chief technical officer of Airbus said, "Wing of Tomorrow is a crucial part of Airbus' research and technology portfolio, will help us assess the industrial feasibility of future wing production.

"High-performing wing technology is one of several solutions – alongside sustainable aviation fuels and hydrogen – we can implement to contribute to aviation's decarbonisation ambition. Wing of Tomorrow is also an example of how large-scale industry collaboration will be critical to achieving our sector's agenda for a more sustainable future."

Wing of Tomorrow is being part-funded by the UK Government through the Aerospace Technology Institute and involves global partners and teams across Airbus' European sites, including Bremen in Germany, where the 'Wing Moveables' team is based.

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