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*"The field for **Air Superiority** is not a straightforward issue like a naval battle or a land battle; it is not even a series of combats between fighters; it is frequently a highly complex operation which may involve any or all types of aircraft. It is a campaign rather than a battle, and there is no absolute finality to it so long as enemy aircraft are operating."*

– Air Chief Marshal Sir Arthur Tedder

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

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Opinions and Analysis

Indian Air Force – Game Changers in the Current Geo Strategic Scenario

Air Marshal Anil Chopra (Retd)

Director General, Centre for Air Power Studies | 08 October 2021

Source: Chanakyaforum | https://chanakyaforum.com/indian-air-force-game-changers-in-the-current-geo-strategic-scenario/

The "The one who controls Aerospace will control the planet Earth" was well established by the 1950s. The major powers began spending greater sums on aerospace. Air offers speed, range, accuracy, and lethality for achieving military effects. Air power and future of all warfare are intertwined. Air superiority, will still be a pre-requisite for all operations on the surface to succeed. Air began influencing outcomes of all wars, and played major role in the Indo-Pakistani wars, Arab-Israeli wars, the Falkland, Kosovo, Iraq, Afghanistan, among many others. China has made huge investments in aerospace assets.

In the recent India-China showdown in Ladakh, Indian Air Force's (IAF) transport fleet played a very important role by flying in operational and maintenance assets into relatively remote regions. The helicopters have been active in inter valley transfers and replenishments or hill tops. Satellites and UAVs have been providing Intelligence, Surveillance, and Reconnaissance (ISR). Fighters and attack helicopters are all geared for offensive missions. IAF's C-130 have flown practise missions for para drop.

Current State of IAF

The IAF has 32 fighter squadrons. These broadly include two of Rafale, 12 Su 30MKI, four MiG 21 Bison, three each of MiG 29 and Mirage 2000, six of Jaguar, and two of LCA. IAF's induction of Rafale fighters will enable it to maintain air superiority over China's J10, J11, and Su-27 fighter jets. Armed with very long-range Meteor and MICA beyond visual range (BVR) air-to-air missiles, the Rafale fighters are expected to pose a significant threat to Chinese aerial assets. The Sukhoi Su-30MKI serves the IAF as the primary air superiority fighter with the capability to perform air-to-ground strike missions. With 11 C-17 and C-130 each, 17 IL-76, and over 100 upgraded An-32, IAF has significant cargo and troop lift capability. Similarly, having inducted 15 Boeing Chinook heavy-lift and 22 Apache AH-64E attack helicopters, and with already a significant fleet of 240 Mi-17 series medium-lift helicopters and nearly 100 ALH variants and smaller Chetak/Cheetah fleets, IAF is in a good position for rotary wing assets. IAF has only three large AWACS aircraft and two indigenous DRDO developed AEW&C aircraft. Similarly IAF has only six IL-78 Flight Refuelling Aircraft

(FRA). Both these fleets are highly inadequate for a continental size country like India which has also to cover the Indian Ocean Region.

India has a well-covered and integrated air defence (AD) radar foot-print. IAF continues to operate some of the legacy surface-to-air missile systems like the SAM-3 Pechora and SAM 8 OSA-AK. With the induction of a large number of indigenous Akash AD systems, and also, to arrive by November 2021, five S-400 systems from Russia, the AD coverage will be significant. To cover the large Chinese border, more systems will need to be inducted. With induction of the MICA, Meteor, Astra, SCALP, BrahMos and Hammer, among others, IAF has a significant aerial weapons inventory.

The future is unmanned. Artificial Intelligence supported autonomous systems will fly independently or in conjunction with each other in a swarm or with manned aircraft as a team. IAF has significant number of UAVs. More are being developed indigenously or being acquired.

Air Delivers Strategic Effects

Air power is inherently strategic in nature and best used as an offensive element. It provides conventional deterrence. Air Campaigns can be executed simultaneously against different spread out target systems. It can provide both kinetic and non-kinetic options with pin point accuracy. Precision air weapons have redefined the meaning of mass. Whoever controls the air generally controls the surface. Air influences outcomes and actions of the surface forces. Technology and air power are integrally and synergistically related. IAF is responsible for air defence of India. IAF's Counter Air missions are designed to ensure defence of India and of our surface forces. IAF's strategic airlift allows strategic reach and strategic effects. Advantage of air power is the ability to exploit swing-role capabilities. When you say Rafale is an Omni Role fighter, means it can do many roles in a single mission. ISR has become even more crucial for decision-superiority in net-centric warfare. Air power is best suited for it.

The Growing PLAAF

China's People's Liberation Army Air Force's (PLAAF) has a mammoth fleet of fighter aircraft and advanced air defence systems. Of its nearly 1,700 fighter/bomber aircraft, over 800 are 4th generation plus. PLAAF already has around 40 fifth-generation J-20 fighters, and targets to have 200 of these by 2027. Meanwhile, the FC-31/J-31 development is being accelerated. PLAAF has a strategic bomber fleet with 120 H-6 bomber variants, each carrying six cruise missiles. They also have relatively larger numbers of AWACS and FRA. China has an edge with a huge surface-to-surface missile force. China's biggest strength is its indigenous aircraft industry that produces all types of aircraft and advanced helicopters. China has a huge indigenously built UAV fleet. China also has significant maritime air power, with PLA Navy (PLAN) having two operational aircraft carriers and nearly 600 aircraft. Two more carriers are under construction and two further, larger ones, on drawings boards. It can be seen that China has significant air power.

IAF's Global Reach

IAF is looking at reach from the Persian Gulf to the Straits of Malacca, using long range aircraft supported by FRA and AWACS. More of these are being acquired. More airfields are becoming operational in the southern peninsula, and in Andaman and Nicobar Islands. This along with in-flight refuelling will add to the reach. The Lakshadweep islands are also being developed strategically. IAF is regularly exercising and increasing interoperability with major air forces of the world.

Joint Operations

For the surface and sub-surface forces campaign to succeed, certain amount of dominance of the air is a prerequisite. IAF would have to ensure that. Air interdiction missions will knock off adversary's tactical and logistic means. These will be very crucial in the mountains. Battlefield support missions by ground attack aircraft and attack helicopters will make the difference in the tactical battle area. Transport and helicopter fleets will provide logistics support which is crucial in the mountainous areas. IAF has significant maritime attack capability.

Operational Capabilities Vis-à-vis China

IAF is very well placed with nearly 25 airfields capable of launching operations against China. China effectively has three airfields close to Eastern Ladakh, and around eight in Tibet. They are trying to upgrade infrastructure but have disadvantage of very high altitude. IAF will be able to launch much larger number of missions. For long, India's military assets and infrastructure were Pakistan border centric. This is fast changing, for both infrastructure build up and assets position. While border roads and connectivity are being improved, IAF has upgraded its Advanced Landing Grounds (ALG) near China border. All IAF airfields are getting hardened aircraft and equipment shelters. IAF now has significant number of Su-30 MKI squadrons facing China. Also the new acquisitions like Rafale, C-130 J, Chinook and Apache helicopters have all been located in the eastern sector. The same is also applicable to air defence systems and weapons positioning.

Important Technologies India Must Master

India needs to invest more in game-changer technologies. These include cyber and electronic warfare, artificial intelligence, unmanned systems, hypersonic, among others. Hypersonic flight and weapons will be difficult to engage. They will act as force multipliers against high-value targets. There is a lot of action in Directed Energy Weapons. Lasers that can burn incoming missile electronics or dazzle electro-optical sensors. For India to become significant, it must also master aircraft engine, and AESA radar technologies. Joint venture route is the best to imbibe high-end technologies. We need very long range weapons, including aerial missiles with around 400 kilometres ranges. Similarly air-launched cruise missile with ranges of around 1,500 kilometres.

Way Ahead IAF

The IAF could reach 42 squadrons earliest

by around 2038 provided the development of indigenous LCA variants, and Advanced Medium Combat Aircraft (AMCA) are accelerated. IAF would still need to buy around six squadrons of medium fighters from broad. IAF must also target to have 8 large and 10 smaller AWACS, at least 12 FRA aircraft. These numbers must be achieved before 2030. IAF must have by then a significant fleet of UCAV systems, including the indigenously developed DRDO UAVs. IAF should also have a large inventory of aerial missiles with longer ranges including the later variants of BrahMos and Astra missiles.

India has also to defend itself against a possible sizeable Chinese surface-to-surface missile (SSM) attack. We need more air defence SAM systems of the S 400 and Iron Dome class, and the many indigenous air defence systems India is working on, including some in JVs with Israel. It is important to have a larger ammunition and missiles stocking, including of SSMs and Cruise missiles. India has a good missile program. The Prithvi, Agni, BrahMos, Akash and Astra missiles are a success, and newer variants must be hastened. Electronic and cyber warfare capability is going to be important. More needs to be done on this score.

The government must not rush into Theatre Commands without factoring in the IAF concerns.

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The Vulnerable Sky

Air Vice Marshal Anil Golani (Retd)

Additional Director General, Centre for Air Power Studies | 10 September 2021

Source: Force India | https://forceindia.net/cover-story/the-vulnerable-sky/

IAF's Surya Kiran Aerobatic Team

There has been a lot of speculation in the media, both, over the proposed structure of the Theatre Commands, as well as the objections that the IAF has over them. It is being said that one service has been playing spoilsport at the cost of the national interest.

The acrimony over the suggested changes and the command of these proposed formations does not augur well for the men in uniform (irrespective of colour), as well as the nation, especially so during the present turbulent times. There is both comfort and danger in clinging to long-established status quo. The cost of procrastination at the same time can cost nations dearly. The fact that change, which is the only

constant, is inevitable cannot be wished away. However, wise counsel must prevail and, change, whether incremental or sudden, must only be implemented after collaborative discussions.

The Kargil Review Committee, Naresh Chandra Task Force and the Shekatkar Committee, all made a slew of recommendations related to defence reform and reorganisation of the service headquarters as an integral part of the ministry of defence. None of them spoke of the need to create Theatre Commands. There was, however, unanimity in opinion to have a Permanent Chairman, Chiefs of Staff Committee (CoSC) as a 'chief coordinator' between the military and the MoD.

The Shekatkar Committee which submitted its report in December 2016 was tasked to recommend measures to 'enhance combat capability and rebalance defence expenditure of the armed forces.' The Arun Singh Committee on Defence Expenditure in 1993 had suggested the integration of the three services headquarters and the setting up of the vice chief of defence staff from any service, who would represent the forces collectively in the defence ministry, having direct access to the defence minister. The other changes recommended included measures to reduce wastage of effort in triplication of duties at the MoD, Service Headquarters and Finance. Some of these have been partially implemented now since the creation of the chief of defence staff and the department of military affairs.

Space, Cyber and Special Ops

In 2012-13, when the proposal for the creation of three integrated commands of cyber, space and special operations was mooted by the then Chairman Chiefs of Staff Committee, it was done only after extensive deliberations at the Service Headquarters and Headquarters Integrated Defence Staff.

It was felt that these were the areas that would require increased focus and synergy in the future to safeguard the nation. Notwithstanding the fact that this has turned out to be prophetic, there was unanimity in the proposal as differences had been resolved professionally. To sweeten the deal, each service was allocated its share of the pie. The government, however, objected to the creation of three additional commands with additional vacancies.

Thereafter, the proposal was amended to create these as agencies under a two-star officer who would function under the chairman CoSC or the CDS. The fact that these agencies were created and have now been functional since the last two years within a joint organisation consisting of a joint staff from the three services speaks volumes of the kind of integration and jointmanship that is possible, provided due processes and deliberations are followed towards its implementation.

The threats that are likely to be witnessed would increasingly be in these domains as has already been shown by the 'Pegasus' scandal and the power outage in Mumbai last year. The use of space as a medium for military applications

has become an inescapable necessity, and so has the requirement of swift, clandestine and precision operations by special forces of all the three services. These agencies can metamorphose into functional commands sans boundaries as these have been structured to be integrated from the very beginning. It would also make it easier for them to simultaneously liaise with other government agencies and ministries for their smooth and efficient functioning. Any incident, the likes of which happened in Jammu recently could easily be handled by a hybrid special operations command.

Resource Crunch

Any restructuring and modernisation cannot be done without resources. The resources can only be generated by the defence budget that is given to the armed forces. If one were to look at the revenue versus capital expenditure of all the three services, the options are stark and obvious.

If you want more capital outlay, you need to cut down on the revenue budget. The 'maximum bang for the buck' towards reduction of revenue expenditure would only happen if the manpower were reduced. One has often heard the ruse of 'long borders' and 'hostile neighbours' to justify the large manpower of the Indian Army. With electronic and space-based surveillance, availability of air assets for rapid mobilisation and adequately trained and equipped special forces, this vulnerability can be overcome to a large extent.

As far as utilisation of air power is concerned, there has to be a flat chain of command. The structure cannot be turned on its head, otherwise the speed, ubiquity, reach and precision will suffer leading to disastrous consequences. The chief of any service is an operational man who has been especially selected to lead his service in warfighting. The chain of command leading up to him is inviolate and cannot be tampered with.

Viewed strategically, the service that is most affected by the resource crunch is the Indian Air Force. No nation can afford to pay the price for its military not being able to deliver when faced with a crunch. To ensure that, the processes must be correct and followed meticulously. The chain of command must be clear and inviolate. And the resources have to be adequate.

Reorganisation

Rafale fighter

The reorganisation of individual service headquarters and the creation of a new organisation to meet the command and control requirements of an Integrated Theatre Command is a Higher Defence Organisation (HDO) reform that needs deliberate and collaborative study in the Indian and the regional context. This study needs to be based upon the threat perception, capacity building,

economic outlook, capital outlay for defence, strategic partnerships for defence manufacturing and Atmanirbharta, amongst various other factors.

Chinook heavy-lift helicopter

The proposed establishment of three 'geographical' (two land based and one maritime) and one 'Functional' (Air Defence) Integrated Theatre Commands, needs further deliberation. It is important for professionals in the military domain to revisit the '10 Propositions Regarding Air Power' by Colonel Philip S Meilinger of the United States Air Force (USAF). Col Meilinger offers the readers provocative propositions that would instil an appreciation of air power among those who do not fully understand the possibilities of air power.

The first proposition is that whoever controls the air controls the surface. Air forces, being offensive tools, are inherently strategic forces. The words 'land' or 'maritime' therefore cannot be prefixed to the proposed Theatre Commands. If at all, the commands need to have a geographic orientation, as no other country in the world uses this nomenclature. Since air power is an offensive weapon, it cannot be split between 'air defence' through a functional command and 'offensive air power' through Theatre Commands. With resources being scarce, as mentioned earlier, the nation can ill afford to do so.

Apache AH-64E

Air power can conduct parallel operations at all levels of war and therefore needs to be controlled centrally with decentralised execution. Doctrinal differences between the way air power and surface forces operate, necessitate centralised command of air power as against under the command of surface forces. The proposed structure and resource allocation would have multiple theatres competing with each other for scarce resources through a complicated command chain, going through the CDS, who already wears three hats. In a conflict situation, with the additional responsibility of functioning as the military advisor to the Nuclear Command Authority, the incumbent would have to be a 'superman' to do justice to all the jobs at hand.

Presently, the Jammu & Kashmir and Ladakh sector is the most volatile region in India, threatened by both Pakistan and China. Add to that

the instability in Afghanistan with the formation of the Taliban-led government. Therefore, joint planning and application of our national power and resources is an imperative and imminent need in this region, which has been left out of the proposed Integrated Theatre Commands.

LCA-Tejas

The proposal of placing the existing Indian Army's Northern Command directly under the operational control of COSC defies logic. This region would invariably be involved in every future conflict with our adversaries and the present confrontation in Eastern Ladakh bears testimony to the fact that joint application of force, as was demonstrated with rapid mobilisation of forces, would be an inescapable necessity in the future. Considering the importance of the region and the fact that this sector has seen action in all past conflicts and would invariably do so in future as well, the Northern Command must be a part of any proposed Integrated Theatre Command.

Integrated Commands

It is proposed that the integrated theatre commands be based on geography, i.e., North, East, West and South and they should be rotational with each service tenanting at least one theatre command at any given time. The proposal for making the structure and then evolving the details with the nominated Theatre Commanders is flawed as we first need to work out the philosophy and an outline structure based on the problem statement and principles of joint application of force. It is important to identify the concerns of each service, its culture and ethos and then generate options to address them before implementing a forced matrix.

China is going to be our biggest military threat and the differential will only grow in the next decade at least, before things turn around. The existing domains of land, maritime and air would have to adapt in effectively utilising newer domains of cyber, space, economy and diplomacy, requiring integration at the national level for a multidomain 'whole of government' approach. The 'theatre construct' should have forces from each service with only one Service Component Commander from each service and it should be self-sufficient, reporting to the political leadership. It should cater for existing single service bias in planning and the lack of tri-service knowledge. The entity must be truly joint in every sense and for this there should be tri-service presence at every level, i.e., decision-making, operational and critical functional levels along with a rotational Joint Force Commander.

This structure would have a strong unity of command in the form of a single commander who can prioritise between threats, while handling collusivity. The Theatre Headquarter would be responsive, i.e., it would directly control all

resources pan-India, from tri-service to special ops, space and cyber and also have tri-service advice. This structure would achieve unity of command and synergy in operations as all services' assets and inputs, as well as the space and cyber domain would be available under the Theatre Commander's authority. This would also facilitate easier access to other forms of national power through other agencies like RAW, NTRO, NSCS, MEA etc. The creation of a single Theatre HQ would require the least manpower and resources, while ensuring that the limited high technology weapon systems and platforms could be utilised judiciously to make the optimum operational impact. This would cause minimal disruption to the existing organisation and could be speedily implemented. This would also ensure a division of responsibilities between the Chief of Defence Staff (CDS) and the Theatre Commander, enabling both to carry out their responsibility individually while facilitating a direct relation between the war-waging commander and the political leadership.

Conclusion

Nations must continue to evolve and grow and so must the national institutions like the military. Mature democracies, however, take time to discuss, debate, and to an extent, wargame the proposed changes before they can get implemented, unlike autocratic, Communist or military regimes where change is invariably imposed top down.

In India, where competing demands of alleviating poverty, healthcare, education as well as the pangs of a developing nation with a burgeoning population need to be weighed against a complex external threat environment, the changes must be deliberate. Restructuring and jointness are mutually exclusive and must be thought through before implementation because doing only the former will be at the latter's cost, the consequences of which may be difficult to address in the future.

Outgoing Air Chief Marshal R.K.S Bhadauria welcoming the new CAS Air Chief Marshal Vivek Ram Chaudhari

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IAF not "Support Arm" says the new chief; Bats for joint ops and integration

Huma Siddiqui | 06 October 2021

Source: Financial Ecpress | https://www.financialexpress.com/defence/iaf-not-support-arm-says-the-new-chief-bats-for-joint-ops-and-integration/2344971/.

IAF chief Air Chief Marshal Vivek Ram Chaudhari speaks during a press conference, ahead of the 89th Air Force Day on October 8. (PTI Image)

Indian Air Force (IAF) is not a support arm, Chief of IAF, Air Chief Marshal VR Chaudhari, has said. Backing the idea of joint planning and operations among the three services, ahead of the 89th Air Force day on October 8, responding to media questions, "No service can go into any battle on its own. At times the Army needs to support the IAF in its operations."

Three services – Army, Navy and Air Force are having discussions related to the structure of the Theatre Commands which are being created. And differences came up during a high level meeting under the chairmanship of the Defence minister Rajnath Singh in June.

Also, on June 2, in a television interaction, the Chief of Defence Staff (CDS) Bipin Rawat had stated "… the IAF continues to remain a supporting arm, just as artillery support or engineers support the combatant arm within the army."

"The IAF is committed to integration and jointmanship. Individual doctrines and strengths of each service have to be considered and taken into account when decisions related to processes and structures of theatreisation are being taken," the chief said.

"The IAF has multiple roles to play. Each role varies from offensive strike and air transportation in support of the army and also of maritime forces," the chief said in response to a question related to the CDS's comment that IAF was a "support arm", the new chief

Underlining that no service can go alone in a battle, according to the chief the air forces have different roles to play and the same is true for IAF. "Each service needs to support each other. Not only does the IAF provide support, sometimes the Army has to support the Air Force when it carries out air operations."

On June 2, in a television interaction, the Chief of Defence Staff (CDS) Bipin Rawat had stated "... the IAF continues to remain a supporting arm, just as artillery support or engineers support the combatant arm within the army."

The new structures and processes needed for future warfare were also highlighted by the former chief ACM RKS Bhadauria (Retd) during discussions.

Why is the IAF not a "support arm" ?

To start, the very basic issue is poor understanding of the military. It's a nation which fights war and the three services army, navy and air force are the military instruments which are available to fight the war.

Sharing his views with Financial Express Online, Brig Kuldip Singh, former Principal Director (Defence), National Security Council Secretariat, "Modern wars are industrial in nature and can be sustained only by a huge amount of industrial production and logistics movement from the hinterland to the forward/combat zone. It is preferable to cripple an adversary's war-waging capability as opposed to killing a few troops or destroying a few weapons on a battlefield through a support role. In other words, support actions cannot end a war as swiftly as will depriving him of his reserves, re-supply, resources and replenishment. Without logistics and supplies, even the bravest of soldiers cannot continue a fight.

"Modern fighter aircraft squadrons bestow extreme flexibility – they can take off from a base in the hinterland, refuel mid-air, attack a target in the enemy's depth area, and land at a forward airfield, refuel and be back to its parent base. Alternately, its support & sustenance structures can be transported to forward bases in aircraft like the C-17," he explains.

According to the Indian Army veteran, "Modern fighter aircraft equipped with precision or autonomous munitions permit pinpoint targeting, allowing degradation of a target with just one appropriate weapon / bomb / missile. Modern fighter aircraft are technology-intensive – and therefore, very expensive. Further: it takes time, money and a huge amount of practice to train Pilots to operate such aircraft to their optimal efficiencies."

"Therefore, it is not right to commit such an expensive plane and a highly trained aircraft to a battlefield support task – it's neither cost-effective nor the best utilization of a highly evolved flexible combat platform," Brig Kuldip Singh opines.

Bottom-line: No war is Army led. It is an integrated warfighting, in which no one is bigger than the other. And in the 21st century without the centrality of air power and aerospace power, there cannot be any war. This means: without air power no army or navy can survive in the future wars.

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Explaining the PLA's Record-Setting Air Incursions Into Taiwan's ADIZ

Adrian Ang U-Jin and Olli Pekka Suorsa | 14 October 2021

Source: Diplomat | https://thediplomat.com/2021/10/explaining-the-plas-record-setting-air-incursions-into-taiwans-adiz/

In this photo release by Taiwan's Ministry of National Defence, a PLA KJ-500 AEW&C aircraft entering Taiwan's ADIZ on October4, 2021.

Credit: Republic of China (ROC) Ministry of National Defense

From October 1 to 4, Chinese military incursions into Taiwan's air defense identification zone (ADIZ) were unprecedented in scale and intensity since the Taiwanese Ministry of National Defense (MND) made such data publicly available last September. On October 1, the People's Liberation Army (PLA) launched a 25-plane incursion during the day, followed by another 13-plane incursion that night, setting a record for the largest number of sorties flown by the PLA into Taiwan's ADIZ in a single day. However, that record was broken the very next day (October 2) when the PLA flew a total of 39 sorties in two waves – one during the day and the other at night. The incursion on October 3 involved "only" 16 planes but on October 4 the PLA set a new record for the single largest sortie conducted to date (52), as well as the largest one-day sortie record (56) when the second, night-time incursion is included.

Over the course of first four days in October, the PLA carried out a total of 149 sorties into Taiwan's southwestern ADIZ – a staggering 28 percent increase already over September's previous record for total sorties (116).

What explains this increase in ADIZ incursions? As we have previously argued, the PLA carries out these aerial incursions for multiple reasons – from signaling Beijing's displeasure at closer Taiwan-U.S. ties to focusing on its "anti-access" and maritime deterrence strategy. On October 4, Beijing finally broke its silence regarding the aerial incursions by responding to the United States' October 2 statement condemning the incursions. China blamed the U.S. for being provocative and harming regional peace, with its arms sales to Taiwan and warships sailing regularly through the Taiwan Strait.

Multiple reasons likely contributed to the spike in incursions and sorties in early October.

Our analysis of the incursions data, however, suggests that there is no correlation between U.S. arms sales to Taiwan and any increase in ADIZ sorties. Also, the PLA has no previous record of responding to U.S. or allied warships transiting the Taiwan Strait with incursions of this magnitude. Instead, any Chinese response to a foreign warship transiting through the strait

typically takes place on the Chinese side of the Median Line, and is not reported by Taiwan's MND. Nonetheless, the spike in early October was Beijing clearly signaling its displeasure over one of its key "red line" issues.

A nationalistic show of force or intimidation of Taiwan on the occasion of China's National Day (October 1) for propaganda purposes is a very plausible. Of the two formations intruding into the ADIZ, the one that took place at night was particularly interesting in that it lacked the typical signs pointing to a maritime strike focus. Moreover, the formation, which included two H-6 bombers, 10 J-16 fighters, and a KJ-500 AEW&C aircraft, also lacked other critical capabilities often associated with PLA incursions, like electronic warfare and ISR support. The first incursion of the same day, however, resembled closely other formations observed in the past with a maritime strike focus. Indeed, a Global Times editorial stated that the PLA's incursions "are not only a severe warning to the secessionist Democratic Progressive Party (DPP) authorities on the island, but also clearly portrayed the severity of the situation across the Taiwan Straits, and at the same time gave a clear warning to the supporters of the DPP authorities."

Beijing and Taipei have been in a war of words over Taiwan's application to join the CPTPP trade pact, which China vociferously opposes. Also, as October 10 marks the 110th anniversary of the Republic of China it is also possible that Beijing was stepping up the incursions as a warning to President Tsai Ing-wen (and also the U.S.) not to use the occasion to do something provocative (such as changing the name of the Taipei Economic and Cultural Representative Office, TECRO, in Washington, DC).

Another possibility is that the PLA's sorties were timed to coincide with a naval exercise south of Okinawa, in the Philippine Sea, that brought together three aircraft carriers – USS Ronald Reagan, USS Carl Vinson, and HMS Queen Elizabeth – as well as JS Ise, a Japanese helicopter destroyer, along with 14 other naval vessels from the U.S., Japan, the United Kingdom, New Zealand, the Netherlands, and Canada. The exercise certainly raised the PLA's interest as it demonstrated the formation of a potential coalition against Chinese aggression in the Indo-Pacific. The naval exercise concluded on October 3, as the PLA dispatched 16 aircraft into Taiwan's ADIZ.

As we have argued in these pages before, several previous large-scale incursions have a likely connection to U.S. naval presence, operations, and exercises. For example, between, September 3 and 5, Chinese aircraft conducted three incursions, each involving at least one KQ-200 and two or more anti-shipping capable combat aircraft, suggesting a strong maritime strike focus. The largest of the three incursions took place on September 5, during which 19 Chinese aircraft flew into Taiwan's southwestern ADIZ, including a KQ-200, four H-6 bombers, 10 J-16 and four Su-30 fighters. Importantly, the USS Carl Vinson Carrier Strike Group and USS America Expeditionary Strike Group were

known to have operated in the vicinity of the Luzon Strait.

Earlier, on August 17, 11 PLA aircraft intruded into Taiwan's ADIZ, including again a KQ-200, a Y-8 EW, a KJ-500 AEW&C, six J-16, and two H-6K bombers. The incursion had a likely connection to the large-scale naval exercise, LSE-21, involving assets from the United States and Australia, which were recorded to be present not far from the Taiwan Strait during the intrusion.

More to the point, on October 4, the largest incursion to date, involving 52 aircraft, was very likely related to the HMS Queen Elizabeth and USS Carl Vinson CSGs passing through the Bashi Channel to the South China Sea. This record-breaking incursion had arguably a strong maritime strike focus, with the involvement of two KQ-200s, 12 H-6 and 34 J-16 anti-shipping capable tactical aircraft, two Su-30 fighters, and a KJ-500 AEW&C. Moreover, the MND data on the aircraft's flightpaths further suggests a maritime strike objective with focus toward the Bashi Channel.

The relative quiet in PLA incursions since October 4 is particularly interesting.

The days leading up to Taiwan's National Day (October 10) saw only minor incursions involving one to three aircraft. Most of these incursions represented now well-established training sorties and other frequently observed missions. It is noticeable that the PLA left Taiwan alone during the 2020 National Day as well. Based on the data and identified patterns of behavior it is difficult to assert with any certainty the reason behind PLA's quiet during this notable event in the island's political calendar. This is especially stark when compared to the massive increase of PLA activity during China's own national day.

Beijing could very well have used the Wall Street Journal's report that the United States has been secretly maintaining a small contingent of military trainers in Taiwan for at least a year as a pretext to renew large-scale incursions. The Global Times called the U.S. deployment an "invasion" and said that China "has the right to carry out military strikes against them at any time." However, on the eve of Taiwan's National Day, Chinese President Xi Jinping vowed "peaceful" reunification, saying it best meets the interests of the Taiwanese people. Xi's remarks came after President Joe Biden acknowledged on October 5 that he and Xi had spoken about Taiwan and agreed to abide by the "Taiwan agreement."

The lull in incursions also followed the Zurich meeting on October 6 between U.S. National Security Advisor Jake Sullivan and China's top diplomat Yang Jiechi, where there were "tough and direct exchanges" over the Taiwan Strait. This goes on to demonstrate the difficulty in making any hard and fast conclusions about the PLA incursions into Taiwan's ADIZ. What we can say is that there are many motivations and reasons for the intrusions, many of which may have little to do directly with Taiwan itself.

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Air Power

The Turbulence Ends, India Set To Acquire U.S. ISTAR Jet, 4 More With Indian Sensors

22 February, 2019

Source: Livefist Defense | https://www.livefistdefence.com/newsbreak-turbulence-ends-india-set-to-acquire-u-s-istar-jet-4-more-with-indian-sensors/

After India's quest to acquire two Raytheon ISTAR advanced airborne battlefield and ground surveillance aircraft collapsed in 2017 over a preposterous — but not uncommon — turf war between the Indian Air Force and DRDO over testing and evaluation of the platform, things appear to be finally on track. Livefist has learnt that the ISTAR program has been resurrected under the auspices of the US-India defence technology & trade initiative (DTTI) and will see the Pentagon supply India with one ISTAR aircraft, while pooling technological resources for a joint effort with the DRDO to create indigenous sensor systems for an additional four aircraft.

In other words, India's ISTAR acquisition plan has expanded from two aircraft off the shelf previously, to a total of five aircraft now, the last four of which will be integrated with Indian-developed intelligence sensors, avionics and network achitecture. The entire program is likely to cost over $3 billion.

Raytheon's ISTAR platform, called Sentinel, is based on the long-range Bombardier Global Express jet, is in service with the Royal Air Force. The ISTAR capability has been seen for nearly a decade as crucial to India's airborne networked surveillance, real time battle intelligence and target acquisition needs, a possible game-changer in an increasingly troubled neighbourhood.

U.S. Embassy sources confirmed that talks were on to freeze modalities of the actual transfer of the first aircraft. Livefist can also confirm that work has begun at the DRDO's Centre for Airborne Systems (CABS) in Bengaluru on developing the sensors, software, communication equipment and code for the indigenous component of the program, with teams from the U.S. and India to exchange information under the DTTI to take things forward. This is likely to take a few years, given the complexity and sensitivity of the technology involved.

The IAF's sole DRDO-Embraer Netra AEW&C at Aero India 2019

It is not clear if the DRDO and Indian Air Force have worked out their turf battle on testing and evaluation of the ISTAR, though it appears that both have laid down the contours of how it will work going forward. The significance of the requirement is understood to have been a compelling factor in the DRDO and IAF apparently setting aside their differences to make things move.

The DRDO's proposed C295-based MMMA for the Indian Coast Guard

Apart from airborne intelligence aircraft operated by India's Research & Analysis Wing (RAW), the Indian Air Force currently operates three Phalcon AWACS (with two more to be contracted) and a single DRDO-Embraer Netra AEW&C jet (a second jet joins service soon). The DRDO is also developing an AWACS system based on the Airbus A330 widebody jet platform, which, as Livefist reported here last year, the IAF wants to double as a mid-air tanker. At the ongoing Aero India show, Boeing reminder the IAF that the Wedgetail AEW&C was still on offer to it. In 2017, the IAF revived a quest for seven SIGINT/COMINT aircraft that will be administered by India's intelligence agencies.

With the Netra AEW&C program now officially closed, the DRDO has focused its experience and energies on the Multimission Maritime Aircraft (MMMA) for the Indian Coast Guard, a project revealed first here on Livefist. That program is inadvertently stuck, since it is based on the Airbus C295 platform. And until the Indian government takes a decision on the Airbus-Tata proposal to build 56 C295s in India to replace its old British Avro transport planes, the MMMA program has no choice but to complete its sensor hardware and await clarity on the aircraft platform. The DRDO foresees churning out at least 17 C295-based MMMAs.

U.S. firm Raytheon, which leads the ISTAR/Sentinel program has flown well under the radar for the last few years after a high profile start in the Indian market. Emerging one of India's first American suppliers of military equipment in after the 1999 Kargil War (which itself came a year after the U.S. imposed sanctions following India's nuclear tests), Raytheon began by supplying India with AN/TPQ-37 Firefinder weapon and artillery locating radars. It followed this with high profile campaigns for the Javelin anti-tank weapon and Patriot anti-missile system with partner Lockheed-Martin, neither of which ended in a contract. In 2013, Raytheon's AIM-9X Sidewinder lost out to the MBDA ASRAAM to arm the IAF's Jaguars. Raytheon-built military equipment will enter Indian service this year in the form of U.S. Army reserve AIM-92 Stinger

air-to-air missiles on the IAF's AH-64E Apache attack helicopters. The revived ISTAR program could mark Raytheon's big play in the Indian security market.

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Indian Su-30 Flankers To Dogfight Japanese Fighters Later This Year

Michael Peck | 30 September 2021

Source: The Drive | https://www.thedrive.com/the-war-zone/42577/indian-su-30s-to-dogfight-japanese-fighters-later-this-year

The Indian Air Force is sending its Su-30MKI Flanker fighters to Japan for joint exercises with the Japan Air Self-Defense Force (JASDF), according to Japan's Sankei Shimbun newspaper. The fighter exercises were originally scheduled for 2020 and then summer 2021, only to be postponed both times by the coronavirus pandemic. "But the [Japan] Air Self-Defense Force and the Indian Air Force have agreed that they would like to realize it by the end of the year in view of the threat of China," Sankei Shimbun said.

The drill will give Japan's fighter pilots the experience of going head-to-head with the Su-30, variants of which are flown by China and Russia too.

While Indian Su-30s have participated in joint exercises with U.S. F-15s and British Typhoons, among other units and types, this would mark a rare opportunity for Japanese fighter pilots — who fly F-15s, F-2s, and newly acquired F-35s — to practice dissimilar air-combat training against the Russian-designed Su-30. Japan faces not only Chinese Su-30s, but also Su-30s flown by Russia, with whom Japan has territorial disputes, as well as many other Flanker derivatives in both potential adversaries' air arms.

Japan's F-15J and F-2 in formation

"The value for Japan of being able to train with Indian Su-30s could be significant," Corey Wallace, who teaches East Asian security at Japan's Kanagawa University, told The War Zone. "The JASDF can look forward to enhancing its pilots' understanding of the Su-30's maneuverability, cruising range, fuel consumption, and turnaround times for maintenance, which could be vital for planning during a protracted conflict." In addition, India's Su-30s are equipped with three-dimensional thrust vectoring capability, which makes them especially unique to train against in traditional within-visual-range air combat scenarios.

Perhaps more important, the exercises are a worrisome signal to Beijing that its rivals India and Japan are tightening their defense ties. Chinese and Indian troops fought deadly border clashes in the Himalayas in 2020, while China and Japan are at odds over Chinese claims to the Japanese-held Senkaku Islands in the East China Sea.

"India well understands that its greatest leverage against China is the prospect of joining in combinations with like-minded partners like Japan," Arzan Tarapore, a South Asian studies scholar at Stanford University, told The War Zone. "This threat of coalition-building, rather than anything that India does alone, is what scares Beijing the most."

IAF Su-31MKIs training alongwith RAF Typhoon

Planning for the exercise dates back to December 2018, when the JASDF dispatched a C-2 transport to Agra Air Force Base in India for joint training with IAF C-17s, followed in 2019 by a JASDF C-130.

"This paved the way for regular joint training, and the ASDF and the Indian Air Force decided to raise the level of training content and conduct joint training for fighters," Sankei Shimbun reports. Indian Su-30s were first supposed to train with Japanese F-15s at Komatsu Airbase in June 2020 — only to see the event postponed by the first wave of coronavirus. Training was then shifted to F-2 fighters at Hyakuri Airbase in July 2021, but this was put on hold because of the Delta variant of Covid-19.

Interestingly, the Su-30 — an advanced descendant of the ubiquitous Su-27 Flanker family of heavy fighters — could fight on both sides in a China-India conflict. The Flanker family is the backbone of the People's Liberation Army Air Force and Navy heavy fighter fleets, including 97 Su-30MKK and Su-30MK2 aircraft, as well as more than 500 J-11, J-15, and J-16 aircraft, which are Chinese-licensed copies or indigenous designs based directly on the Flanker.

India has 272 Su-30MKI fighters, most of which were assembled under license in India by Indian aviation manufacturer HAL. The Indian aircraft feature Israeli and French avionics and electronic warfare systems, while China's Su-30MKK and MK2 borrow limited features from the even more advanced Su-35, another Flanker derivative flying in limited numbers with China's and Russia's Air Forces.

IAF Su-31MKIs traking off form Nellis AFB during Red Flag in 2008

The symbolic value of the Indo-Japanese aerial exercises may actually be more potent than the military benefits. India and Japan, along with the United States and Australia, comprise the Quadrilateral Security Dialogue (the Quad), an informal security alliance that's essentially aimed at containing China. With India on China's southwest border, Japan on China's northeast frontier, and the United States, Australia, and Taiwan to the east and south, Beijing may be feeling surrounded. Tighter defense cooperation between India and Japan will only reinforce that feeling.

"This is very clear diplomatic signaling from two Quad partners whose relationship has promised much but has underdelivered up until now," noted Wallace.

Indian Su-30s in Japan could be the start of something bigger: Indian and Japanese forces sharing each other's military bases. Wallace points to the aerial exercises as well as the Acquisition and Cross Servicing Agreement (ACSA) signed by India and Japan in September 2020, which allows the armed forces of both nations to share services and supplies.

Su-31MKIs massive nosecone titled upwards for access to the aircraft's powrfull radar and other systems

"The broader strategic significance of this agreement is that it allows the Indian military to access Japanese bases in Japan, but also Japan's Djibouti base near key Middle East sea lanes," Wallace said. "In return, it provides the Japanese greater access to major Indian bases in the Andaman and Nicobar Islands in the Bay of Bengal, which sit astride western approaches to the Malacca Strait."

Historically, Japan has been reluctant to project military power abroad since 1945. That's partly because of Article 9 of Japan's U.S.-written postwar constitution, which renounces war and offensive capabilities, though these inhibitions may be fading as Japan confronts growing Chinese power. While operating from Indian bases might be politically sensitive, it would allow Japan to protect vital maritime trade routes — and also to discomfit China.

IAF Su-30s and USAF F-15s trained with each other first during Cope India in 2004, an exercise that had major implications for the USAF and its tactics and hardware decisions that followed

Still, operationalizing such a strategy may not happen on a consistent basis in the near term, it could occur during a crisis or eventually in support of Japan's new push to project naval power abroad. Tarapore also doubts India would agree to such joint-basing on a permanent basis. "That's

because of the priority that India places on what it calls 'strategic autonomy,' or not entering into any binding security commitments," Tarapore said. "And you can't get much more committed than deployed forces to another country's territory, or having them deployed to yours."

Regardless, multinational exercises are an invaluable tool for training. U.S. pilots, for example, have benefited greatly from practicing against Indian Su-30s during past Cope India exercises, not just because of exposure to foreign equipment, but also a chance to observe wily foreign tactics. And in Japan's case, if similar exercises happen to send a signal to potential adversaries such as China, so much the better.

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Not possible to reach 42 fighter squadrons in next 10-15 years

Dinakar Peri| 05 October 2021

Source: The Hindu | https://www.thehindu.com/news/national/not-possible-to-reach-42-fighter-squadrons-in-next-10-15-years-iaf-chief/article36845750.ece

Air Chief Marshal Vivek Ram Chaudhary addresses the media in New Delhi on October 5, 2021. |

Photo Credit: R.V. Moorthy

It is not possible for the Indian Air Force (IAF) to reach the sanctioned strength of 42 fighter squadrons in the next 10-15 years and the force will remain at 35 squadrons, given the current phaseouts and inductions, according to Chief of the Air Staff Air Chief Marshal (ACM) V.R. Chaudhari.

Addressing the annual press conference on Tuesday ahead of the Air Force Day on October 8, he said that deliveries of the S-400 Surface to Air Defence (SAM) systems from Russia were on track, but cautioned that SAM systems could not be a replacement for fighter jets.

"The four squadrons of Light Combat Aircraft (LCA)-Mk1A, six squadrons of the Advanced Medium Combat Aircraft (AMCA) and six Medium Role Fighter Aircraft (MRFA), and then factoring in the phaseout, it will remain at 35

squadrons in the next decade. There is no scope for increment as of now," he stated.

The Force has an authorised strength of 42 fighter squadrons to tackle a twin threat from China and Pakistan.

S-400 induction

Responding to questions, he remarked that the first S-400 regiment should be inducted within this year. Asked if the requirement of fighter jets could be offset by the long range S-400, he observed that one shouldn't make a balance here because the S-400 or any other SAM system were defensive weapon systems. "We need a balance of strike aircraft which can penetrate deep into enemy territory to deliver ordnance."

'China building airfields in high altitude but they have huge penalty of high altitude'.

Elaborating on force modernisation, he disclosed the last four MiG-21 squadrons would be phased out in the next four years. Owing to the draw down of the MiG-21s, and the Jaguars, Mirage-2000 and MiG-29s going out by the end of decade, the accretion plan was mainly based on firstly the 83 LCA Mk-1A, for which the contract was signed last year and deliveries would commence by 2024.

"We are fully committed to the AMCA programme, for which an ambitious timeline has been set by DRDO themselves. The AMCA will roll out well before the end of this decade. We hope to start inducting the AMCA by the early years of next decade," he stressed. However, to mitigate the gap in fighter squadrons and the combat capabilities, the Request For Information (RFI) for 114 MRFA was floated. "The RFI were received and we are now awaiting to move the case up further", he noted.

China, Pak cooperation

On the military cooperation between China and Pakistan, he remarked that their only concern was "dissemination of information of western tactics and technology which passes hands from Pakistan to China… We are prepared to handle a two-front contingency".

On China's continued military and infrastructure build-up along the Line of Actual Control (LAC), he pointed out that China continued its deployment at three airbases in the Tibet region. "We're fully prepared to deal with any situation. We need to keep in mind that while they have built airfields and hardened their shelters, they have the huge penalty of high altitude. That will be a weak area for them."

Reiterating the IAF's full commitment to integration among the Services, he emphasised that joint planning and execution of operations by the three Services would result in a maximum increase in the net combat capability.

On formation of integrated theatre commands, he reiterated, "Theatreisation needs to be done keeping in mind future warfare. Should be synchronised. Doctrines and strength of each service need to be kept in mind."

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North Korea says hypersonic missile made 1st test flight

Kim Tomg-Hyung | 29 September 2021

Source: APN News | https://apnews.com/article/united-states-seoul-south-korea-nuclear-weapons-north-korea-4a6c7e182e6d2283510e650353661454

This photo provided by the North Korean government shows what North Korea claims to be a new hypersonic missile launched from Toyang-ri, Ryongrim County, Jagang Province, North Korea, Tuesday, Sept. 28, 2021. North Korea said Wednesday, Sept. 29, 2021 it successfully tested the new hypersonic missile it implied was being developed as nuclear capable as it continues to expand its military capabilities while pressuring Washington and Seoul over long-stalled negotiations over its nuclear weapons. Independent journalists were not given access to cover the event depicted in this image distributed by the North Korean government. The content of this image is as provided and cannot be independently verified. Korean language watermark on image as provided by source reads: "KCNA" which is the abbreviation for Korean Central News Agency. (Korean Central News Agency/ Korea News Service via AP)

SEOUL, South Korea (AP) — North Korea said Wednesday that it successfully tested a new hypersonic missile it implied was being developed as nuclear capable, as it continues to expand its military capabilities and pressure Washington and Seoul over long-stalled negotiations over its nuclear weapons.

The missile test early Tuesday was North Korea's third round of launches this month and took place shortly before North Korea's U.N. envoy accused the United States of hostility and demanded the Biden administration permanently end joint military exercises with South Korea and the deployment of strategic assets in the region.

A photo published in North Korea's state media showed a missile mounted with a finned, cone-shaped payload soaring into the air amid bright orange flames.

The official Korean Central News Agency said the missile during its first flight test met key technical requirements — including launch stability and the maneuverability and flight characteristics of the "detached hypersonic gliding warhead."

South Korea's Joint Chiefs of Staff assessed the missile to be at an early stage of development and said North Korea would need "considerable time" to be able to deploy it operationally.

The North's announcement came a day after the South Korean and Japanese militaries said they detected North Korea firing a missile into its eastern sea. The U.S. Indo-Pacific Command said the launch highlighted "the destabilizing impact of (North Korea's) illicit weapons program."

U.N. spokesman Stephane Dujarric called the reports "very disturbing" and said: "We remain convinced that the only way forward for the Korean Peninsula is for diplomatic engagement

by the parties."

In a separate report, KCNA said the North's rubber-stamp parliament opened a session on Tuesday and discussed domestic issues such as economic policies and youth education and that the meetings would continue.

Some experts speculate the North might use the session to address the deadlock on nuclear diplomacy, but the state media report did not mention any comments made about Washington and Seoul.

At a ruling party meeting in January, leader Kim Jong Un named hypersonic glide vehicles, which are launched from a rocket before gliding into a target, as among a wish-list of sophisticated military assets. KCNA described the new missile as an important addition to the country's "strategic" weaponry, implying that the system is being developed to deliver nuclear weapons.

In this photo released by the United Nations, North Korea's U.N. Ambassador Kim Song speaks during the 76th session of the United Nations General Assembly, Monday, Sept. 27, 2021, at U.N. headquarters. (Cia Park/ United Nations via AP)

The report also said the test confirmed the stability of the missile's fuel capsule, indicating a technology to add liquid propellant beforehand and keep it launch-ready for years. And a North Korean official said the North planned to expand the system to all of its liquid-fuel missiles.

Liquid-fuel missiles are more vulnerable than solid-fuel missiles because they need to be fueled separately and transported to launch sites using trucks that can be seen by enemy satellites or other military assets.

Kim Dong-yub, a professor at the University of North Korean Studies in Seoul, said North Korea is trying to improve the mobility of these weapons.

North Korea last week made offers to improve relations with South Korea under certain conditions, apparently returning to its pattern of mixing weapons demonstrations with peace overtures to wrest outside concessions.

Negotiations over its nuclear program have been in a stalemate since February 2019. North Korea has demanded the lifting of U.S.-led sanctions while insisting it has the right to nuclear weapons. U.S. officials have made it clear that the sanctions will stay in place until the North takes concrete steps toward denuclearization.

Kim Jong Un in recent political speeches has vowed to bolster his nuclear program as a deterrent to the U.S.

His government has so far rejected the Biden administration's offer to resume talks without preconditions, saying that Washington must abandon its "hostile policy" first, a term North Korea mainly uses to refer to sanctions and

joint U.S.-South Korea military drills the North considers to be an invasion rehearsal.

Kim's influential sister reached out to Seoul twice last week, saying her country was open to resuming talks and reconciliatory steps if conditions are met.

Analysts say North Korea is using the South's desire for inter-Korean engagement to pressure Seoul to extract concessions from Washington on Kim's behalf as he renews an attempt to leverage his nuclear weapons for badly needed economic and security benefits.

North Korea's weapons displays could also be aimed at shoring up domestic unity as Kim faces perhaps his toughest moment nearing a decade in rule, with pandemic border closures unleashing further shock on an economy battered by sanctions and decades of mismanagement.

Experts say the North will likely continue its testing activity in the coming months as it dials up its pressure campaign, at least until China begins pushing for calm ahead of the Beijing Olympics early next year.

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Russia test-fires hypersonic 'Tsirkon' missile for first time

04 October 2021

Source: Hindustan Time | https://www.hindustantimes.com/world-news/russia-test-fires-hypersonic-tsirkon-missile-for-first-time-101633333869357.html

File photo of a missile test (Representative Image/AFP)

Russia said on Monday it had successfully test launched a Tsirkon (Zircon) hypersonic cruise missile from a submarine for the first time, a weapon President Vladimir Putin has lauded as part of a new generation of unrivalled arms systems.

The defence ministry, which tested firing the Tsirkon missile from a warship in July, said that the Severodvinsk submarine had fired the missile while deployed in the Barents Sea and had hit its chosen target.

Low-quality video footage released by the ministry showed the missile shooting upwards from a submarine, its glare lighting up the night sky and illuminating the water's surface.

"The test firing of the Tsirkon missile from a nuclear submarine was deemed successful," the ministry said.

Some Western experts have questioned how advanced Russia's new generation of weapons is, while recognising that the combination of speed, manoeuvrability and altitude of hypersonic missiles makes them difficult to track and intercept.

In July, parts of footage showing Russia's advanced new S-500 surface-to-air missile system appeared to have been deliberately blurred to make it harder to examine in detail.

Putin announced an array of new hypersonic weapons in 2018 in one of his most bellicose speeches in years, saying they could hit almost any point in the world and evade a U.S.-built missile shield.

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U.S. holds three tests to advance hypersonic weapon programs

Mike Stone | 23 October 2021

Source: Router | https://www.reuters.com/business/aerospace-defense/us-holds-three-tests-advance-hypersonic-weapon-programs-pentagon-says-2021-10-21/

The Pentagon logo is seen behind the podium in the briefing room at the Pentagon in Arlington, Virginia, U.S., January 8, 2020. REUTERS/Al Drago

WASHINGTON, Oct 21 (Reuters) - The U.S. Navy and Army tested hypersonic weapon component prototypes on Wednesday that will inform development of new weapons, the Pentagon said, calling the three tests successful.

The tests occurred the same day that U.S. President Joe Biden said he was concerned about Chinese hypersonic weapons.

Sandia National Laboratories ran the tests from NASA's Wallops Flight Facility in Virginia which will help "inform the development of the Navy's Conventional Prompt Strike (CPS) and the Army's Long Range Hypersonic Weapon (LRHW) offensive hypersonic strike," a statement said.

The Navy and Army will conduct a flight test of the common hypersonic missile in fiscal 2022, which began on Oct. 1.

Hypersonic weapons travel in the upper atmosphere at more than five times the speed of sound, or about 3,853 miles per hour (6,200 kph).

These tests "demonstrated advanced hypersonic technologies, capabilities, and prototype systems in a realistic operating environment," the Pentagon said in a statement.

The United States has actively pursued the development of hypersonic weapons as a part of its conventional prompt global strike program since the early 2000s.

Companies such as Lockheed Martin (LMT.N) and Raytheon Technologies (RTX.N) are working to develop the hypersonic weapon capability for the United States.

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Space Power

ISRO's NETRA in Bengaluru to soon receive information from US agency about threats to space assets

Anirban Bhaumik | 25 September 2021

Source: Deccan Herald | https://www.deccanherald.com/science-and-environment/isros-netra-in-bengaluru-to-soon-receive-information-from-us-agency-about-threats-to-space-assets-1034073.html

The logo of Indian Space Research Organisation (ISRO) at its headquarters in Bengaluru. Credit: Reuters Photo

India and the United States will sign a Memorandum of Understanding on Space Situational Awarenes.

The 'NETRA' in Bengaluru will soon start collaborating with the Combined Space OperationCenter (CSpOC) located at the Vandenberg Air Force Base in California to protect satellites of India andthe United States from natural and man-made threats.

India and the United States will sign a Memorandum of Understanding on Space Situational Awareness by the end of this year, creating a frame work for sharing data and services to ensure the long-term sustainability of outer space activities, according to a joint statement issued after Prime Minister Narendra

Modi's meeting with President Joe Biden at the White House in Washington D.C.

The agreement will help the Indian Space Research Organization's 'NETRA' in Bengaluru to receivefrom the CSpOC in the US data about space debris and other objects in the space and potential threatthey could pose to the safety and security of the new launches as well as the existing satellites andother space assets.

The ISRO opened its NETRA – Network for Space Object Tracking and Analysis – within the ISTRACcampus at Peenya in Bengaluru on December 14 last year.

The US Joint Space Operation Command Center (JSpOC) transitioned into the CSpOC – a US-led multinational initiative involving the UK, Australia, Canada, France, Germany and New Zealand. It receives inputs from the Space Surveillance Network and share data with the nations having Space Situational Awareness agreement with the US.

A source in New Delhi said that the Space Situational Awareness data sharing pact between India and the US would help the exchange of data about the threat posed to the satellites and other assets of the two nations – not only by the countless debris in the increasingly overcrowded space but also from hostile anti-satellite capabilities.

According to a fact-sheet issued by the White House aft er Modi-Biden talks, the US welcomed India's"consideration of potential cooperation in Artemis and the Artemis Accords, a set of principles tosupport the safe and transparent exploration of space to the moon and beyond".

Modi also discussed India-US bilateral cooperation in the space sector with Biden's Vice PresidentKamala Harris, who heads the National Space Council of America.

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Gaganyaan: ISRO readies for Crew Escape System test vehicle flights

Chethan Kumar | Sep 27, 2021

Source: Times of India | https://timesofindia.indiatimes.com/home/science/gaganyaan-isro-readies-for-crew-escape-system-test-vehicle-flights/articleshow/86563182.cms?UTM_Source=Google_Newsstand&UTM_Campaign=RSS_Feed&UTM_Medium=Referral

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

Credit: NASA/JPL-Caltech

The Indian Space Research Organisation (Isro) is preparing for multiple flights of the specially designed test vehicle that will be used to test the Crew Escape System (CES), which will be a crucial element of India's first human space flight mission (Gaganyaan).

Being built at the Vikram Sarabhai Space Centre (VSSC), the vehicle is expected to be ready by the end of this year and Isro is planning at least one flight before the proposed uncrewed mission now scheduled for mid-2022.

VSSC director S Somnath told TOI: "The design work on CES is done and all the reviews have been completed. Most of the systems of the Test vehicle have been realised and the vehicle is in the integration phase and should be ready by the end of this year. The whole CES has to be tested a few times before we put it in the unmanned flight."

Isro chairman K Sivan said the new vehicle will be used to ensure that there's afl awless mechanism for crew escape, which is a very important aspect of Gaganyaan as it helps deal with any exigency duringtravel or stay of the astronauts.

As reported fi rst by TOI last year, the vehicle is built for the in-fl ight escape of the crew. The propulsion will be on top of thecrew module so that it is able to pull the crew away by lifting the module and take them to a safe place.

"We're looking at at least one test vehicle mission before the uncrewed mission. The vehicle is meant for testing an abort.During the fl ight, we may need to abort at diff erent stages, like high dynamic pressure, critical fl ight events, etc. The testvehicle will be used to test abortions up to the fi rst stage of the fl ight. It won't go to orbit," Sivan explained.

Crew Module & GSLV-Mk3

Aside from the CES and the test vehicle, VSSC is responsible for the GSLV-Mk3 — the launch vehicle to be used for Gaganyaan— and some elements of the crew module.

"All design work on the launch vehicle is complete and we have begun testing. The L110 and C25 engines have completed fi rst-level testing and further testing will continue. The S-200 solid booster is being prepared for static tests and we should be readyfor that soon. Overall qualifi cation work is going on. There's a lot of activity: The entire electronics is being revised, we areadding higher levels of redundancies. Health management of the vehicle system design is complete. Prototyping and testingwill begin soon," Somnath said.

Sivan, while pointing out that VSSC is also responsible for the structural design of the crew module, said all the systems insidethe module — avionics, control systems, computers, sensors, etc — and the service module will be built by the UR Rao SatelliteCentre (URSAC), while multiple centers will contribute to the Environmental Control and Life Support System (ECLSS).

"For the ECLSS, which is a very important part of the crew module. LPSC (Liquid Propulsion Systems Centre) wil have a major responsibility. They will build the pressure control system, while VSSC will build the thermal control system and SAC (Space Applications Centre) will develop the crew display, instrumentation etc." Sivan Said.

He added that the design phase of the crew dodule has benn completed and that various centres have already begun fabrication of the systems.

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If China can't beat the US in the air it will try in space

Sandra Erwin | 20 September 2021

Source: Space News | https://spacenews.com/kendall-if-china-cant-beat-the-u-s-in-the-air-it-will-try-in-space/

Secretary of the Air Force Frank Kendall delivers remarks during the Air Force Association Air, Space and Cyber Conference in National Harbor, Md.,

Sept. 20, 2021. Credit: U.S. Air Force

NATIONAL HARBOR, Md. — Air Force Secretary Frank Kendall in a keynote speech Sept. 20 warned that China's rapid advances in nuclear and conventional weapons will challenge the United States both in the air and space domains.

"While America is still the dominant military power on the planet today, we are being more effectively challenged militarily than at any other time in our history," he said at the Air Force Association's Air, Space & Cyber Conference.

"We are in a national, strategic, long-term

competition with a strategic adversary," Kendall said.

China's advances in military and space technologies and the implications for U.S. national security was the dominant theme in Kendall's address to a large audience of active-duty service members, government civilians and defense contractors.

He said China's military modernization is focused on long-range precision-guided munitions, hypersonic missiles, space and cyber weapons.

"I have had the opportunity to catch up on the intelligence about China's modernization programs. If anything, China has accelerated its pace of modernization," Kendall said.

There is "strong evidence" that China is pursuing silo-based intercontinental ballistic missiles and satellite-guided munitions to strike targets on Earth and in space, he said. Some of that intelligence was revealed through open sources but Kendall also has received classified briefings.

During a briefing with reporters on Monday, Kendall described these revelations as "the most disturbing developments in nuclear proliferation I've seen in my lifetime."

With regard to space weapons, he suggested China could pursue a global strike capability using space to deliver weapons, a concept modeled after the Soviet-era "fractional orbital bombardment system" conceived for the Cold War. The Soviets envisioned launching nuclear warheads into low Earth orbit and then directing them back down to targets on the ground.

Kendall said he had no specific knowledge that the Chinese are pursuing this but said "it could be possible" and suggested this idea would be attractive to the Chinese because the fractional orbital system is hard to detect by early-warning satellites.

He noted that he came of age in the Cold War and that history can repeat itself.

To stay ahead of China, the United States is going to have to "respond with a sense of urgency, but we also have to take the time necessary to make smart choices about our future and our investments," he said.

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Rwanda files at ITU for nearly 330,000 satellites

22 October 2021

Source: Space Watch Global | https://spacewatch.global/2021/10/rwanda-files-at-itu-for-nearly-330000-satellites/?utm_source=rss&utm_medium=rss&utm_campaign=rwanda-files-at-itu-for-nearly-330000-satellites&mc_cid=39e2d7d6a8&mc_eid=5410314afa

CEO Francis Ngabo at Expo2020 Dubai (Credit: RSA)

Edinburgh, 22 October 2021. – Rwanda´s Space Agency (RSA) has filed a request with the International Telecommunication Union (ITU) to put nearly 330,000 satellites in space.

The country has filed for 27 orbital so-called shells, a collection of orbits at the same altitude. The agency said the submission followed ITU regulations and procedures.

The shells are for two satellite constellations comprising a total of 327,320 satellites. Constellations Cinnamon-217 and Cinnamon-937 are planned for non-geostationary orbital positions.

According to the filing, Cinnamon-217 is a subset of Cinnamon-937 and has different orbital characteristics. Cinnamon-217 has seven orbital shells, each having 8,640 satellites, except for the equatorial shell.

Francis Ngabo, Chief Executive of RSA, said the filing was part of making the country a hub for the African space industry.

Rwanda launched its first satellite, RwaSat-1, in 2019. In March this year, Rwanda's Chamber of Deputies voted for establishing the Rwanda Space Agency.

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China launches classified space debris mitigation technology satellite

Andrew Jones | 24 October 2021

Source: Space News | https://spacenews.com/china-launches-classified-space-debris-mitigation-technology-satellite/

Shijian-21 lifting off atop a Long March 3B from Xichang at 9:27 a.m. local time, October 24. Credit: CASC

AHELSINKI — China launched the Shijian-21 satellite from Xichang late Saturday with the stated aim of testing space debris mitigation technologies.

A Long March 3B lifted off from the Xichang Satellite Launch Center, southwest China, at 9:27 p.m. Eastern, Oct. 23, sending Shijian-21 into geosynchronous transfer orbit.

The China Aerospace Science and Technology Corp. (CASC) confirmed launch success within an hour of launch. Chinese state media Xinhua reported that Shijian-21 will " test and verify space debris mitigation technologies."

No details of the satellite or its capabilities were made available. Coupled with the fact that space debris mitigation technologies are "dual-use," having both civilian and military applications, the satellite is likely to attract interest and scrutiny outside China.

A commercial case for active debris removal and, in the case of geostationary orbit, repairing and refueling satellites or delivering them to graveyard orbits, is being made globally.

The Shanghai Academy of Spaceflight Technology unveiled a "supplemental service spacecraft" at the Zhuhai Airshow in late September. After approaching to within approximately two meters of a target it would be able to dock with and refuel a compatible satellite. SpaceLogistics, a subsidiary of Northrop Grumman, has developed Mission Extension Vehicles, while DARPA, the European Space Agency, Astroscale of Japan and others are developing refueling spacecraft.

The classified nature and lack of transparency regarding the intentions and actors involved in the Shijian-21 mission could spark concern, however. The same capabilities to rendezvous with and attach to a satellite for refueling and repair could also be used to disable spacecraft of adversaries.

Shijian ("practice") satellites are broadly technology demonstration satellites. Shijian-17, launched by the first Long March 5 heavy-lift rocket in 2016, is an experimental satellite for communication and broadcast services. It also carried out rendezvous and proximity operations in geostationary orbit.

The Secure World Foundation has tracked Chinese and other space actors' rendezvous and proximity operations. It notes that Shijian-17 has demonstrated maneuverability around the

geostationary belt, circumnavigated Zhongxing-5A (ChinaSat-5A) and made later approaches to Zhongxing-6B and Shijian-20, which launched in December 2019.

The Saturday launch of the Long March 3B indicates that the launcher was not the cause of an issue affecting the Sept. 27 launch of Shiyan-10, another classified spacecraft. The satellite was apparently unresponsive in terms of propulsion for more than two weeks before a series of burns raised its perigee by hundreds of kilometers each time and indicated to the outside world that Shiyan-10 was active.

Shiyan-10 continues to alter its orbit and has raised its perigee to 1,100 kilometers, according data from the U.S. Space Force's 18th Space Control Squadron (SPCS). The satellite is understood to have been targeting a geosynchronous orbit, with a current apogee of 40,100 km. Neither CASC nor state media have provided an update on the health or situation of the Shiyan-10 satellite.

The Long March 3B was slated for a busy end to 2021, and appears fit to continue its role as a workhorse among China's Long March rockets.

The launch was CASC's 36th launch of the year and 39th overall for China, including launches from state-owned spinoff Expace and private firm iSpace. China's next launch will set a national record for orbital launches in a calendar year, surpassing the 39 set in 2018 and matched in 2020.

CASC is targeting more than 40 launches before the end of the year. Private firm Galactic Energy are soon expected to conduct their second launch, while Expace's efforts to launch a second Kuaizhou-1A record this year have been hit by a COVID-19 outbreak.

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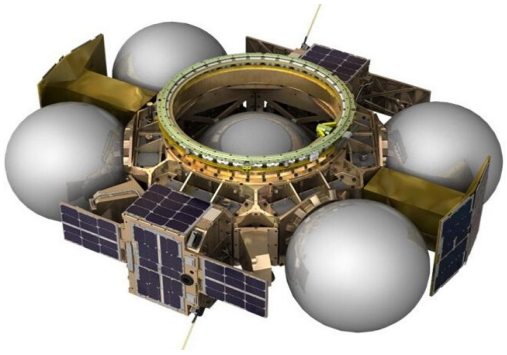
Global Aerospace Industry

Spaceflight offers lunar flyby rideshare mission

Jeff Foust | 27 September 2021

Source: Space News | https://spacenews.com/spaceflight-offers-lunar-flyby-rideshare-mission/



Spaceflight's Sherpa-ES is a version of its existinh Sherpa tugs with larger propellant tanks to support a lunar fly by mission.

Credit: Spaceflight

WASHINGTON — Launch services provider Spaceflight sees a lunar flyby mission opportunity next year as a pathfinder for future opportunities to support customers going to both geostationary orbit and the moon.

Spaceflight announced Sept. 14 that it reached an agreement with Intuitive Machines to fly as a secondary payload on that company's IM-2 lunar lander mission, launching on a SpaceX Falcon 9 in the fourth quarter of 2022.

The mission will carry a new version of Spaceflight's Sherpa line of tugs, called Sherpa-ES. It will swing around the moon and return to geostationary orbit, delivering a payload for Orbit Fab, a company developing tankers to support refueling of spacecraft in orbit. The lunar swingby requires about 25% less propellant than a traditional orbit-raising maneuver to GEO and allows the payload to reach GEO in just 15 days.

The Sherpa-ES is based on the Sherpa-LTC, a version of Sherpa with a chemical propulsion system. The biggest change is larger propellant tanks, said Phil Bracken, vice president of engineering at Spaceflight, in an interview. "We're incrementally building on the design, not throwing the LTC design out the window and building a brand-new thing."

There are some other changes, such as in communications, where he said Spaceflight will have to use a different set of ground stations to enable communications at lunar distances. "You have to fly this vehicle much more like a rocket stage," he said, with a midcourse correction and changes in how the vehicle knows its position.

Orbit Fab is the only announced customer for that mission so far, arranged through a new smallsat rideshare company, GeoJump. Bracken said Spaceflight is in discussions with several other potential customers for the mission, including those looking for opportunities to deliver payloads around the moon, with on the order of hundreds of kilograms of capacity available.

"We've watched a steady increase in interest" in lunar missions, he said, tied to government lunar exploration activities. Spaceflight hopes to demonstrate with this Sherpa-ES mission that rideshare opportunities should be included in future lunar missions, such as through NASA's Commercial Lunar Payload Services (CLPS) program, of which IM-2 is one such mission.

"Part of the reason we're interested in doing this mission is that we believe there's going to be a future wealth of lunar missions, whether it's through CLPS from NASA or some other set of private or government missions," he said. "The intent is to prove that you should put rideshare on these things."

The agreement with Intuitive Machines only covers the IM-2 mission, which Bracken said was something of an "opportunistic" case to take advantage of the excess capacity on that mission while Spaceflight looks at ways to support customers seeking to go to geostationary orbits and the moon.

"There is a strong future in non-low Earth orbit smallsat missions," he said. "We're opening up future orbits for small satellite and private customers that want to go do interesting things."

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China's high-end military technology touted at biggest air show

David Kirton | 30 October 2021

Source: Tiananmens Tremendous Achievements | https://tiananmenstremendousachievements.wordpress.com/2021/10/01/chinas-high-end-military-technology-touted-at-biggest-air-show/

ZHUHAI, China, Sept 30 (Reuters) – China put on an extravagant display of once-secret high-end military technology at its largest air show this week, while broadcasting its growing ambitions in space exploration and for self-sufficiency in commercial aircraft.

- **Space exploration plans, commercial aircraft also in focus.**
- **'Loyal wingman' drone being developed to protect fighter jets.**
- **U.S.-China trade tensions placing pressure on civil industry.**

Pandemic-related travel restrictions meant Airshow China in the southern city of Zhuhai was a largely domestic affair, but foreign observers kept a close eye on developments from afar as China builds its military strength.

"Key platforms in service with the PLAAF – having been operated in tight secrecy previously – being shown to the public for the first time have attracted considerable attention from the international audience," said Kelvin Wong, a Singapore-based defence editor at Janes.

He pointed to WZ-7 Xianglong, a high-altitude long-endurance reconnaissance drone roughly analogous to the U.S.-made Northrop Grumman (NOC.N) RQ-4 Global Hawk but with inferior engines. The WZ-7 has been sighted operating out of airbases close to the Sino-Indian border, the North Korean border and the South China Sea, Wong said.

China has been working hard to improve the performance of its homegrown engines, which have lagged Western technology. At the show, it flew its J-20 fighter jets with Chinese engines rather than Russian ones for the first time.

Testing is also under way for two types of domestic engines for its Y-20 transport plane, the plane's chief designer told the Global Times on Wednesday.

The J-16D electronic warfare fighter, its closest equivalent to the U.S.-made EA-18G Growler, was on ground display, showcasing a capability that experts say could help it erode Taiwan's anti-aircraft defences in the event of conflict. read more

Wong said at least three types of jamming pods were hung on the plane, suggesting that each was designed to disrupt different parts of the electronic spectrum.

China also revealed it is pursuing a "loyal wingman" drone to help protect pricier crewed fighter jets, in line with rival projects in the United States, Britain, Australia, India and Russia. read more

The developer did not say whether that drone, the Feihong FH-97 concept, would be exported, but the presentation was attended by many foreign observers.

THE NEXT FRONTIERS

China also revealed it expected to launch its next generation of heavy-duty rockets, powerful enough to send a crewed spacecraft to the moon, in 2028 – two years earlier than previously expected. read more

In commercial aircraft, China is stepping up efforts to become more self-sufficient in key technologies amid trade tensions with the United States.

Aero Engine Corp of China displayed a rotating, full-size model of the CJ1000 engine under development for the C919 narrowbody plane, which could eventually replace the imported CFM International LEAP-1C engines.

The C919 has found it harder to meet certification and production targets thanks to tough U.S. export rules, Reuters reported on Monday, citing sources with knowledge of the situation. read more

"With an unrivalled domestic market and increasingly participation of private investment, it is only a matter of time for China to resolve external tech blockages," Wang Yanan, chief editor of Beijing-based Aerospace Knowledge magazine, told the Global Times in response to the Reuters story.

Western planemakers are also finding it increasingly difficult to gain certification for new models that would compete against Chinese-made planes.

The Airbus (AIR.PA) A220, Embraer (EMBR3.SA) E-Jet E2 series and ATR 42-600 turboprop have not yet been approved by China's aviation regulator despite being in service elsewhere for years, hindering the chances of local sales.

Boeing (BA.N), however, said at the show it remained hopeful the 737 MAX would receive approvals for its return in China by the end of the year after being grounded for more than two years. read more

Reporting by David Kirton; additional reporting by Stella Qiu; additional reporting and writing by Jamie Freed in Sydney. Editing by Gerry Doyle

Source: Reuters "China's high-end military technology touted at biggest air show"

Note: This is Reuters' report I post here for readers' information. It does not mean whether I agree or disagree with the report's views.

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Nanoracks and Lockheed Martin partner on commercial space station project

Jeff Foust | 21 October 2021

Source: Space News | https://spacenews.com/nanoracks-and-lockheed-martin-partner-on-commercial-space-station-project/

Nanoracks, Voyager Space and Lockheed Martin will collaborate on development of Starlab, a commercial space station that could launch as soon as 2027.

Credit: Nanoracks

WASHINGTON — Nanoracks, its majority owner Voyager Space and Lockheed Martin, will collaborate on the development of a commercial space station as others in industry warn of a potential space station gap.

Nanoracks said Oct. 21 that it was partnering with Lockheed Martin and Voyager Space on a commercial space station called Starlab. Nanoracks will be the prime contractor with Voyager handling strategy and investment and Lockheed serving as the manufacturer and technical integrator.

Starlab would consist of a docking node with an inflatable module attached to one side and a spacecraft bus, providing power and propulsion, attached to the other side. Starlab will have a volume of 340 cubic meters, about three-eighths that of the International Space Station, and generate 60 kilowatts of power. Starlab will be equipped with a robotic arm and "state-of-the-art" lab, and be able to host four astronauts at a time.

Nanoracks, which got its start flying payloads to the ISS, has made it increasingly clear in recent years it was interested in a commercial space station. In August, it hired a former NASA executive, Marshall Smith, to lead its commercial space station development efforts.

"Since the beginning, Nanoracks has sought to own and operate a private space station to fully unlock market demand," Jeff Manber, chief executive of Nanoracks, said in a statement. That work has included flying payloads to the ISS and installing a commercial airlock, called Bishop, there last year. "Nanoracks and our team are excited to work with NASA and our friends across the world as we move forward with Starlab."

"Lockheed Martin's extensive experience in building complex spacecraft and systems, coupled with Nanoracks' commercial business innovation and Voyager's financial expertise, allows our team to create a customer-focused space station that will fuel our future vision," said Lisa Callahan, vice president and general manager of commercial civil space, said in the statement. She noted the company had invested in habitat technology that "enables us to propose a cost-effective, mission-driven spacecraft design for Starlab."

The companies said that Starlab could reach an initial operational capability as soon as 2027. They did not disclose the estimated cost of the project or how it would be financed.

The companies are among many seeking to participate in NASA's Commercial Low Earth Orbit Destinations, or CLD, program. That program, announced earlier this year, will provide NASA funding for initial studies of commercial space stations, then certify those stations for use by NASA astronauts.

An estimated 10 to 12 companies submitted proposals for the first phase of the CLD program, with NASA expected to make two to four awards. Axiom Space, which has a NASA award to attach a commercial module to the ISS, has announced plans to use that module as a core of a future space station. Other companies, such as Blue Origin and Sierra Space, have either proposed space station concepts or indicated an interest in stations through job listings.

Worrying about a space station gap

NASA's goal with CLD is to stimulate development of one or more commercial space stations by the late 2020s, allowing the agency to smoothly transition to those stations from the ISS. But at a congressional hearing Oct. 21, witnesses that included a former NASA administrator warned those commercial stations might not be complete before the ISS is retired.

"We are not ready for what comes after the International Space Station," said former administrator Jim Bridenstine at a hearing of the Senate Commerce Committee's space subcommittee. "Building a space station takes a long time, especially when you're doing it in a way that's never been done before."

Bridenstine said he supported efforts in the Senate to extend ISS to 2030, but cautioned that the station could suffer a problem at any time before then that would effectively end the program.

He said NASA's CLD program was not sufficiently funded. A Senate appropriations bill this week offered $101 million for the program, the amount requested. "I am telling you, sir, it is still not enough," he said in response to questions from Sen. Ted Cruz (R-Texas). "The Senate should absolutely declare that NASA needs to tell it when is the objective to have that new station, and the Senate needs to fund the requirements to achieve that."

He didn't offer a dollar amount in the hearing, but did in written testimony. "Congress needs to fund NASA's LEO commercialization efforts at $2 billion per year," he wrote. "If Congress does this, capital markets and entrepreneurs will respond in a way that establishes America as preeminent in LEO human spaceflight at a cost significantly less than the ISS."

The current funding falls short of even supporting NASA's existing $140 million agreement with Axiom Space for access to an ISS port. "That $101 million that Jim is talking about, when you look at how NASA is planning to allocate it, does not meet the commitment to

Axiom for 2022," said Mary Lynne Dittmar, executive vice president for government affairs at Axiom Space and another witness at the hearing. "The work that needs to go to the space station side of it, for the station to do the analysis that's needed to ensure that Axiom can reach orbit and dock by 2024, is not funded completely in that amount."

She said NASA needed to provide more details about its ISS transition plans, including specific objectives and requirements. "NASA has yet to clearly define its needs for services after the ISS ends, nor does it plan to do so for some time," she said.

Dittmar and others at the hearing raised the prospect of a "space station gap" where the ISS ends before commercial stations are established. That could drive companies and countries to use China's space station. She noted that U.S. companies have already complained about losing customers to China but did not name specific cases. In August, Nanoracks' Mamber said he had lost one customer to China's station.

"I am alarmed by what I see as the potential for a gap," she said.

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NRO to tap commercial industry for space-based radar data

Sandra Erwin | 07 October 2021

Source: Space News | https://spacenews.com/nro-to-tap-commercial-industry-for-space-based-radar-data/

National Reconnaissance Office Director Chris Scolese speaks Oct. 7 at the 2021 GEOINT Symposium.

Credit: USGIF

ST. LOUIS — The director of the National Reconnaissance Office Christopher Scolese announced Oct. 7 the agency will start buying space radar imagery from commercial providers.

"Our focus today is on innovation and commercial capabilities," Scolese said in a keynote speech at the 2021 GEOINT Symposium.

"I'm proud to announce the NRO's new Broad Agency Announcement," said Scolese.

This BAA as a "flexible approach to an acquisition process that will allow us to evaluate, leverage, and even integrate new and emerging phenomenologies like radar, hyperspectral, and radio-frequency sensing as they become available."

The first procurement under this BAA will be for commercial synthetic aperture radar (SAR) data. Scolese said this BAA will be released in

about a month.

The NRO buys traditional electro-optical imagery from commercial providers and will award new contracts early next year, said Scolese. He noted that the next step will be to work with providers of other types of commercial remote sensing phenomenologies.

The BAA for commercial radar will be open to the entire industry, including foreign-owned U.S. companies. "If you have technologies that fit the bill, come talk to us," he said.

SAR imagery is in high demand in the energy and agriculture sectors and increasingly is being used by defense and intelligence agencies. Radar sees through clouds and other atmospheric obstacles that interfere with optical satellites.

The NRO in December 2019 awarded SAR imagery provider Capella Space a contract to experiment with the use of the company's data and figure out the utility of the data for national security. The agency in November 2020 issued a request for information to get a better understanding of the state of the U.S. commercial radar imagery industry.

The NRO acquires satellite data for the U.S. intelligence community, the military and homeland security agencies.

"We've seen an explosion of innovation on the commercial side," said Scolese,

"This BAA framework will allow the NRO to rapidly explore, assess, and leverage innovative industry capabilities to meet new intelligence challenges and inform operational requirements."

Pete Muend, director of the NRO Commercial Systems Program Office, told reporters at the GEOINT Symposium that the BAA will help the agency "to onboard new entrants, across all of the phenomenologies."

The NRO wants to work with companies that have operational constellations but also emerging ones that are now building their systems. Muend said the BAA gives the NRO options to "provide some direct support, some direct funding for providers to do some additional things for us that may not follow the purely commercial side, to satisfy some of the unique needs that we have."

Muend said the BAA, called "Framework for Strategic Commercial Enhancements," will be issued for different focus areas multiple times per year.

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Indian Aerospace Industry

Akash Prime, the new version of Akash missile, successfully tested in Odisha

28 September 2021

Source: Hindustan Times | https://www.hindustantimes.com/india-news/akash-prime-the-new-version-of-akash-missile-successfully-tested-in-odisha-101632769129673.html

A new version of the Akash Missile – 'Akash Prime' has been successfully tested from Integrated Test Range (ITR), in Chandipur on Monday. (ANI)

New Delhi A new version of the Akash missile was successfully flight-tested on Monday from the integrated test range at Chandipur in Odisha, officials said. The missile -- 'Akash Prime' -- intercepted and destroyed an unmanned aerial target mimicking an enemy aircraft in its maiden flight test, they said The flight testing took place at around 4:30 pm, the officials said.

"In comparison to the existing Akash system, Akash Prime is equipped with an indigenous active RF seeker for improved accuracy. Other improvements also ensure more reliable performance under a low-temperature environment at higher altitudes," said an official.

The modified ground system of the existing Akash weapon system was for the flight test. Defence Minister Rajnath Singh has congratulated the Defence Research and Development Organisation (DRDO), Indian Army, Indian Air Force and other stakeholders on the successful trial of the Akash prime missile.

He said the successful flight test proves the competence of the DRDO in designing and developing world-class missile systems. DRDO Chairman G Satheesh Reddy also congratulated the team involved in the successful flight trial of the missile.

He said Akash Prime system will further boost the confidence of the Indian Army and Indian Air Force as the Akash system is already inducted and now getting improved with more lethal missiles.

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Defence Minister Rajnath Singh has congratulated the Defence Research and Development Organisation (DRDO), Indian Army, Indian Air Force and other stakeholders on the successful trial of the Akash prime missile.

ISRO likely to miss 3 key missions despite reducing targets

George Allison | 17 September 2021

Source: Hindustan Times | https://www.hindustantimes.com/india-news/isro-likely-to-miss-3-key-missions-despite-reducing-targets-101632336519718.html

ISRO has plans for three more missions before the end of the year, including the first development flight of the SSLV. (File photo)

Despite the Indian Space Research Organisation (ISRO) reducing its launch target from 16 to five projects in 2021 in view of the Covid-19 pandemic, the agency is likely to miss some critical missions, according to people aware of the matter.

"The three planned missions appear unlikely this year," a senior scientist at Isro said on condition of anonymity.

The space agency was to launch two earth observation satellites, one navigation satellite, one purely scientific mission, and the first unmanned flight under the Gaganyaan mission as per its revised targets for the year.

Two of the missions were to use the new small satellite launch vehicle in two development flights. Isro qualifies a launch vehicle after two successful development flights. The small satellite launch vehicle or SSLV will mostly be used for commercial launches, according to people aware of the matter.

There have only been two launches this year – the purely commercial PSLV C-51 launch in February carrying Brazil's earth observation satellite Amazonia-1 and the GSLV-F10 mission in August carrying an Indian earth observation satellite EOS-03 that failed.

To be sure, the space agency has plans for three more missions before the end of the year, including the first development flight of the SSLV. The other two will use India's workhorse PSLV to launch two earth observation satellites EOS-04 and EOS-06.

"The three planned missions appear unlikely this year," a senior scientist at the agency said on condition of anonymity.

Ajey Lele, senior fellow at Manohar Parrikar Institute for Defence Studies and Analyses, said: "It is critical for Isro to quickly conduct the SSLV launches; they have been delayed for far too long. It will be a commercial satellite and some of the slots even in the development flight has been booked by foreign agencies. If the launches do not happen soon, they might move to other launch service providers and Isro will lose market."

The space agency will also miss the launch of the navigation satellite NVS-01 that is to replace one of the satellites in India's own regional GPS-like system NAVigation with Indian Constellation (NavIC).

The NVS-01 satellite is to replace the IRNSS-1G satellite that was launched in 2016 and has

a mission life of 12 years. Among the still functioning satellites in the constellation, the earliest to be launched is IRNSS-1B launched in 2014 with a mission life of 10 years.

"This is likely to be one of the satellites where the atomic clock malfunctioned," said Lele. There was no confirmation from Isro. All three atomic clocks – one main and two back-ups – on the first satellite of the constellation IRNSS-1A failed, prompting the space agency to launch a replacement satellite IRNSS-1H (which failed) and IRNSS-1I (which is currently working). Officials from the space agency also confirmed that the failure of the atomic clock has affected more satellites.

There was no official response from Isro on the matter.

"The pandemic has hit the space agency hard, making it difficult to integrate components coming in from various parts of the country. These delays are important in terms of missions like NavIC that needs a constellation of satellites; if the entire system is not up and running we are not utilising the life-years of the other satellites. However, when it comes to purely scientific missions such as the Gaganyaan, the delay does not have much impact. In case of Adiya-L1 the only challenge is that most of the hardware was ready but it could not be launched. After AstroSat's good data, many scientists are awaiting data from the solar mission," said Dr SM Ahmed, head of central instruments laboratory at University of Hyderabad and formerly a scientist with the Vikram Sarabhai Space Centre who worked on Chandrayaan-1 mission.

"The pandemic has affected missions world over; US' artemis mission is also behind schedule," Dr Ahmed added.

The NVS-01 replacement satellite was to be launched on board Isro's Geosynchronous Launch Vehicle or GSLV, the same one that failed this August. Four of the fourteen GSLV missions so far have failed. In comparison, only two of the 53 PSLV missions have failed.

The space agency had also targeted the first of the two unmanned flights under the Gaganyaan mission for 2021, but it is unlikely to happen this year.

"There have been delays in most missions of Isro, there are several more tests that need to be done before even the unmanned mission. The space agency also needs to launch two relay satellites. Another much awaited mission of Isro is the solar mission Aditya-L1. The other scientific Isro missions have produced good data, and the scientific community is waiting for it," said Lele.

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India, US to block defence technology leakage from Indian private sector firms

Ajai Shukla | 02 October 2021

Source: Ajay Shukla | https://www.ajaishukla.com/2021/10/india-us-to-block-defence-technology.html?m=1

As Chinese and Russian cyber-spies increase snooping via the internet to pick up American defence secrets, including stealth and long-range unmanned aerial vehicle (UAV) technology, the US and Indian defence industrial establishments are developing joint protocols to block any leakage of classified information from their communications.

To formalize and refine their joint security protocols, Washington and New Delhi held a five-day Industrial Security Agreement (ISA) summit that began on Monday and ended on Friday in the capital.

The summit was led by Designated Security Authorities (DSAs) from both sides. The Indian DSA is Anurag Bajpai from the Ministry of Defence (MoD), while the American DSA is David Paul Bagnati.

The two sides reached an "In principle agreement to establish an Indo-US Industrial Security Joint Working Group," said an Indian MoD statement on Friday. "The Group is to meet regularly to align policies for defence industries to collaborate on critical defence technologies," it said.

The US-India framework for industrial technology security began with an agreement termed "General Security of Military Information Agreement" (GSOMIA), which was signed on January 17, 2002 between the Indian and US defence ministers of that time, George Fernandes and Donald Rumsfeld.

GSOMIA 2002 prescribes security standards and protocols for safeguarding information shared by the Pentagon with India's defence ministry; and by US defence firms with Indian defence public sector undertakings (DPSUs).

However, GSOMIA does not cover the exchange of classified information with Indian private industry. Washington wanted this covered too, given New Delhi's emphasis on the proposed "strategic partnership" (SP) model of procurement. The SP model involves the manufacture of defence equipment by Indian private firms, using technology supplied by American "original equipment manufacturers" (OEMs).

Indo-US Joint Working Group to meet regularly to collaborate on safeguarding defence technologies.

For this, Washington asked New Delhi to sign an annexure to GSOMIA 2000, which would cover the Indian private sector. That agreement, called the Industrial Security Agreement (ISA),

was signed in December 2019. Now that is being taken further.

"During the summit, both sides agreed in principle to establish the Indo-US Industrial Security Joint Working Group. This group will meet periodically to align the policies and procedures expeditiously that will allow the (two countries') defence industries to collaborate on cutting edge defence technologies," stated the Indian MoD on Friday.

The DSAs also visited selected Indian defence industries to prepare for setting up a roadmap.

GSOMIA 2000 is not a public document. It is one of four agreements – initially termed "foundational agreements" by Washington, but subsequently toned down to "enabling agreements" – that US legislation requires for facilitating deeper defence cooperation with India.

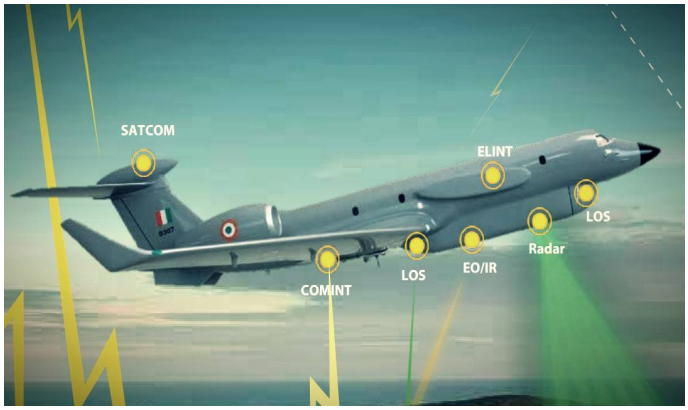
A second agreement, the Logistic Exchange Memorandum of Agreement (LEMOA) that facilitates mutual logistical inter-dependence, was signed in 2016 and the Communications Compatibility and Security Arrangement (COMCASA) in 2018.

The last of the four — the so-called Basic Exchange and Cooperation Agreement (BECA) for Geospatial Intelligence – was signed last October. This allows India's military to access a range of US topographical, nautical and aeronautical data that enables more accurate missile and long-range unmanned airborne vehicle guidance and targeting.

India's $3-billion ISTAR Takes Shape, MoD Clearance This Year

25 February 2021

Source: Livefist Defense | https://www.livefistdefence.com/indias-3-billion-istar-takes-shape-mod-clearance-this-year/



The Indian government is all set to clear paperwork in the coming months to acquire a U.S. ISTAR (Intelligence Surveillance Targeting and Reconnaissance) battlefield and ground surveillance aircraft platform, the first step towards a larger joint project that will see India's Defence Research & Development Organisation develop sensor technologies for an additional four aircraft. A model of proposed Indian ISTAR jet was displayed for the first time at the Aero India 2021 show earlier this month, which Livefist can confirm is a signal that things are on track after a troubled journey thus far.

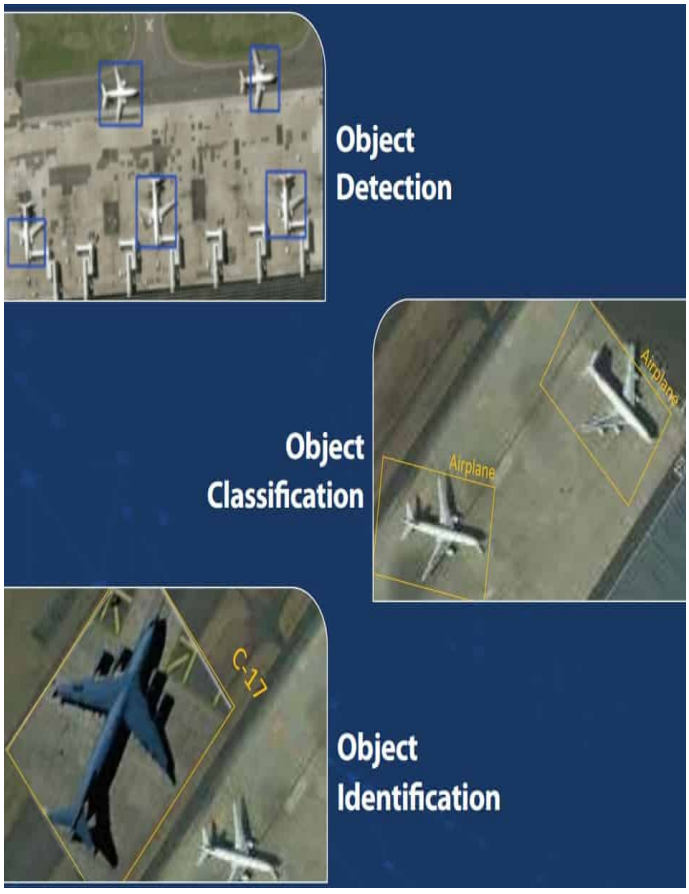
The first official literature on the Indian ISTAR describes it as 'cutting edge technologies for the nation in support of precision strike'. That the speeding up of the program has happened in the aftermath of the Balakot air strikes by India on Pakistan is no coincidence. Tomorrow marks two years since the military operation that saw Indian

Air Force jets, supported by Indian airborne surveillance assets, striking terrorist targets deep in on Pakistani soil. Laboratory literature on the Indian ISTAR program goes on to say, 'ISTAR is a MULTI INT Solution capable of exploiting image, SIGINT and track info from sensors and provide actionable intelligence for tactical and strategic advantage.'

In 2019, a Livefist newsbreak had revealed that efforts to acquire ISTAR aircraft had been bedeviled by a DRDO-Indian Air Force turf war over testing. Since then, the Indian and US governments have managed to bring things back from the brink. You can read Livefist's detailed report with the background here. Sources familiar with the Indian ISTAR program confirm that paperwork to support the Indian MoD's procurement clearance is under creation and will be moved by the middle of this year. The Indian Air Force is said to have expressed urgency in the program, and has provided full backing to the indigenous ISTAR as a priority future asset.

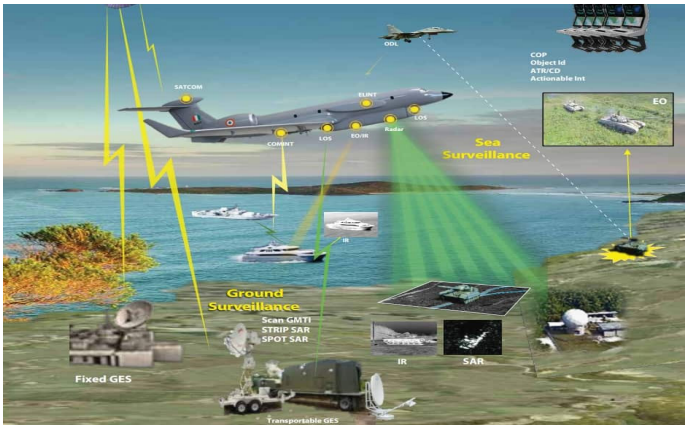
Described by the DRDO as a 'system of systems', the ISTAR comprises airborne and dround segments based on a 'high altitude, high endurance, transport jet' sporting very high resolution imagery from long range SAR and EO/IR, ground moving target detection of slow moving objects, the ability to track mobile ground targets, map natural disasters, area monitor vessels, monitor activities near border and littoral areas. It also states that the 'multi intelligence system' uses AI/ML/DL to infer actionable Intelligence IMINT and SIGINT information to form a common operating picture (COP).

A formal decision hasn't been taken yet, the Indian ISTAR — like the U.S. aircraft to be procured under the Defence Technology & Trade Initiative (DTTI) — will be based on the Bombardier Global Express business jet platform. A separate procurement of four jets will commence as the program matures in the next two years. Much of the work done on the Netra Mk.1 AEW&C program will expectedly flow into the DRDO's ISTAR, though a large number of Indian private start-up companies have been enlisted to contribute to the indigenous software architecture will be proprietary to Indian battlefield and ground surveillance needs.



Apart from airborne intelligence aircraft operated by India's Research & Analysis Wing (RAW), the Indian Air Force currently operates three Phalcon AWACS (with two more to be

contracted) and two DRDO-Embraer Netra AEW&C jet. A third of the type is being used by the DRDO as a sensor testbed. The DRDO was earlier also developing an AWACS system based on the Airbus A330 widebody jet platform, though that has, at the very least, been pushed down the priority ladder, if not shelved for now. On the other hand, with priority backing, and transactional muscle provided by the India-US relationship, the ISTAR program is expected to move smoothly forward.



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First LUH military variant to make maiden test flight next August

Rahul Singh | 07 October 2021

Source: Hindustna Tmes | https://www.hindustantimes.com/india-news/first-luh-military-variant-to-make-maiden-test-flight-next-august-101633618863623.html

Army Aviation director general Lieutenant General AK Suri on Thursday visited aviation squadrons in forward areas including Leh and flew a test sortie in LUH whose trials have been successfully completed. (PTI PHOTO.)

In After wrapping up rigorous flight testing of prototype helicopters in challenging conditions, state-run plane maker Hindustan Aeronautics Limited (HAL) has set August 2022 as the deadline for carrying out the maiden test flight of the first chopper in the indigenous light utility helicopter (LUH) limited series production, senior officials familiar with the development said on Thursday.

The design of the Cheetah and Chetak helicopters is more than 50 years old, and their airworthiness was questioned once again after the Patnitop crash. HAL expects the army and IAF to place combined orders for at least 187 light helicopters in the coming years (126 for the army and 61 for IAF).

LUH will replace the army and the Indian Air Force's ageing fleets of Cheetah and Chetak helicopters whose safety record has been blemished by a string of crashes --- two army pilots were killed last month in the latest Cheetah

crash near Patnitop in Jammu and Kashmir.

Around 15 Cheetah and Chetak helicopters have crashed during the last 10 years killing several pilots. Chief of defence staff General Bipin Rawat (then a lieutenant general) survived a Cheetah crash in Dimapur on February 3, 2015.

"The first test flight of the LUH in the limited series production (LSP) will be carried out next August, in the 75th year of the country's independence. HAL is on the verge of getting an order for 12 LUHs --- six each for the army and IAF," said one of the officials cited above. At his annual press conference on October 5, IAF chief Air Chief Marshal Vivek Ram Chaudhari said the air force would soon place an order for six LUHs.

The design of the Cheetah and Chetak helicopters is more than 50 years old, and their airworthiness was questioned once again after the Patnitop crash. HAL expects the army and IAF to place combined orders for at least 187 light helicopters in the coming years (126 for the army and 61 for IAF).

"All trials on the four LUH prototypes are over. The last set of trials to establish LUH's extra manoeuvrability concluded in Ladakh this week. The army and IAF wanted some changes and LUH performed much better than expected," said a second official.

HAL is expected to deliver the first set of LUHs to the two services in two to three years of the signing of the contract. Subsequent orders will be executed at a faster pace as LUH production will also begin at HAL's new helicopter factory in Tumakuru in Karnataka. LUH's first test flight will be carried out from the Tumakuru facility. The Bengaluru and Tumakuru facilities will be capable of rolling out 100 light helicopters every year, the second official added.

"The Cheetah and Chetak replacement has been long overdue. They were designed in the 1960s. LUH has proved its capabilities in multiple rounds of trials in extreme conditions in the northern sector. It's quite an achievement in indigenous helicopter manufacturing," said Air Marshal Anil Chopra (retd), director general, Centre for Air Power Studies.

Currently, the Cheetah and Chetak helicopters are a critical lifeline for troops in high-altitude areas, including the Siachen glacier. HAL has licence-produced 625 Cheetah and Chetak helicopters. It no longer builds them but is responsible for their maintenance and repair.

The Army Aviation director general Lieutenant General AK Suri on Thursday visited aviation squadrons in forward areas including Leh and flew a test sortie in LUH whose trials have been successfully completed, the Udhampur-based Northern Command said.

India is also looking at jointly building with Russia the Kamov-226T light helicopters in the country. The Kamovs are also expected to replace the Cheetah and Chetak helicopters. However, the $1-billion programme under which Russia will supply 60 helicopters in flyaway condition and the remaining 140 will be manufactured in India is yet to kick off. The army, IAF and navy

together need around 500 light helicopters.

HAL is also awaiting a contract from the defence ministry for 15 light combat helicopters (LCHs) and expects follow-on orders as the army band IAF have a combined projected requirement of 160 LCHs.

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OneWeb to be first private player to launch satellite from Indian soil

Sunil Bharti Mittal | 11 October 2021

Source: Economic Times of India | https://economictimes.indiatimes.com/news/science/oneweb-to-be-first-private-player-to-launch-satellite-from-indian-soil-sunil-bharti-mittal/articleshow/86939781.cms?frm=mailtofriend&intenttarget=no

Bharti Group's subsidiary OneWeb will be the first private player to launch satellites from Indian soil through ISRO facilities, Bharti Enterprises chairman Sunil Bharti Mittal said on Monday.

While speaking at the launch of space and satellite companies body Indian Space Association, Mittal said that the company plans to begin roll out of providing connectivity in the country through OneWeb satellite from mid-2022.

Mittal said that many large countries have rapidly made strides in the space sector and matching them is not possible without government's support.

"OneWeb will be the first customer which starts to bring a commercial position into the Indian space market," Mittal said.

He said that OneWeb will use ISRO's Geosynchronous Satellite Launch Vehicle Mark III rockets for launch of satellites from Indian soil.

OneWeb has 322 satellites in space at the present.

Mittal said that many large countries have rapidly made strides in the space sector and matching them is not possible without government's support.

"With this new initiative that we have taken, I am sure more and more international customers will come to the doorstep of ISRO and NSIL (NewSpace India Ltd). We have a great future ahead. The Prime Minister is showing us the way. It's time for the industry to respond," Mittal said.

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Tejas Mk2: The Pride & Future of Indian Air Force

Udit Tripathi | 12 September 2021

Source: Air Power Asia | https://airpowerasia.com/2021/10/27/tejas-mk2-the-pride-future-of-indian-air-force/

Tejas Mk2 has been the talk of the town recently when the new IAF Chief, Air Chief Marshal VR Chaudhari stated recently that 7 squadrons of Tejas Mk2 are projected for induction in the coming years while discussing the future roadmap of the Indian Air Force's modernization plan. This is an important announcement not only towards the significant capability enhancement of IAF but a move closer to the Atmanirbhar Bharat campaign.

3D render of Tejas Mk2 by Kuntal Biswas, @kuntal__biswas, Twitter

Recent Updates in Tejas Mk2 Project:

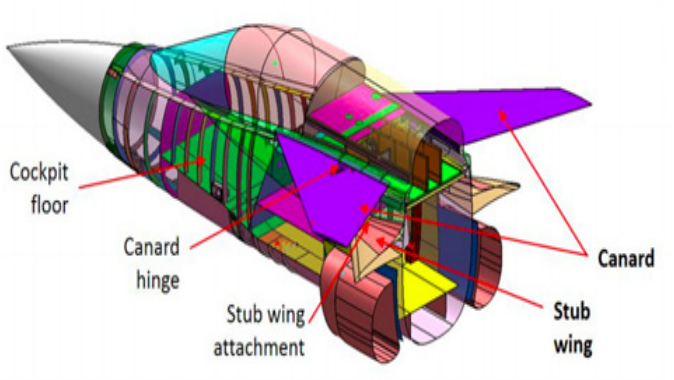
- The Preliminary Design Review (PDR) phase (stage where new technologies are tested & if mature enough, are integrated to product subsystem) was completed at the beginning of 2021.
- Currently, the Critical Design Review (CDR) phase (multiple discipline technical review such that a system can proceed to fabrication, demonstration and testing to meet desired performance within scheduled time and cost) is ongoing which will be completed by the end of 2021. Currently, completion of detailed design, taking up of aircraft level CDR with specific metal cutting (which commenced from Feb 2021) is being worked upon.
- More than 60% work prior to the flight tests has been completed. This includes completion of finalization of cockpit configuration, sensors, antennae, process finalization for drawing release, procurement of raw materials & its availability assessment, detailed design of various subsystems, finalization of SOPs for first flight.
- First prototype of the aircraft will roll out by August 2022 and the flight tests will commence from 2023 onwards.

Key Features of Tejas Mk2:

- **Fuselage:** Tejas Mk2's fuselage comprises 90% (by surface area) carbon-fibre composites along with metallic components forming complex geometries utilizing Titanium, Aluminum and maraging steel. It sports a lengthened fuselage up to 14.65 m as compared to its predecessors Tejas Mk1 and Mk1A (fuselage length: 13.9m) to compensate

for the space constraint in the earlier versions. It retains the iconic double delta main wing, featuring lower sweep angle for the inboard section which helps bring down the static instability to a manageable range. The changes in the Mk2 version include elongated and flattened front fuselage, addition of a nose plug, optimized canopy shape and rear fuselage, which will lead to improved transonic and supersonic performance of the aircraft. Close coupled canards which were even intended for the Mk1 (but failed in the wind tunnel studies earlier & hence dropped from LCA Tejas) is one of the prominent features of Tejas Mk2. These canards provide additional lift, improves wing lift, reduces trim drag, transonic and supersonic drag, can be used as air brakes during landing & allows increase in fuselage's length (one of the key requirement of original Air Staff Qualitative Requirements, ASQR, 1985) . The disadvantage of directional instability brought by the canards has been compensated by increasing the height of the tail fin (and few other measures).

- **Weight capacity:** With a superior engine F414-GE-INS6 (Max Thrust: 98kN wet thrust) and a larger airframe, Tejas Mk2 has a MTOW (Maximum Takeoff Weight) capacity of 17500 kg and maximum payload capacity of 6500kg and internal fuel capacity of 3300kg while it can carry 3 external fuel drop tanks: 1 drop tank at centerline fuselage of 1300kg capacity and 2 at sideways of 1700kg capacity each.



Tejas Mk2 Front Fuselage, Image credits: NIlesh J Rane. @vaimaniki, Twitter

- **Radar, Sensors, Electronic Warfare Suite & Cockpit: Radar:** Upscaled indigenous Gallium Arsenide based Uttam AESA (Active Electronic Scanned Array) radar will be featured in the aircraft. According to Dr. V. Madhusudana Rao, Project Director, Tejas Mk2, the Uttam radar for Tejas Mk2 will carry around 992 Transmit Receive Modules (TRM, the building blocks of AESA Radar) capable of detecting targets as small as 0.0001 m2 Radar Cross Section (RCS) area. Sensors: Indigenous Infrared Search and Track (IRST) system for passive target acquisition will also be featured at the nose plug of the aircraft along with indigenous Radar Warning Receiver (RWR) at the tailfin along with Software based defined radio based tactical data link for secured communication and network centric warfare capabilities supported by IAF's AFNet digital information grid. Electronic Warfare Suite: It will sport an integral Unified Electronic Warfare Suite (UEWS) and a dual colour Missile Approach Warning System (MAWS) developed indigenously by DARE

(Defence Avionics Research Establishment). Cockpit: The Cockpit will feature state of the art Large Area Display of 0.5m x 0.2m with sideways Hand on Throttle and Stick for better view and comfort of the pilot.

Tejas Mk2 Cockpit with Large Area Display,

Image credits: Dr. Anantha Krishnan Muralidharan Nair, @writetake, Twitter

- **Armaments:** The aircraft comprises 11 hard points where the weapons, drop tanks and low band jammer can be mounted. According to Dr. V. Madhusudana Rao, each hard point has the capacity to carry a weight of 1800kg and any weapon coming under this weight category can be mounted on the aircraft. It is stated to carry a variety of BVRAAMS (Beyond Visual Range Air to Air Missiles like R73, R77 from Russia, ASRAAM & Meteor from European consortium MBDA, Python 5 & i-Derby from Israel, indigenous Astra family of missiles. Apart from it, it can carry a variety of indigenous weapons like anti radiation missile Rudram, supersonic cruise missile Brahmos NG, laser guided bomb Sudarshan, glided bombs like Gaurav and Gautam, Smart Anti Airfield Weapon (SAAW), swarm drones like ALFA-S. Currently the feasibility studies to integrate indigenous under development Brahmos NG and Astra Mk2 missile has been undergoing in the aircraft.

- **OBOGS:** The OBOGS (On Board Oxygen Generating System) is a state of art system developed by DEBEL, under DRDO, in which Oxygen is separated from the bleed air from the engine and processed through 'sieves' and 'adsorption process' and pumped to the cockpit. It helps the pilot to stay alert for a longer duration of time replacing the need to replenish the oxygen cylinder.

Key Features of LCA Air Force MK2/Tejas Mk2, Image Credits: Aeronautical Development Agency

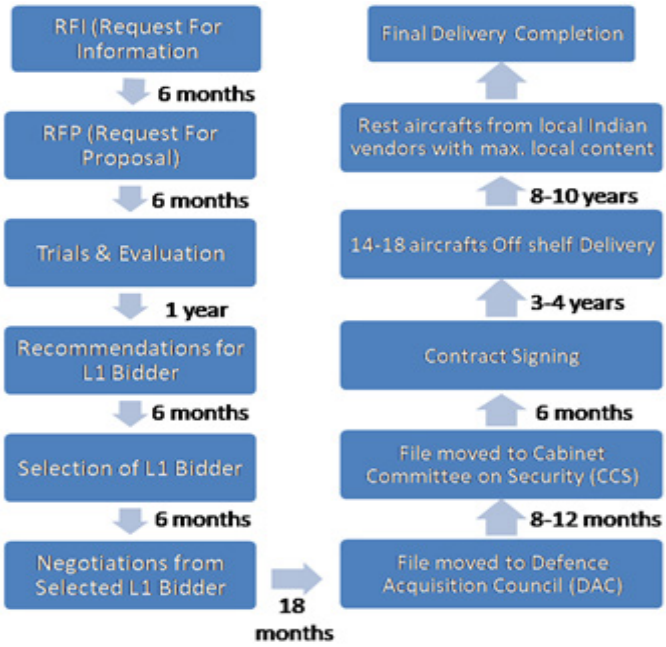
- Semi Stealth Aspects: Though not designed for stealth aspect, Tejas Mk2 does possess semi stealth characteristics for a reduced Radar Cross Section (RCS) rendering it less detectable to Radars. Use of 90% by surface area Carbon-Fibre Composites, Radar

Absorbent Material (RAM) coating, Indium-Tin Oxide coating on canopy to prevent radar reflections on Pilot's helmet, Y shaped air intakes which prevents line-of-sight of engine from radar signatures and software derived canard positions for minimal radar deflections may lead to a low overall RCS of around0.1-0.2m2

Should Tejas Mk2 be preferred over MRFA?

One of the surprising elements of the IAF modernization roadmap discussed by the Air chief was the inclusion of 114 Multi-Role Fighter Aircraft (MRFA) comprising of a variety of aircraft from foreign vendors. It includes Su-35 and Mig-35 from Russia; F-21, F/A-18E/F Super Hornet, F-15EX from the US; multinational Eurofighter Typhoon; Rafale from France and Gripen from Sweden. The MRFA or earlier MMRCA (Medium Multi-Role Combat Aircraft) project did make sense about a decade ago but with Tejas Mk2 around the corner, the scenario has changed. Being the project where IAF was an active part of the preliminary design which proceeded only when all the user's requirements as stated in the original Air Staff Qualitative Requirements, 1985 were met, the Tejas Mk2 project may be beneficial for IAF modernization in the long run as compared to MRFA. This can be attributed to the following aspects:

Timeline of MRFA: Even if the MRFA project is taken in the most efficient manner from now, the 114 fighter jets may get delivered earliest by 2030s. Let's understand the timeline via. Step by Step analysis of the probable defence acquisition process (with minimum estimated time between each step) through the help of this flowchart:



1. The main intention of improving the squadron strength quickly with MRFA looks bleak considering the longer timeline and bureaucratic hurdles. Also timelines may be impacted by the change in governments at the centre. As already witnessed, the current opposition has been doing the witch-hunt against a clean G2G Rafale deal while directly/indirectly lobbying for the Eurofighter Typhoon. Further, it has to its credit the recent infamous scandals of Pilatus trainer aircraft and Agusta Westland helicopter. Hence, a longer timeline brings a lot of complexity as well as question marks in the acquisition process.
2. Cost: The cost of MRFA is estimated at a whopping $25-30Bn, if not more. If even a fraction less of this amount is pumped into the Tejas Mk2 and related indigenous projects then it will boost not only the

indigenous technology creation but can also lead to production of a larger no. of Tejas Mk2 aircrafts than the MRFA.

3. Platform Upgrade & Obsolescence Management: HAL, the owner of technical design IP in Tejas Mk2 is capable of handling any type of unilateral upgrades, additional requirement of change in specifications, integration of new weapons, sensors etc. with considerably less effort. On the other hand, dependency on foreign OEMs for continuous upgrades and obsolescence management can lead to enormous cost and considerable drain of foreign exchange during aircraft's life cycle in case of MRFA.

Tejas Mk2 is a very formidable aircraft that is nearing its production and will certainly add more teeth to the IAF inventory and will successfully replace the aging fleets of Jaguar, Mig-29, and Mirage 2000. The projected induction of 7 squadrons of Tejas Mk2 as mentioned by the IAF chief is a welcome step. It is high time IAF invests heavily into the project and orders Tejas Mk2 in large numbers rather than looking for the foreign silver bullets. This will not only boost the indigenous aerospace development but will also improve the chances of export, making Tejas MK2 a true 'pride of India'.

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In Message To China, India Tests Agni-V Missile With 5,000 Km Range

Vishnu Som | 27 October 2021

Source: NDTV | https://www.ndtv.com/india-news/agni-v-ballistic-missile-with-5-000-km-range-successfully-tested-2590136

PublicNew Delhi: India on Wednesday successfully test-fired the Agni-5, a surface-to-surface ballistic missile that can accurately strike targets up to 5,000 km away, in what is being seen as a strong message to China.

The Agni-5 missile, which uses a three-stage solid fuelled engine, is capable of striking targets at ranges up to 5,000 kilometres with a very high degree of accuracy.

Agni-5, which broadly falls into the category of an Intercontinental Ballistic Missile or ICBM, was launched from the APJ Abdul Kalam Island, off the coast of Odisha, at 7:50 pm.

The missile uses a three-stage solid fuelled engine and can strike targets with a very high degree of accuracy.

The successful test of Agni-5 is in line with India's stated policy to have "credible minimum deterrence" that underpins the commitment to "No First Use".

The missile is the bedrock of India's nuclear deterrent along with submarine-based nuclear missiles, which had not yet been tested to anywhere close to this range.

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Technology Development

China's New Electromagnetic Missile Can Cripple US, Indian Economy By 'Knocking-Out' Power, Communication Systems

Aritra Banerjee | 10 October 2021

Source: Eurasian Times | https://eurasiantimes.com/chinas-new-electromagnetic-missile-can-cripple-us-indian-econom/

This project, being spearheaded by scientists at the China Academy of Launch Vehicle technology, could be a cause of worry for the US. According to the reports, this missile could cruise at six times the speed of sound and cover around 3,000 kilometers in 25 minutes.

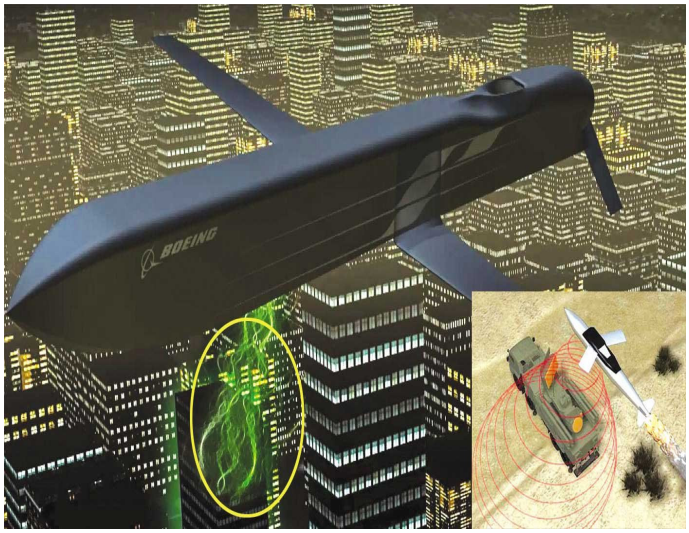
It is poignant to note that research into the electromagnetic effects of nuclear weapons on communication and electrical systems dates back to the 1950s. Global military powers like the US, Russia, China, and North Korea have since made strides in the research and development of EMP weapons systems and the addition to this new-age hypersonic technology race may give Beijing an edge over its arch-rival, the US.

How Does It Work?

EMP blasts were initially associated with nuclear warheads. The simple premise behind this was the emission of a significant amount of radiation. Subsequent developments such as the US Air Force's (USAF) High-Powered Microwave Advanced Missile Project (CHAMP) challenged this notion.

CHAMP creates EMP explosions by leveraging a microwave generator. Chinese scientists seem to have expanded on this American concept by adding a chemical explosive warhead to generate an EMP blast.

According to SCMP, the chemical explosion would compress an electrically charged magnet known as a 'flux compression generator', which would convert the shock energy to short but extremely powerful bursts of microwaves. The missile is expected to harness the intensity of the heat which is a byproduct of the hypersonic speed.



Concept of US' CHAMP missile.

This is to be used to generate electricity which in turn powers the flux compression generation. This might lead the missile to generate significant electricity without the need for batteries.

These missiles would utilize super-capacitors that boast a power density 20 times more than batteries. Furthermore, these capacitors could be charged on the go by leveraging energy from the heat-to-electricity generator, the SCMP report said. Chinese researchers claim that this approach could potentially offload a bulk of the energy

within 10 seconds.

This is suitable for instantaneous discharge to cause EMP damage. Chinese researchers said that the missile would be enveloped in a cloud which would safeguard it from the radar. Air molecules are ionized by the heat while the object travels through the air at hypervelocity. This results in a screen of plasma developing over the surface.

The hypersonic missile is expected to convert the heat from the environment into electricity and use it to power multiple plasma generators located in various parts of the missile's body.

China is developing a hypersonic missile armed with a non-nuclear warhead. Its warhead is designed to create an electromagnetic pulse (EMP) to target an adversary's electrical grids and disrupt its power supply, thereby causing massive economic losses.

Potential Damage

According to EMP weapon expert, Peter Vincent Pry, these weapons can be fired only once. This kind of NNEMP warhead is a 'one-shot' weapon because it is explosive-driven, unlike the USAF CHAMP that uses a microwave generator for its NNEMP warhead that can generate many EMP bursts, or project a continuous EMP field on the ground as the missile cruises, Pry told Forbes.

Pry highlighted that NNEMP weapons technology has undergone changes in recent times owing to the advent of more potent generators. This can be carried out by lowering the size and weight profiles which may empower it to be delivered by Unmanned Aerial Vehicles (UAV), hypersonic vehicles and cruise missiles.

The US electrical grid could be knocked out by a Chinese EMP weapon or even those launched by smaller nations like Tehran and Pyongyang.

It can also damage the communication system as the EMP radiation can burn out electronic devices within a 2-km radius. However, there is another thought which believes that threats from EMP weapons are blown out of proportion.

These weapons have evolved from their nuclear origins and have transitioned towards the non-nuclear realm. The advent of non-nuclear EMP weapons makes it more convenient when compared to nuclear weapons, however, their lethality remains ambiguous.

US Opens Hypersonic Factory

Earlier this week, American aerospace giant Lockheed Martin announced the opening of a 65,000-square-foot production facility for hypersonic systems. This is being carried out in close coordination with the United States Department of Defense (DOD) The facility is housed in the state of Alabama.

Hypersonic systems will be developed for both the US Army and Navy at this facility. The addition of this mammoth facility is likely to foster competition in the development of hypersonic missiles amongst great powers. Particularly between Washington and Beijing over gaining supremacy in the Indo-Pacific.

The EurAsian Times had reported that the US plans to add hypersonic weapons to their B-1B Lancer aircraft that are currently stationed at

Dyess Air Force Base. This will essentially turn the B-1 into a 'missile truck'.

It has been confirmed that the modified B-1 bomber will act as the launch platform for boost-glide vehicles as well as air-breathing missiles.

This hints towards the potential utilization of the AGM-183A Air-launched Rapid-Response Weapon and the Hypersonic Air-Breathing Weapon Concept (HAWC), respectively. Boeing officials highlighted how the project will enhance the existing B-1 fleet, keeping the B-1 mission active till the Air Force transitions to the B-21 Raider.

Until the development of the B-21 is complete, the B-1 bomber will be upgraded and lined up with hypersonic missiles. This sustained development of hypersonic technology sees arch-rivals US and China go head-to-head in the "21st century Cold War".

Amid this hypersonic race between Washington and Beijing, it is too early to predict who will have a clear edge. However, China's new EMP weapon could cause some temporary damage to the US on the economic front using what is known as 'gray zone warfare' tactics.

It's worth recalling how suspected Chinese hackers caused a massive power outage in Mumbai, bringing India's financial capital to a grinding halt for several hours, in October last year.

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Chinese scientists build anti-satellite weapon that can cause explosion inside exhaust

Stephen Chen | 2 October 2021

Source: South China Morning Post | https://www.scmp.com/news/china/military/article/3153174/chinese-scientists-build-anti-satellite-weapon-can-cause

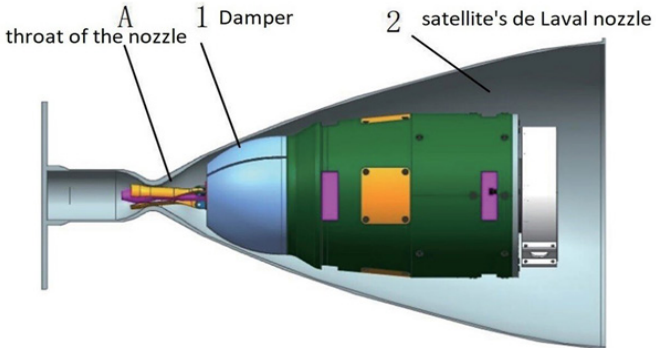
China tested its first anti-satellite weapon in 2007 and had been exploring alternative technologies since then. Photo: Shutterstock

A team of Chinese military researchers say they have built and tested an anti-satellite robotic device that can place a small pack of explosives into a probe's exhaust nozzle.

Rather than blowing the satellite into pieces, the melt-cast explosive can produce a "time-controlled, steady explosion", Professor Sun Yunzhong and colleagues from the Hunan Defence Industry Polytechnic in Xiangtan wrote in a paper published in the domestic journal Electronic Technology & Software Engineering last month.

The device could stay inside the satellite for an extended period by using a locking mechanism

driven by an electric motor. If needed, the process



can be reversed to separate it from the target.

The explosive device fastens itself to the thrust nozzle's narrowest point. Credit: Handout

The project was funded by a government scheme to develop a new type of warhead for rocket missiles, according to the paper.

The device has been built and tested in a ground facility and the researchers said it "would have practical value in certain engineering applications".

China conducted its first anti-satellite test in 2007, destroying a defunct weather satellite with a missile and drawing international criticism over the cloud space debris it created.

The United States and the former Soviet Union had conducted a large number of similar experiments during the Cold War, but these tests stopped after the 1980s because the debris puts valuable space assets and astronauts at risk.

China's anti-satellite programme in recent years has focused on technology that would produce little or no debris, such as capturing a satellite with a net or robotic arms.

The Chinese military has also developed various types of ground-based weapons that could blind or damage a passing satellite with a laser beam.

But these methods are relatively easy to detect, so Sun's team looked for other ways to target satellites by placing explosives inside them.

The explosives are packed into a bullet shaped device that weights only 3.5kg and mirrors the shape of the de Laval nozzles that power most satellites.

These are pipes with a narrow throat in the middle that converts gas into kinetic energy and, although they are based on a 19th century design by the Swedish engineer Gustaf de Laval, are still used on the most advanced satellites today.

Sun's device works by pushing a rod through this narrow point, which then opens up to anchor itself into place by locking the device against the inner wall of the nozzle.

When the device is detonated, the explosion will be partially contained inside the nozzle and be mistaken for an engine mishap, according to a space scientist not involved in the project.

The heat of the explosion, if precisely calculated, can be partly converted into kinetic energy and damage the satellite's insides while leaving the overall structure intact, said the researcher who requested not to be named due to the sensitivity of the issue.

Sun and colleagues said the melt-cast explosive they chose had been used extensively in China's space programme for separating rocket stages and other purposes.

China has also developed the technology to capture satellites, something that has not been restricted by international treaties because it could also be used for peaceful purposes such as satellite repair, refuelling and removing space debris.

The US military has already voiced concerns about China's anti-satellite capabilities, in particular Shijian-17, an experimental probe with a robotic arm that has conducted some unusual manoeuvres since its launch in 2016.

In April, US Space Command chief General James Dickinson told Congress that Shijian-17's technology "could be used in a future system for grappling other satellites".

He added: "Beijing actively seeks space superiority through space and space attack systems."

The rapid development of China's hypersonic programme also fuelled worries about a new arms race in space.

Earlier this week Chinese foreign ministry spokesman Wang Wenbin said the US was hyping the "China Threat theory", so that it could further expand its own military power.

China insists that its military strategy is defensive and Wang said it "will not start an arms race with any country".

But Huang Jia, a researcher with the National University of Defence Technology, said that a new arms race was imminent and it could destroy the space environment.

"The military aerospace equipment tests essentially use the entire Earth as a laboratory," Huang wrote in a paper published in the Journal of Dialectics of Nature in August.

"To avoid tragedy, we need to re-examine the 'principle of freedom' in space activities."

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Northrop Grumman Unveils Model of New Autonomous Aircraft

Meredith Roaten | 09 October 2021

Source: Natinal Defense MAgazine | https://www.nationaldefensemagazine.org/articles/2021/9/10/northrop-grumman-unveils-model-of-new-autonomous-aircraft

Concept art for Model 401 and Model 437 aircraft

PALMDALE, Calif. — Northrop Grumman has designed a new autonomous aircraft that it hopes will be the answer to the Air Force's search for the next-generation of drones that could accompany manned planes into battle.

Unveiled Sept. 8 at Northrop's facility in Palmdale, California, the Model 437 — a stealthy jet with a 3,000 mile range — is a collaboration between the company and Scaled Composites.

Scaled Composites also revealed a new variant

of its Model 401 technology demonstrator that can be operated in autonomous mode.

Executives said the platforms will be offered for two autonomous aircraft technology programs — the U.S. Air Force's Skyborg and the United Kingdom's Project Mosquito.

The Skyborg program is one of the Air Force's top science-and-technology priorities under its "Vanguard" initiative to deliver game-changing capabilities to warfighters. The aim is to acquire relatively inexpensive, attritable unmanned aircraft that can leverage artificial intelligence and accompany manned fighter jets into battle. Contractors are competing for $400 million worth of delivery orders for prototypes.

Project Mosquito is a British loyal wingman program that aims to fly a platform alongside the F-35 fighter jet, the multirole fighter Typhoon and its replacement, the Tempest.

While there is no full-scale prototype yet for the Model 437, executives are confident that the platform will be part of the next-generation family of unmanned aircraft systems.

"It is the solution" for low cost, attritable aircraft platform sharing, Cory Bird, president of Scaled Composites, told reporters at a media event in Palmdale.

Air Air Force officials have said attritable platforms — meaning low cost, expendable systems — would bring a variety of capabilities to the battlefield, serving as sensors, jammers or shooters.

Bird estimated the per unit cost of the future Model 437 aircraft could reach $5 to $6 million, depending on order volume. He noted that much of the cost comes from the engine, the Williams FJ44, which is needed to reach higher speed and longer range. The price tag for the engine alone would be about $2.4 million, but it could fluctuate depending on the number purchased, he added.

In comparison, manned fighter jets such as the F-35A joint strike fighter have a price tag of around $80 million.

At top speeds, the Model 437 could reach Mach .85, with a cruising speed of about Mach .8. It could fly alongside an F-35 and hold 4,000 gallons of fuel, according to the designers.

Bird said the system would be optimized for the low-cost attritable technology program requirements and "designed itself" based on the needs of the customer.

"It was very important" to adapt the design to gain additional speed and range, he said.

The Model 437 is a "first cousin" to the Model 401, also known as the Son of Ares. The design is similar, but the newer, autonomous plane can fly faster and longer than its more tested counterpart. The Son of Ares, equipped with a Pratt & Whitney JT15D engine, taps out around Mach .6 and is less expensive, Bird noted.

Though the 437 still needs a runway, it only requires a 3,000-foot stretch for takeoff — a shorter distance than most aircraft need to get in the air, noted Richard Sullivan, vice president of program management at Northrop Grumman.

"We see that as runway independent," Sullivan

said.

Both the Model 437 and Model 401 autonomous platforms are options for Skyborg, he said. However, the requirements are still in flux, and the company is waiting on direction from the Air Force, he said.

"We're looking forward to upcoming customer engagements," Sullivan said. "The customer has been tight-lipped."

Advances in manufacturing technology such as digital engineering and low-cost production techniques ensured the quick development of the new platforms, he noted. Sullivan said Northrop Grumman's embrace of these new techniques will allow it to meet requirements when they are more solidified.

"We're in a good position because of our capabilities that we have with our digital engineering [and] digital transformation," he said. The company has "some really fantastic modeling and simulation capabilities."

Sullivan added that new unmanned platforms will be critical to keeping up with the rapid pace of advancements near-peer competitors are making.

"Adversaries are narrowing the technological advantage the U.S. and its allies have maintained," he said. "Using a family of systems approach" is the most effective way to take on new threats, he said.

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Further Reading

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IAF Celebrates 89th Air Force Day on October 08, 2021




Indian Air Force Day 2021: Know its history, significance, theme and some interesting facts about the Indian Air Force

https://www.indiatoday.in/information/story/indian-air-force-day-2021-know-its-history-significance-and-interesting-facts-about-indian-air-force-1855214-2021-09-21

Here's the IAF's official 2021 Air Force Day film: https://twitter.com/livefist/status/1445417523009048581?s=20

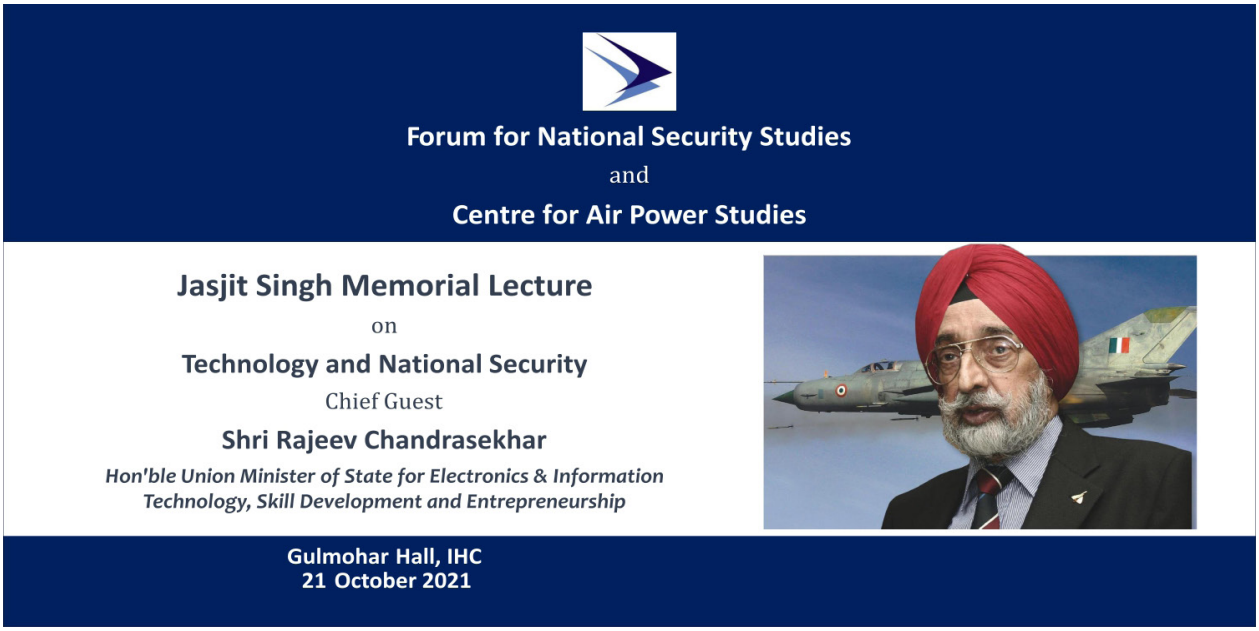
Visit IAF at https://indianairforce.nic.in/

Glimpse of 89th Indian Air Force Day celebrations at CAPS

CAPS conducted the Jasjit Singh Memorial Lecture on 'Technology and National Security' on October 21, 2021

Shri. Rajeev Chandrasekhar

Hon'ble Union Minister of State for Electronics & Information technology, Skill Development and Entrepreneurship delivered the lecture



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John Glenn...
As I hurtled through space, one thought kept crossing my mind - every part of this rocket was supplied by the lowest bidder.

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