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> *"Since the air, space, and cyber domains are increasingly interdependent, loss of dominance in any one could lead to loss of control in all"*
>
> *- Gen T. Michael Moseley*

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Opinions and Analysis

Indo-US Engine Deal will be a Major Technological Boost

Air Marshal Anil Chopra (Retd)
Director General, Centre for Air Power Studies |

14 Jume 2023

Source: India Strategic | https://www.indiastrategic.in/indo-us-engine-deal-will-be-a-major-technological-boost/

F 18 Super Hornet fighter jet

Prime Minister Narendra Modi's forthcoming state visit to the US has very significant strategic undertones. Other than the ceremonials attached to a head-of-government's visit, including a state dinner in the White House, the PM will address the Joint Session of the Congress.

Clearly President Joe Biden is laying the red-carpet to woo India and bring it closer in the West's geo-strategic fold. The West needs the rising India, to counter China which is not only trying to challenge USA's unipolar status, but is spitting fire and flexing muscles in the Indo-Pacific, against all its neighbour minus North Korea. The Ukraine conflict has also pitted the US and its allies against India's traditional friend Russia, and Washington wants to wean it a little away.

Of immediate interest in the India-US matrix are the Defence Technology and Trade Initiative (DTTI) related deals. After years of back channel discussions, US has offered to make the GE F414 engine through a joint venture with HAL in India. On offer reportedly is 100 percent Transfer of Technology (ToT). The very significant deal is expected to be signed during the PM visit. Spade work for the same has been done during US Defence Secretary Lloyd Austin recent visit to India.

Geostrategic Indo-US Closeness

One policy objective of the US administration is to strengthen the capacity of the Indian military to play a key role in countering China. Chinese regional belligerence has brought strategic congruence between India and USA. The two are well connected through QUAD. The US has supported India's admission into multilateral export control regimes like Nuclear Suppliers Group (NSG), Missile Technology Control regime (MTCR), Wassenar Arrangement, and Australia Group. US has been selling high-end military equipment to India since 2004 when Raytheon supplied the Weapon Locating Radars for the Indian Army. The two countries have signed logistics and communications compatibility agreements like LEMOA, COMCASA, and BECA that support inter-operability between militaries. There are regular Summit and 2+2 Minister level meetings between them.

Indo-US Military Aviation Connect

Since 2008, USA has been the major supplier of airborne platforms to India. IAF acquired the Lockheed Martin C-130J-30 Super Hercules aircraft in 2008 for special operations, and Indian Navy received the Boeing P-8I Poseidon. The IAF inducted three specially equipped Boeing 737 Business Jet (BBJ), and two custom-built B-777 for VVIP duties. Boeing C-17 Globemaster III strategic airlift military transport aircraft, Boeing

Apache Longbow AH-64E attack helicopters, and Boeing CH-47 D/F Chinook heavy-lift helicopters have all joined the IAF.

In June 2017, the US State Department approved the sale of 22 General Atomics MQ-9 Guardian/Predator-B long-range unmanned combat aerial vehicle (UCAV) drones to India. Two of these sophisticated drones have been on lease with the Indian Navy since 2020. The case for procuring 10 each for the three armed forces is under process although the numbers may change. There is a possibility that a contract may be inked during Indian PM's forthcoming visit.

Why the Aero-Engine is Important

An aircraft engine has the most complex technologies in an aircraft. It has to operate very efficiently from the ground-level to very high-altitudes under changing atmospheric conditions. It has to operate from zero to supersonic speeds, and under high positive and negative 'g' conditions. Many engine components have to operate at high RPM and at very high temperatures. All this requires very special design and materials. A modern engine's life could be a few thousand hours of operation. More often, the aircraft engine costs nearly one-third of the total cost of the aircraft.

In view of the complexities, there are very few engine manufacturers in a few advanced countries. And they are unwilling to share the technologies, which in any case are controlled by their respective governments.

Even though the F 414 is a relatively old engine, sharing its technology with India required approval of the US Departments of State and Defense, and of course, the President of the US of A.

Major Engine Manufacturers

The turbofan engine market is dominated by a handful of mostly western players. They manufacture both military and civil engines.

The top four aircraft turbofan engine manufacturers are Pratt & Whitney, Rolls Royce, GE Aviation, and Safran. GE and Safran of France have a joint venture, called CFM International for civil aircraft. Pratt & Whitney also has a joint venture, International Aero Engines, with Japanese Aero-engine Corporation and MTU Aero Engines of Germany.

Then, Pratt & Whitney and General Electric have a joint venture, Engine Alliance, selling a range of aircraft engines. Honeywell Aerospace makes smaller engines for executive jets and UAVs.

Russians make mainly military engines and often depend on the West for commercial aircraft. Chinese companies have been trying to reverse-engineer Russian engines and trying to develop their own through intellectual theft. They have still to succeed, and depend on Western engines for their airliners.

Indian DRDO's GTX-35VS Kaveri Engine

India's Gas Turbine Research Establishment (GTRE) is a Defence Public Sector Undertaking (DPSU). The GTX-35VS Kaveri is an afterburning turbofan project developed by GTRE.

The engine was originally meant to power the HAL Light Combat Aircraft (LCA) Tejas. However, the Kaveri programme failed to satisfy the necessary technical requirements and keep up with its envisaged timelines and was officially delinked from the Tejas programme in September 2008. A dry variant of the Kaveri engine is now

being developed to power the DRDO Ghatak UCAV.

The Kaveri engine as developed is continuing in the meanwhile. India's private firm Godrej & Boyce has won the contract to manufacture six more engines to carry out further tests. In February 2023, high-altitude tests of the engine were conducted successfully in Russia. GTRE is aiming to integrate Kaveri to DRDO Ghatak by 2026. Will foreign help be sought to take forward the Kaveri engine for fighter aircraft is still being considered, and will depend on how the evolution goes.

General Electric Engines

General Electric (GE) is a major aircraft engine manufacturer. The GE engines include the CF6 on the Boeing 767, Boeing 747, and Airbus A330. The GE90 is on Boeing 777. The GenX was developed for the Boeing 747-8 and Boeing 787 Dreamliner, and proposed for the Airbus A350. The GE9X currently holds the title for the most powerful engine in the world. The engine features on the Boeing 777X.

GE engines also power many US military aircraft. The F110, is on-board the F-16, and the F404 and F414 engines on F-18 variants. F404 is also powers India's LCA Tejas Mk1 and Mk1A. The F414 has been chosen for the LCA Mk2, and perhaps for initial Advanced Medium Combat Aircraft (AMCA). Nearly 60 F404-GE-IN20 engines were procured for LCA Mk-1 programme and around 99 more engines ordered for Mk 1A.

GE Aerospace has been growing its presence in India for four decades, leveraging joint ventures to gain market share.

Air India placed a massive order for more than 800 GE LEAP engines. The highly fuel efficient and reliable LEAP (Leading Edge Aviation Propulsion) engines entered service in 2016. Over 2500 LEAP engine variants are flying. GE and India's Tata group signed an agreement in 2017 to manufacture LEAP engine components in India for the global supply chain. The two companies had then also announced their intention to jointly pursue military engine and aircraft system opportunities for the Indian market.

Aero-Engine Technology Critical for India

Over the last few decades, India has mastered designing and building aero-structures for both fixed-wing and rotary-wing aircraft but needs much more forward movement. India is also manufacturing airborne radars, avionics and weapons.

However, the aero-engine is much more complex and, despite years of licensed production, and foreign engine overhauls, India has not been able to successfully design one of its own. The handful of manufacturers keep their cards very close to the chest and are unwilling to share technologies that they have acquired after years of research and investment. The only easy way to get these is through Joint Ventures.

The American offer, negotiated by respective National Security Advisers and approved at the President's level, is thus highly significant. Nonetheless, to what level would this technology be actually transferred would emerge after the fine-print of an agreement is reached and read.

American Aviation Presence in India

Boeing has been a pioneering and major player in India's commercial aviation sector for ages, and Air India has recently announced a huge order for Boeing for which President Joe Biden has personally expressed thanks to India.

Boeing has been pushing for its F 18 Super Hornet fighter jet since the tender for 126 MMRCA (Medium Multi Role Combat Aircraft) was floated in 2007. Later the requirement for 57 aircraft for the Indian Navy also came up.

The MMRCA tender was scrapped due to complications and the MoD opted for 36 Rafales as an emergency measure from France for IAF. The fresh proposal for the IAF combat jet requirement is 114, now called Multi Role Fighter Aircraft (MRFA).

Notably, Rafale is also a shipboard fighter and used both by the French Air Force and Navy.

The transfer of F 414 engine technology to India will have huge implications for Boeing as while this engine basically powers the shipboard F 18 for the US Navy, it can also be used for an air force. The then Boeing's head for Defense and Space Chris Chadwick had said in 2012 in an interaction with India Strategic that despite the tail hook, for arrester wires on an aircraft carrier, the F 18 will be a formidable asset for IAF with hardly any change.

Perhaps Boeing will revive and intensify its India campaign for the F 18 Super Hornet again.

In fact, Boeing has been the most successful US company in India in selling military and civil aircraft, and has joint ventures with HAL and many private companies. It is sourcing aero-structures and sub-systems for many airborne platforms supplied to India and for global customers.

Notably, US Lockheed Martin's F-21 is also a contender for India's 114 fighter order. They too have JVs in India to make a large number of aero-structures and precision components for the C-130J airlifter and the S-92 helicopter for deliveries to customers around the world. Lockheed martin is supplying 24 Sikorsky multi-role MH-60R Seahawk maritime helicopters to the Indian Navy. The company is also engaged in supporting many Indian Start-Ups.

American Policy Level Support

India and USA are carrying out bilateral and multilateral military exercises with increasing frequency to improve interoperability.

The India US DTTI has helped push the engine deal, and is exploring new areas of technological development. United States has designated India as Strategic Trade Authorization-1 (STA-1) country that allows purchase of cutting-edge sensitive technologies from US companies. Appropriately, the major focus for the US-India Business Council (USIBC) is also on aerospace and defence.

The India-US Defence Policy Group (DPG) in Washington closely monitors defence cooperation, technology, trade, and military-to-military engagements under various working groups.

Way Ahead

With many single and twin engine aircraft on the horizon for acquisition, the selected engine's reliability has to be very high, and it has to be very fuel efficient and for better range and endurance. Notably, in addition to the High Thrust-By-Engine Weight parameters, acquisition of newer and emerging technologies has to be kept in mind while doing Government-to-Government deals.

It would also be a good idea to get into the Maintenance, Repair and Overhaul (MRO) market by encouraging such tie-ups between foreign OEMs and India's private sector entities.

Air Power at Sea Requires a Big Boost

Group Captain Praveer Purohit | 14 Jume 2023

Source: Financial Express | https://www.financialexpress.com/business/defence-air-power-at-sea-requires-a-big-boost-3125656/

On 31 May 2023, the Indian Air Force (IAF) tweeted about four Rafale aircraft undertaking a six-hour long mission in the Indian Ocean. (Representative image)

In this very month, 81 years ago, the Americans and Japanese fought an intense four-day air-sea battle in the Pacific Ocean. Historians hail it as a decisive engagement that turned the tide of World War II in the Pacific. Known as the Battle of Midway, it was unique for two things. One, it laid to rest Japanese hopes of neutralizing American naval power and two, the decisive role played by air power in its conduct and outcome. The Japanese air attack on Pearl Harbour in December 1941 had brought to fore the deadly punch inherent in aircraft carriers. It also reinforced the offensive characteristic of air power. Preceding the Battle of Midway by a month, the USA and Japanese had fought each other in the Battle of Coral Sea – the world's first air-sea battle with carrier borne air power.

Preceding the Battle of Midway by a month, the USA and Japanese had fought each other in the Battle of Coral Sea – the world's first air-sea battle with carrier borne air power.

Fast forward to present. On 31 May 2023, the Indian Air Force (IAF) tweeted about four Rafale aircraft undertaking a six-hour long mission in the Indian Ocean. On 09 June, the IAF tweeted about, "another outing in the Indian Ocean", this time by Su-30 aircraft that flew for nearly eight hours. Well, the excitement did not end here. The very next day, on 10 June, the Indian Navy (IN) tweeted and released video footage of multi-carrier operations in which both the aircraft carriers- INS Vikramaditya and INS Vikrant operated in tandem along with a significant element of embarked air power assets. Few media reports gave it a "with an eye on China" twist. Air power practitioners in both IAF and IN would have been more circumspect, knowing as they would, the enduring lessons – both doctrinal and tactical from the aforementioned World War II battles. The importance of air power at sea was not lost on the Indian Navy. Its first aircraft carrier, INS Vikrant was commissioned on 04 March 1961, giving our Navy a head start in carrier operations. Acquisition of the next aircraft carrier had to wait till 1987, even as budgetary constraints and a continental mindset prevented it from acquiring the much needed third carrier. To be sure, Indian air power at sea has made steady progress, due to the experience gained in carrier operations, expansion of shore based naval aviation and modification of IAF aircraft with anti-ship capability. Recent acquisitions such as P-8I and MH-60R Helicopter have significantly boosted the maritime air capability. Yet, a dispassionate and professional analysis reveals, to paraphrase Robert Frost, that we have miles to go before we sleep.

Capability development is a function of many factors, primary amongst these being the national strategy and a military strategy that flows from the former. Since India has not enunciated a national security strategy, the exercise of force structuring

and capability development suffers from lack of sanctified guidance. However, examination of factors such as the geography around us, our vast coastline, Exclusive Economic Zone (EEZ), island territories, maritime trade, freedom of navigation in the oceans & Sea Lines of Communication (SLOC) and the Chinese game plan give us indicators on the capabilities that we must develop. With Indian interests extending not just in the Indian Ocean Region (IOR) but also in the Pacific, it is but natural that we must factor the geography and requirements of force projection not just in IOR but in the larger Indo-Pacific.

It is in this context that our air power at sea assumes greater importance. As the Battles of Coral Sea and Midway showed, the outcome of the larger war was decided in air-sea battles in the ocean, far away from the mainland of both Japan and the USA. No system by itself is a game-changer, be it surface combat ships, submarines or ship-based air power. It is the synergistic application of these systems linked with shore-based air power through a robust, secure, reliable and redundant network that acts as a meaningful deterrent to the adversary. It also acts as a comforting factor to friends, allies, and partner countries. The inherent characteristics of air power such as reach, responsiveness, lethality and versatility lend itself as a system of choice to keep own warships out of harm's way and ensure sea control. Quality and quantity of platforms is both important to demonstrate capability and viable deterrence. Let us examine the assets that can be brought to bear in maritime air operations over the Indo-Pacific. The IN presently has only the MiG-29K fighter that is beset with serviceability problems. The Twin Engine Deck Based Fighter (TEDBF) project has still not been accorded approval by CCS which means it won't be on the operational flight line before 2031-32. Sadly, the interim requirement of IN for 57 fighters to be purchased 'off the shelf' was curtailed to 26. Despite trials of the F/A-18 Super Hornet and Rafale-M, government decision on the acquisition is awaited. The present capability may appear adequate for fleet air defence but seems woefully short for strike roles. Shore based fighters of IAF can augment the strike capability but the low strength of IAF fighters and their commitment to many other equally important missions poses a major challenge. Fortunately, the P-8I and the smaller Do-228, accords us good capability in Maritime Reconnaissance (MR). The threat from enemy air power entails us to possess good early warning capability. On land one can deploy several radars and aerostats, but at sea there are limitations on the number of radars (which is a function of the number, types and position of warships deployed) as well as their range. This is sought to be overcome by Airborne Early Warning (AEW). The IN does not have any fixed wing AEW aircraft and hence employs the Ka-31 helicopter for the purpose. Its development began in 1980 and first flew in 1987. The Navy received the first batch of these helicopters in 2003. The mechanically scanned radar has a range of about 150 kms for a fighter class target and it can remain on station for two and half hours. Thus, the only AEW asset with the Navy is obsolescent and its numbers, serviceability and vintage imply the Navy has to do with 'what it has' rather than 'what it must have'. The IAF's AEW/AWACS assets are also limited resulting in an unhealthy situation. The answer lies in ship based fixed wing AEW aircraft that have the advantage of better range, time on station and sensors than their rotary wing counterparts. Sadly none of our aircraft carriers can embark such aircraft for lack of a catapult launch system. The helicopter fleet

of the Navy still flies the vintage but venerable Chetak and Sea King. Its ongoing induction of the MH-60R is a shot in the arm but the numbers contracted (24) are inadequate against the earlier stated requirement of 123.

Air power can deter and destroy multifarious threats in the maritime environment that emanate from under the surface (submarines), surface (warships) and from air. Its ability to do so fast and without getting close to the enemy would undoubtedly give sleepless nights to a nation without adequate air power, even in peacetime. Chinese expansion of air power is progressing at a hectic pace and given its trajectory and our tortoise like pace, we run the risk of spending sleepless nights. Hence, it is imperative that we invest substantially in crafting a potent capability. To do so, here are a few 'must do fast' actions. First, a third aircraft carrier of at least 75000 tonnes, capable of operating fixed wing AEW aircraft and a larger number of fighters requires immediate approval and commencement of work. Secondly, the IAF requirement of 114 Multi Role Fighter Aircraft (MRFA) and IN one of either F/A-18 Super Hornet or Rafale-M must be fulfilled on a 'fast track' basis. Thirdly, the quality and quantity of critical combat enablers in IAF such as Air to Air Refuellers (AAR) and AWACS must be augmented immediately. Fourthly, add more teeth to the anti-submarine/ anti-surface vessel capability by inducting more numbers of MH-60R. Fifthly, increase joint participation by IAF and IN in multinational maritime exercises in the Indo-Pacific. Last, develop a major joint air base in the Andaman &Nicobar Islands and deploy assets that give it full spectrum conventional capability.

Geo-political currents in the Indo-Pacific due to China have destabilized the region. As a Quad member, India can be a major stabilizing player. Neither the littorals in the Indo-Pacific nor China will be swayed by our statements or optics. Hard power is what the Chinese respect. Hard power is also what will enable us to live in peace, focus on stability and ensure development, which is our vision of Security And Growth for All in the Region (SAGAR). Our hard power must bring more value to the table. The more valuable our hard power is to friends, partners, and allies, the better our geo-political standing. Enhancing our air power capability is a good start.

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What is the Long-Term Strategy for Ukraine's Air Force?

John Hoehn and William Courtney | 06 June 2023

Source: Fefence News | https://www.defensenews.com/opinion/commentary/2023/06/06/what-is-the-long-term-strategy-for-ukraines-air-force/

A Sukhoi Su-25 jet of the Ukrainian Air Force flies low on June 16, 2022, in the country's Donetsk region. (Scott Olson/Getty Images)

On May 19, U.S. President Joe Biden announced the country would help train and support the transfer by European allies of F-16 fighter jets to Ukraine. But the F-16s are older aircraft that will need to be replaced in just a few years, so some consideration should be paid now to what's next for the Ukraine Air Force.

The current plan is to begin training experienced Ukrainian pilots while European nations begin to send aircraft from their existing inventories. Many

of these aircraft were purchased in the 1980s. Most have received some upgrades, such as modern networking equipment, allowing aircraft to share targeting data with one another (known as Link 16). However, these aircraft do not have the latest sensors and electronic protections.

Many NATO members fly the F-16 and are ordering new aircraft — mainly the F-35 — to replace their aging fleets. F-35s are slow to arrive, however, meaning that only a handful nations are prepared now to provide aircraft.

The F-16 is designed to fly up to 8,000 hours. They typically fly between 200 and 350 hours a year in peace time. Likely aircraft going to Ukraine could have up to 7,000 hours of flight time. Thus, while F-16s might offer improved capabilities compared to Ukraine's Soviet-era fleet, they will need to be replaced in perhaps four to six years.

One option might be to provide Ukraine with new F-16 Block 70s. This option would keep Ukraine in the F-16 ecosystem — streamlining both training and sustainment — and offer the latest software, radar and electronic protection technologies. It would also allow Ukraine to continue using the weapons it has been given. But this option would be expensive and take years, and the U.S. would surely bear the cost rather than sharing it with allies.

Challenges with New F-16s

Recent F-16 Foreign Military Sales cases to Bulgaria and Slovakia illustrate the cost of modern fighters — nearly $200 million per aircraft. F-16 flight packages include initial stockpiles of parts, munitions and training. Ukraine says it intends to procure between 40 and 100 aircraft. Low-end estimates would amount to $8 billion. With funding for the Ukraine Security Assistance Initiative running out soon, new aircraft, as the Department of Defense has said, might break the bank.

F-16s also cost a substantial amount to operate. According to a recent Government Accountability Office report, operating one F-16 costs $4.6 million a year, or $184 million for a fleet of 40 aircraft. Ukraine's Air Force budget in 2020 was nearly $1.1 billion, which included support for about 70 older, former Soviet fighters.

Time delays are another major consideration. Lockheed Martin moved the F-16 production line from Fort Worth, Texas, to Greenville, South Carolina. This required both training a new cohort of workers to produce the aircraft and the installation of machine tooling.

Slovakia, for example, placed orders for F-16s in 2018, but its first delivery will occur only in 2024, or five to six years from contract award to aircraft delivery.

Are there other Options?

European allies may receive F-35s over a period of some years. This means they could continue for some time to transfer used F-16s, allowing Ukraine access to a flow of these aircraft for a decade or more. This option would allow for continued allied burden-sharing.

This also makes sense in a strategic context since Russia's war on Ukraine may be viewed as an existential challenge to European security.

There might be other options for combat fighters, such as the Saab Gripen, the Dassault Rafale and the Eurofighter Typhoon.

The Gripen is expensive to buy but cheaper to operate than the F-16. In recent years, Rafale

aircraft have outsold F-16s on the international market, implying improved capabilities. The Eurofighter might offer the most advanced capabilities compared to the other options.

These aircraft could be available sooner than new F-16s and might offer some improved capabilities compared to older F-16s. Introducing multiple Western combat aircraft into Ukraine's Air Force might offer some improved capabilities, but at the cost of sustainment and training challenges.

Europeans may be unlikely to finance the provision of new aircraft for Ukraine, but might be willing to provide used aircraft. Ukraine could end up with a used fleet of multiple aircraft with different maintenance, repair and overhaul requirements.

It is encouraging that Ukraine might receive F-16s to improve its combat capabilities. Over the longer term, Ukraine may seek a continuing flow of used F-16s and possibly of one or more European combat fighters. Western policymakers might begin thinking now about what the Ukrainian Air Force may require in the future, especially if the Russian threat remains acute.

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Air Power

12 Countries To Participate In IAF's Biggest-Ever Exercise

Mayank Singh | 30 June 2023

Source: News India Express | https://www.newindianexpress.com/nation/2023/jun/30/12-countries-to-participate-in-iafs-biggest-ever-exercise-2589987.html

Representational image. (File Photo | Shekhar Yadav, EPS)

NEW DELHI: The Indian Air Force is preparing to host its biggest-ever multinational exercise, which will see participation from some of the most advanced air forces in the world.

Indian Air Force's 'Tarang Shakti' exercise is likely to bring together the frontline aircraft, including combat jets, transport aircraft and airborne warning and control system aircraft.

"The exercise, to be held in the last quarter of this year, is named 'Tarang Shakti'. Air forces of 12 countries are to participate, with six nations joining with their air assets and the other six will be joining as observers," said a source privy to the information.

The exercise is likely to bring together the frontline aircraft, including combat jets, transport aircraft, mid-air refuellers, and airborne warning and control system aircraft. All the preparations for the exercise in the Rajasthan sector have been done and the approval of the government is expected soon.

Sources in the defence and security establishment hinted that the advanced air forces,

including those of the Quad nations, United States, Japan and Australia in addition to that of France and the United Kingdom, are the ones sending their aircraft for this exercise.

A major exercise like Tarang Shakti will lead to better professional interactions, enrich the employment philosophy of the forces and get valuable insight into the participating contingents' best practices, said the source. The Indian Army and Navy have hosted multilateral exercises in the past. The Multinational maritime exercise Milan-22 saw the participation of 40 countries. Indian Army held the Africa-India Field Training Exercise-2023 in Pune in March this year with the participation of 25 African nations.

The armed forces of India have been participating in multiple bilateral and multilateral exercises and their professional prowess has been well-acknowledged. In the months of April and May, the IAF's air warriors were part of bilateral and multilateral exercises. In April, the Indian Air Force went to France to participate in Exercise Orion at Mont-de-Marsan, an air force base of the French Air and Space Force (FASF). For the first time, Indian Air Force's four Rafales participated in an overseas exercise.

Besides the IAF and the FASF, air forces from Germany, Greece, Italy, Netherlands, the United Kingdom, Spain and the United States of America participated in this multilateral exercise. Also, Exercise Cope India 23 was held at air force station Kalaikunda in April between the Indian Air Force and the United States Air Force. Personnel from the Japanese Air Self Defence Force were present as observers.

Grounds Prepared for Event in Western Sector

Indian Air Force's 'Tarang Shakti' exercise is likely to bring together the frontline aircraft, including combat jets, transport aircraft, mid-air refuellers, and airborne warning and control system aircraft. All the preparations for the exercise in the Rajasthan sector have been done and the approval of the government is expected soon.

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'Machines, Humans to Work in A Symbiotic Way,' says Indian Air Force Chief, Calls for "Evolved Approach" to Fight Wars

Fareha Naaz | 28 June 2023

Source: Live Mint | https://www.livemint.com/news/machines-humans-to-work-in-a-symbiotic-way-says-indian-air-force-chief-calls-for-evolved-approach-to-fight-wars-11687936920338.html

Indian Air Force Chief Marshal VR Chaudhari highlights the need for to prepare future military leaders to combat future wars

Indian Air Force (IAF) Chief Marshal VR Chaudhari stressed the need for the IAF to adopt a forward-looking approach in preparing future military leaders to effectively navigate the challenges with "accelerated technology infusion" and be ready to "fight the tomorrow's wars." Speaking at a capstone seminar organized by the IAF and Centre for Air Power Studies, Air Chief Marshal VR Chaudhari delivered a keynote address on the subject.

Highlighting the impact of new technologies on the revolution in military affairs, Chaudhari

said “The impact of new technologies on the revolution in military affairs has made us to sit up and acknowledge the fact that new investments in military concepts would have to be made. The new ideas and organizational approaches must be preceded by an evolved approach to cerebral preparation of future military leaders."

Recognizing the technological and numerical edge of adversaries, he emphasised the significance of nurturing an intellectual edge among individuals, enabling them to outthink, outplan, and outsmart the enemy. Chaudhari suggested that focused self-learning, supported by educational institutions like the College of Air Warfare (CAW), could foster this intellectual edge. The course was organised at College of Air Warfare, IAF's premier institute for Air Power Studies

Chaudhari also emphasized the need to blend formal learning with curated self-learning programs, given the evolving nature of warfare and the growing symbiotic relationship between humans and machines. He said, “The impact of emerging technologies and the appreciation that machines and humans have to work in a symbiotic way has to be seen as a requirement." He further mentioned the potential requirement to re-educate generations of officers in the coming years to ensure everyone stays abreast of the accelerated infusion of technology.

Referring to the book "Makers of Modern Strategy: Military Thought from Machiavelli to Hitler," Chaudhari highlighted the relevance of grand strategy and the need for the military to study, analyse, and evolve strategies to effectively address future conflicts.

The Capstone Seminar served as a platform to showcase the learning objectives of the WASP and enable IAF leadership to validate the desired outcomes of the program. Participants presented papers on contemporary topics related to the application of air power in recent conflicts and the evolving doctrinal precepts that emphasise the pivotal role of air power in national security.

The WASP was conceptualized by the IAF to develop a cadre of mid-career air power practitioners equipped with strategic acumen and a profound understanding of warfare history and theory. The program aims to enhance participants' doctrinal vision and cultivate their ability to construct effective strategic arguments. It also seeks to refine their capacity to connect diverse thoughts and theories within a comprehensive whole-of-government approach to statecraft.

The WASP was conducted at the College of Air Warfare (CAW), the premier institute for Air Power Studies in the IAF.

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Emergency Drills: IAF Jets Touch Down on Purvanchal Expressway Airstrip

24 June 2023

Source: Hindustan Times | https://www.hindustantimes.com/cities/lucknow-news/emergency-drills-indian-air-force-fighter-jets-test-airstrip-at-lucknow-s-purvanchal-expressway-after-19-months-101687619889203.html

The Indian Air Force's fighter jets touch the airstrip of Purvanchal Expressway on Saturday. (ANI)

Various types of aircraft took part in the exercise, including fighter jets, transport aircraft and helicopters. Civil and military functionaries were working in close coordination towards achieving greater synergy for this training exercise. They performed familiarisation drills, go-arounds and landings, said Prayagraj defence PRO, Sameer Gangakhedkar

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"Notifications regarding diversion of traffic had been issued by state government officials in advance. Various types of aircraft took part in the exercise, including fighter jets, transport aircraft and helicopters. Civil and military functionaries were working in close coordination towards achieving greater synergy for this training exercise. They performed familiarisation drills, go-arounds and landings," said Prayagraj defence PRO, Sameer Gangakhedkar. According to reports, Jasjeet Kaur, district magistrate of Sultanpur had informed that nearly 10 aircraft performed touch and go exercises on the airstrip with one transport aircraft testing for landing on the airstrip as well.

"This is an emergency exercise performed by the IAF to check the quality and strength of the airstrip so that emergency jets may easily land and go on the airstrip," the defence PRO said. Sukhoi fighter jets were also supposed to be a part of the exercise, but could not fly to the airstrip due to bad weather as the aircraft would be coming in from Bareilly. Senior IAF officials and ground staff were present at the programme.

The event was handled by the Airforce Gorakhpur team on behalf of Central Air Command of the Indian Air Force and the UPEIDA (Uttar Pradesh Expressways Industrial Development Authority).

The Prime Minister had inaugurated the 34-km- long expressway and the 5-km- long airstrip at Akhalkiri Karwat in Sultanpur in November of 2021, when it had been constructed.

Traffic was diverted, movement stopped and all dividers removed from this area ever since the repair began earlier this month. They will be back in place from midnight on Sunday, now that the drills are over.

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Indian Air Force Inducts Indigenised ALS-50 Loitering Munition

John Hill | 06 June 2023

Source: Air Force Technology | https://www.airforce-technology.com/news/indian-air-force-inducts-loitering-munition/

South Block of Central Secretariat, where the Indian Ministry of Defence is located. Photo via Shutterstock.

The Indian Air Force (IAF) has inducted the ALS loitering munition.

The ALS-50 is an advanced weapon system with a unique vertical take-off and landing (VTOL) capability, versatility and adaptability, which allow it to engage air defence systems, ground and naval targets.

The system is produced domestically by the Mumbai-based Tata Group. The ALS-50's induction demonstrates India supporting its domestic defense industry.

The Indian armed forces seek to benefit from the country's sophisticated indigenous technologies. The move will enhance the IAF's operational capabilities by enabling it to conduct swift precision strikes from any terrain, says GlobalData, a leading data analytics company.

GlobalData's latest report, "The Global Military UAV Market 2023–33", reveals India's loitering munition segment is valued at $397m in 2023 and will grow at a compound annual growth rate (CAGR) of 3.7% to reach a value of $568.5m by 2033.

The development and procurement of next-generation loitering munitions constitute a key component of the modernisation drive undertaken by the IAF.

With the increase in complexities and threat levels on the battlefield, the induction of loitering munitions is aimed at improving the effectiveness of the military's engagement during sensitive operations.

India's Defence Industrial Base And Modernisation

The Asia-Pacific is projected to lead investment in uncrewed aerial vehicles (UAVs), garnering a share of 34% of the total global military UAV market over 2022–32. Countries such as China and India are major contributors to investment in this region.

GlobalData says that India's defence industry is sophisticated enough to integrate technologies such as artificial intelligence (AI) and swarm technology to enable a higher level of autonomy in UAV operations.

"The procurement of ALS-50 demonstrates India's dedication to military modernisation by attaining self-reliance in defence procurement. It will help to strengthen India's air power and deter aggression from its adversaries," Harpreet Sidhu, Aerospace Analyst at GlobalData, comments.

UAVs at the Moment

The Russia-Ukraine war, have demonstrated the evolving role of loitering munition in modern warfare, with countries procuring them in significant numbers for augmenting the identification and destruction of potential threats.

According to the UK Ministry of Defence's updates on the conflict in eastern Europe, Russia

has launched more than 300 Iranian Shahed UAVs against Ukraine during May alone. Ukraine has neutralised approximately 90% of them, which leaves the UAV market a lot of room for development against the various types of air defence systems we currently see in Ukraine.

The geopolitical tensions in the Asia-Pacific region are driving countries like Taiwan, Japan, India, and Australia to invest in acquiring loitering munitions to assert their technological dominance over their adversaries

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IAF Elated Over F-414 Engine Deal, Poses Questions on Chinese Jet Engines

Shishir Gupta | 29 June2023

Source: Hindustan Times | https://www.hindustantimes.com/india-news/iaf-elated-over-f-414-engine-deal-poses-questions-on-chinese-jet-engines-101688015832851.html

PM Narendra Modi at Capitol Hill on June 22.

The armed forces and national security planners are elated with GE-HAL F-414 engine manufacturing deal as the proven high-performance engine is said to be technologically much superior to the Chinese indigenously produced jet engine WS-10, which itself is a derivative of the Russian AL-31 series engine that powers the SU-30 MKI fighters.

Described as Doval Deal by US Defence Secretary Llyod Austin, the F-414 is a high performance proven engine as compared to indigenous Chinese WS-10 engine.

After talking to national security planners, former Indian Air Force chiefs and fighter pilots, the Hindustan Times has learnt that though the Chinese fighters including the J-20 are flying on derivatives of Shenyang WS-10 engines, intelligence reports and assessments indicate that the PLA Air Force is struggling with serviceability, downtime, and performance of the engine. China is now testing WS-15 engine on its J 20 aircraft, which will give the fighter a "super cruise (flying at supersonic speeds without use of afterburner and hence lowering the heat signature of the platform)" capability which is a must for a stealth fifth generation fighter.

"It is quite evident that the Chinese reverse-engineered the Russian AL-31 engine to produce the WS-10 series of jet engines. The Indian assessment based on performance of Chinese aircraft in Pakistan inventory and PLAAF aircraft shows that the engine is facing issues albeit it is flying and performing. The Chinese are prone to overstating the performance of their fighters through the state owned media," said a former IAF chief. The PLAAF brought in the J-20 fighters into the western theatre command at the height of the stand-off in East Ladakh to counter the newly acquired Indian Rafales but the so-called fifth generation fighter did little flying and was only used to deter the IAF from any adventure.

While India too has been unsuccessfully trying to develop its own indigenous engine since 1996, the national security planners are pleased with GE's offer to produce F-414 engines in India under transfer of technology to power Tejas Mark II and perhaps upgrade it to manufacturing a higher thrust engine at a later stage. With the Tejas Mark II demonstrator with GE-414 engine ready to take to the skies next year,

the IAF, DRDO and the HAL are on the same page on the high-performance capability of the American GE-414 engine.

"While there is no doubt that the Chinese capability on jet engine manufacturing is growing by the day, no neutral air force would buy a WS-10 engine as its first choice. Even though the Chinese system is opaque, the jet aircraft of Chinese origin with the Pakistan Air Force are facing downtime and serviceability issues. Although the proof of the pudding lies in eating, the Chinese engine would be 60 percent of what the PLAAF is projecting as they still rely on Russian fighters to show their muscle against Taiwan," said a top fighter pilot.

With India planning to manufacture some 500 GE-414 engines to power six squadrons of Mark II fighters, the IAF should be in fighting fit condition towards the end of the decade as aircraft of Russian origin like MiG-29 fighters are phased out and the indigenous Tejas series of fighters inducted.

While India has been negotiating with the US on manufacture of F-414 jet engines under 100 per cent TOT since 2012, it was only effort by former DRDO, IAF chiefs led by National Security Advisor Ajit Doval under the guidance of Prime Minister Narendra Modi that clinched the deal with Biden administration this month. No wonder it is called the Doval Deal in Washington.

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India Successfully Tests Sea-Based BMD Interceptor, Joins Elite Club

22 Apr 2023

Source: IMR India | https://imrmedia.in/india-successfully-tests-sea-based-bmd-interceptor-joins-elite-club/

India successfully tests sea-based BMD interceptor missile on 22 April

The DRDO and Indian Navy on 22 April, successfully conducted a maiden flight trial of sea-based endo-atmospheric interceptor missile off the coast of Odisha.

The Defence Research and Development Organisation (DRDO) and Indian Navy, on 22 April, successfully conducted a maiden flight trial of a sea-based endo-atmospheric interceptor missile off the coast of Odisha in the Bay of Bengal. According to a statement by the defense ministry, the purpose of the trial was to engage and neutralize a hostile ballistic missile threat, thereby elevating the country into the elite club of nations having Naval Ballistic Missile Defence (BMD) capability.

"Prior to this, DRDO has successfully demonstrated land-based BMD system with capability to neutralize ballistic missile threats, emerging from adversaries," the statement added.

Defense minister Rajnath Singh congratulated DRDO and Indian Navy for achieving the feat. DRDO chief Samir V Kamat also complimented the teams involved in the design and development of the missile. "He said that nation has achieved

self-reliance in developing highly-complex network-centric anti-ballistic missile systems," the statement said.

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Space

India's Ambitious Space Programme Receives Boost as US Plans Collaboration for Human Space Flight

23 June 2023

Source: The Week | https://www.theweek.in/news/sci-tech/2023/06/23/human-space-flight-india-and-us-collaborate-to-send-indian-astro.html

International Space Station

India and the United States have announced plans to collaborate on sending an Indian astronaut to the International Space Station (ISS) in 2024. The announcement was made by US President Joe Biden following a meeting with Indian Prime Minister Narendra Modi. President Biden highlighted the extensive cooperation between the two nations in various fields, including healthcare advancements and human space flight.

The collaborative effort to send an Indian astronaut to the ISS demonstrates the strengthening ties between India and the US in space exploration. This partnership aligns with India's ambitious space program, which aims to launch its maiden human space flight mission, Gaganyaan, into a low Earth orbit by the end of 2024 or early 2025. If successful, the Indian astronaut's journey to the ISS would likely take place before the Gaganyaan project.

Furthermore, Prime Minister Modi revealed that India has decided to sign the Artemis Accords—an agreement grounded in the Outer Space Treaty of 1967—further cementing their commitment to space exploration. The Artemis Accords serve as a non-binding framework to guide civil space exploration in the 21st century and support the US-led initiative to return humans to the moon by 2025. The ultimate objective of the Artemis program is to expand space exploration to destinations like Mars.

In addition to the space collaboration, India and the US are also partnering in other areas of mutual interest. The two countries are working together to build a semiconductor ecosystem that promotes supply chain diversification. US companies, including Micron Technology and Applied Materials, have announced significant investments in semiconductor assembly and test facilities in India. These initiatives aim to bolster India's semiconductor workforce and strengthen the global supply chain.

Moreover, India's membership in the Mineral Security Partnership, led by the US State Department, will enhance critical minerals' supply chain resilience for both nations. This collaboration supports the pursuit of climate, economic, and strategic technology goals.

The Indo-US quantum coordination mechanism has been established to facilitate increased collaboration in advanced computing, artificial intelligence, and quantum information science. The two countries have also signed an implementation arrangement on artificial intelligence, advanced wireless, and quantum technologies. These initiatives seek to promote research partnerships, industry collaboration, and

knowledge exchange in these cutting-edge fields.

Additionally, India and the US are cooperating on the development of advanced telecommunications technologies, including 5G and 6G. The partnership includes trials and rollouts of Open Radio Access Network (RAN) systems in both countries. The US International Development Finance will provide support to promote these deployments in India.

The collaboration between India and the US extends to people-to-people ties and higher education. Leveraging the talent in STEM fields, both countries are establishing a university network to foster research partnerships and exchanges in agriculture, energy, health, and other areas of global significance.

The extensive collaboration across multiple sectors highlights the depth and breadth of the partnership between India and the United States, ushering in a new era of cooperation in science, technology, space exploration, and beyond.

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The Republic of India Signs the Artemis Accords

24 June 2023

Source: State.gov | https://www.state.gov/the-republic-of-india-signs-the-artemis-accords/

In a ceremony held at the Intercontinental Willard Hotel in Washington, D.C. on June 21, 2023, the Republic of India became the 27th nation to sign the Artemis Accords, demonstrating its commitment to sustainable and transparent space activity. Indian Ambassador to the United States Taranjit Sandhu signed on behalf of the Government of the Republic of India.

NASA Administrator Bill Nelson, Director Valda Vikmanis-Keller of the State Department's Office of Space Affairs, Deputy Assistant Secretary Nancy Jackson of the State Department's Bureau of South and Central Asian Affairs, Associate Administrator Karen Feldstein for International and Interagency Relations at NASA, Director Sean Wilson of the National Space Council's International Space Policy, and Assistant Director Matthew Daniels of the White House Office of Science and Technology Policy, participated on behalf of the Government of the United States. Ambassador Sandhu, Administrator Nelson, and Deputy Assistant Secretary Jackson delivered remarks noting the significance of India signing the Artemis Accords.

The Artemis Accords, which are grounded in the Outer Space Treaty of 1967, are a set of non-legally binding principles to guide sustainable civil space exploration. These principles, which include transparency, peaceful purposes, registering of space objects and release of scientific data, help make the space environment safer and more predictable, and allow all nations

– even those without space programs – to benefit from the scientific data obtained in space.

From the original eight nations in 2020, Artemis Accords signatories now hail from every part of the globe and possess a variety of space capabilities and interests. By working together, we can advance the beneficial use of outer space for all humankind.

The Artemis Accords signatories are: Australia, Bahrain, Brazil, Canada, Colombia, Czech Republic, Ecuador, France, India, Israel, Italy, Japan, the Republic of Korea, Luxembourg, Mexico, New Zealand, Nigeria, Poland, Romania, Rwanda, Saudi Arabia, Singapore, Spain, Ukraine, the United Arab Emirates, the United Kingdom, and the United States..

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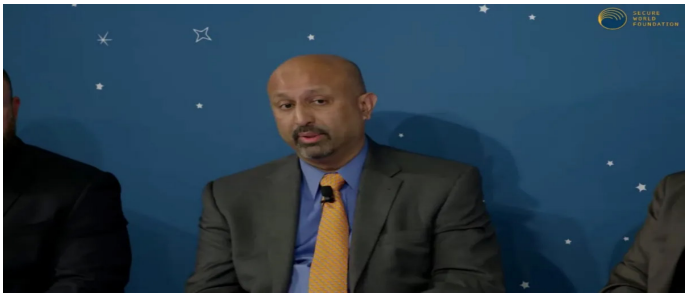
Project Kuiper Urges Regulators to Focus on Satellite Maneuverability Rules

Jason Rainbow | 15 June 2023

Source: Space News | https://spacenews.com/project-kuiper-urges-regulators-to-focus-on-satellite-maneuverability-rules/



Kalpak Gude, Project Kuiper's head of domestic regulatory affairs, discussed orbital safety issues at the 5th Summit for Space Sustainability in New York. Credit: WEF / Summit for Space Sustainability webcast

TAMPA, Fla. — Governments should consider requiring satellites over a certain altitude to be maneuverable to improve space sustainability, according to an executive for Amazon's proposed Project Kuiper constellation.

Kalpak Gude, Project Kuiper's head of domestic regulatory affairs, urged governments June 14 to encourage more satellites to have "maneuverability-with-an-outcome capability" — either through regulations or best practice guidelines — as orbits become more congested.

"I think looking at that and [determining] what altitude is that required, based on a lot of different factors out there, to ensure long-term sustainability … is an area that government should look at," Gude said during the 5th Summit for Space Sustainability in New York.

Project Kuiper is equipping the 3,200 broadband satellites it plans to start deploying by the end of this year to low Earth orbit (LEO) — at an altitude of around 600 kilometers — with active propulsion systems.

The venture says hall-effect thrusters and a propulsion tank on each satellite would enable it to actively maintain a safe distance from other spacecraft in LEO and avoid debris, rather than rely on gravitational forces.

Two prototypes slated to fly in the coming months on the inaugural flight of United Launch Alliance's (ULA) Vulcan Centaur rocket are designed in part to test the reliability of Project Kuiper's propulsion system.

A recommendation for satellites to be maneuverable when operating above 375 kilometers was part of sustainability guidelines the World Economic Forum (WEF) released June 13.

The recommendations also covered orbital data sharing, financial incentives for sustainable missions, and a target to remove a satellite from LEO no more than five years after reaching the

end of its operational life.

Satellite operators Avanti Communications, EchoStar, GHGSat, OneWeb, Planet, and SES were among 27 companies that endorsed the guidelines on their release.

Amazon and SpaceX, each developing constellations far exceeding all these companies by number of satellites, were not among the signatories.

Amazon told SpaceNews it had helped develop WEF's debris mitigation recommendations but is not yet ready to endorse them as it continues to assess these and other best practice guidelines.

"We are still really in the early phases of learning about operations in LEO that maximize and really value safety," Gude said during the sustainability summit.

However, he said if governments adopt rules that leverage increasing academic and industry research, operators will be more than willing to come on board.

Space companies are spending billions of dollars to deploy satellites, he said, and so "we are incredibly incentivized to control our own behavior and ensure safety" across spacecraft design, launch, operations, and ultimate de-orbit.

"When you invest over $10 billion to build an infrastructure in space, you are not creating it in an environment where you think you are at risk because of bad behavior by yourself or others," he told the conference.

Representatives of the U.S. Federal Communications Commission and the U.K.'s space agency were also on the panel and were keen to stress the growing importance of sustainability in their domestic space regulations.

Both countries are modernizing satellite regulations to keep up with the industry's rapid evolution, including rules around emerging applications such as in-orbit servicing, with implications for businesses outside their borders.

Ray Fielding, head of sustainability at the UK Space Agency, said satellite operators licensed in countries with less stringent sustainability requirements could find themselves restricted from providing services in the United Kingdom.

Merissa Velez, chief of the FCC Space Bureau's satellite programs and policy division, said it also looks at "the same information for applicants for U.S. market access as we do for those companies seeking to have a U.S. license."

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Global Aerospace Industry

Ukraine to Get AMRAAM Weapons Under $1 Billion Deal with RTX

Stephen Losey | 21 June 2023

Source: Defence News | https://www.defensenews.com/industry/2023/06/21/ukraine-to-get-amraam-weapons-under-1-billion-deal-with-rtx/

An F-15EX Eagle II fires an AIM-120 AMRAAM in a test of the fighter's added weapons stations. (U.S. Air Force)

WASHINGTON — The U.S. Air Force has awarded a nearly $1.2 billion contract to the missiles and defense sector of RTX, until recently known as Raytheon Technologies, to produce the next lot of AIM-120 Advanced Medium Range Air-to-Air Missiles.

Part of the firm-fixed-price deal — the largest ever awarded for AMRAAM weapons — will cover missiles for sale to multiple foreign allies and partners, including Ukraine.

RTX will produce AMRAAM weapons, telemetry systems and spare parts in Tucson, Arizona, under the contract, as well as provide production engineering support, the Pentagon said in a statement announcing the deal. The company is expected to finish work on Lot 37 of the missiles by the end of January 2027.

RTX said in its own statement the contract will be for the D3 and C8 versions of the AMRAAM, which have the latest F3R — which stands for form, fit, function refresh — upgrades to its software and hardware. Those AMRAAMs also have improved circuit cards and other hardware in their guidance systems.

The Pentagon said about 39% of the value of the contract, or $449 million, will be for foreign military sales to 18 nations, including the United Kingdom, South Korea, Italy, Japan, Singapore, Saudi Arabia and Canada.

Ukraine fires AMRAAMs from its National Advanced Surface-to-Air Missile System batteries. The U.S. Army in December 2022 awarded RTX another contract worth up to $1.2 billion to deliver six NASAM batteries to Ukraine.

While the latest contract was awarded by the U.S. Air Force, the U.S. Navy will provide more than $330 million in procurement funds and will receive some missiles from the lot. The Navy will also provide about $5 million in research and development funds.

The Air Force plans to spend more than $351 million in procurement funds on these missiles, as well as another $10 million for research and development, plus and $3.9 million in operation and maintenance funds.

RTX said this will mark the fifth production lot of the upgraded AMRAAMs.

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India's Azista BST Aerospace Launches 1st Runner Satellite on SpaceX Transporter Mission

Ricardo Meier | 26 May 2023

Source: India Today | https://www.indiatoday.in/science/story/indias-azista-bst-aerospace-launches-1st-runner-satellite-on-spacex-transporter-mission-2392363-2023-06-13

The SpaceX Transporter mission launching from Vandenberg Space Force Base. (Photo: SpaceX)

India's Azista BST Aerospace launched its first satellite, ABA First Runner (AFR), onboard the SpaceX Falcon 9 rocket as part of the Transporter-8 Mission.

The company aims to make India a hub for the mass manufacturing of satellites and the successful mission puts it on the path.

The satellite lifted off from Space Launch Complex 4E at Vandenberg Space Force Base in California on Musk's SpaceX rideshare mission.

There were 72 spacecraft, including CubeSats, MicroSats, a re-entry capsule, and orbital transfer vehicles on the rocket alongside India's AFR.

The 80-kilogram satellite was built on a modular bus platform and hosts a wide-swath optical remote sensing payload with both panchromatic & multispectral imaging capabilities.

"AFR represents the first satellite of its size and performance built by the private space industry in India, capable of supporting various critical applications for civilian and defense purposes," the company said in a statement.

The Ahmedabad-based company claims to have a production capacity of at least two satellites per week at its 50,000-square-foot facility.

"Azista BST Aerospace invites researchers and organizations interested in exploring the use of fresh satellite data for various geospatial applications to get in touch with us and take advantage of this exciting opportunity," Director Sunil Indurti said.

Reacting to the successful mission Lt. Gen. AK Bhatt (Retd), the Director General of the Indian Space Association (ISpA) said, "The satellite launched today will enable a variety of critical applications for civilian and defence purposes. This is also a big milestone for the Indian space startup ecosystem as it takes our private industry into the next leap of international collaboration."

"We take great pride in having Azista-BST as an esteemed member of our association, contributing to the advancement of the growing space industry in India," ISpA DG further added.

Azista BST Aerospace said that the company is working to develop the next set of satellites to demonstrate its capabilities with versatile payloads with its modular satellite buses and that Several of these satellites will be launched within the next two years.

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Air India Formalises Deal for 470 Airbus and Boeing Aircraft

Vishnu Som | 20 June 2023

Source: NDTV | https://www.ndtv.com/india-news/air-india-formalises-deal-for-470-airbus-and-boeing-aircraft-4137893

The purchase agreements were signed on the sidelines of the ongoing Paris Air Show.

New Delhi: Air India today signed purchase agreements to acquire 470 aircraft from Airbus and Boeing. The deal, which is worth $70 billion based on list prices, is one of the largest aircraft orders in civil aviation history.

The purchase agreements were signed on the sidelines of the ongoing Paris Air Show. Air India's firm orders include 34 A350-1000, six A350-900, 20 Boeing 787 Dreamliners and 10 Boeing 777X widebody aircraft, as well as 140 Airbus A320neo, 70 Airbus A321neo and 190 Boeing 737MAX narrowbody aircraft.

"This landmark step further positions Air India for long-term growth and success that, we have every hope, will come together to represent the best of modern aviation to the world," said N Chandrasekaran, Chairman of Tata Sons and Air India.

Satair, an Airbus company, and Boeing Global Services will provide Air India with a broad range of solutions to support its fleet of aircraft. These solutions will include parts and maintenance provisioning, digital applications, and modification services.

"Our ambitious fleet renewal and expansion programme will see Air India operate the most advanced and fuel-efficient aircraft across our route network within five years. We are proud to be working with all our partners in this journey to rebuild a global airline which reflects India taking a more confident posture around the world," said Campbell Wilson, CEO & MD, Air India.

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Airbus Wins Record 500-Plane Order from India's IndiGo

19 June 2023

Source: CNBC | https://www.cnbc.com/2023/06/19/airbus-wins-record-500-plane-order-from-indias-indigo.html

An IndiGo airlines passenger aircraft taxis on the tarmac at Chhatrapati Shivaji International airport in Mumbai, India, May 29, 2023.

Europe's Airbus announced the biggest plane deal in history on the opening day of the Paris Airshow on Monday, with an order for 500 narrowbody jets from Indian budget carrier IndiGo.

The multibillion-dollar deal is the largest ever by number of aircraft, eclipsing Air India's provisional purchase of 470 jets earlier this year as India's two largest carriers plan for a sharp expansion in regional travel demand.

The deal follows months of negotiations first reported by Reuters.

"This is just the beginning, there's more going forward. With the growth of India (and) the growth of the Indian aviation market ... this is the right time for us to place this order," IndiGo Chief Executive Pieter Elbers told a news conference.

The aircraft will be delivered between 2030 and 2035.

Efforts by Indian carriers to keep pace with the world's fastest-growing aviation market, serving the largest population, have sent industry records tumbling even though manufacturers are struggling to meet output goals.

Indian carriers now have the second-largest order book, with an over 6% share of the industry backlog, behind only the United States, according to a June 1 report by Barclays.

But some analysts have expressed concern that airlines could be over-ordering jets in pursuit of the same passengers.

After signing the IndiGo deal, Airbus CEO Guillaume Faury said it was premature to start thinking about narrowbody jet production rates higher than the planned 75 per month.

IndiGo, which accounts for nearly 60% of the Indian domestic market, was widely expected to keep Airbus as its supplier of single-aisle jets to squeeze out further economies of scale.

It continues to hold separate talks with Airbus and rival Boeing for 25 widebody planes, which could either be Airbus A330neos or Boeing 787 jets, sources have said.

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Indian Aerospace Industry

IAF Plans to Build 96 Fighter Jets in India

15 June 2023

Source: IMR India | https://imrmedia.in/iaf-plans-to-build-96-fighter-jets-in-india-2/

Multi-role Fighter Aircraft

Multirole Fighter Aircraft Acquisition

The Indian Air Force has plans of acquiring 114 Multirole Fighter Aircraft (MRFA) under 'Buy Global and Make in India' scheme under which Indian companies would be allowed to partner with a foreign vendor. The Indian Air Force has to rely heavily on these 114 fighter jets for maintaining its superiority over the neighboring rivals Pakistan and China.

Amid a big push for the Aatmanirbhar Bharat scheme by the PM Narendra Modi-led government, the Indian Air Force is planning to acquire 114 fighter jets of which 96 would be built in India, and rest 18 would be imported from the foreign vendor chosen for the project.

As per the plan, after the initial 18 aircraft are imported, the next 36 aircraft would be manufactured within the country and the payments would be made partially in foreign currency and Indian currency. The last 60 aircraft would be the main responsibility of the Indian partner and the government would make payments only in Indian currency. The payment in Indian currency would help the vendors to achieve the over 60 per cent 'Make-in-India' content in the project.

Boeing's F-15EX and F/A-18 Block III Super Hornet, Saab's JAS-39 Gripen, Lockheed Martin's F-21 and Dassault Aviation's Rafale are expected to participate in the tender. Of these, the F 21 and Gripen are single-engine aircraft, while the rest are twin-engines. While the single-engine fighters are cheaper, it is not known whether that will be a consideration for the IAF acquisition.

Interim Plans

The 36 Rafale aircraft procured under emergency orders helped immensely in maintaining an edge over the Chinese during the Ladakh crisis which started in 2020 but the numbers are not enough and more such capability would be required by it. The IAF is highly satisfied with the operational availability of the Rafale fighter jets and wants similar capability in its future aircraft.

The IAF has already placed orders for 83 of the LCA Mk 1A aircraft but it still requires a higher number of capable aircraft as a large number of MiG series planes have either been phased out or are on their last legs.

The fifth-generation Advanced Medium Combat Aircraft project is moving ahead at a satisfactory pace but it will take a lot of time to be able to be inducted in an operational role.

The IAF is also looking for a cost-effective solution for its fighter jet requirement as it wants a plane that is low on operational cost and gives more capability to the service.

Rafale

The main contender is the Rafale fighter which the IAF is already accustomed to, since 36 of

these fighters, bought under a 2016 government to government deal and costing Euro 7.8 billion — are already in use by the IAF.

Known as an omnirole aircraft — one which can conduct complex combat assignments, including ground attacks, beyond visual range (BVR) air-to-air combats or interceptions, during the same sortie — the Rafale fighter is a '4.5 generation aircraft', with a top speed of 1.8 Mach, nearly double the speed of sound.

It is the most potent aircraft currently in use by the IAF, in terms of range, radar and weaponry.

The Rafale is a twin-engine, canard-delta wing, multi-role fighter aircraft, fit for varied purposes, such as reconnaissance, providing ground support to troops, in-depth strikes, and anti-ship strikes.

The Rafale has a ferry range of 3,700 km and is equipped with internal and external fuel tanks. In terms of weaponry, the Rafale has 14 hard points to carry different types of missiles, including the the Meteor air-to-air missiles — which come with a Beyond Visual Range (BVR) of about 150 KMs and the deadly air to surface Scalp which has a range of over 500 KMs.

The Rafale has been used by the French Air Force in multiple campaigns across Afghanistan, Libya, Mali, the Central African Republic, Iraq and Syria.

F/A-18 Block III Super Hornet

Recently featured in the superhit Hollywood film Top Gun: Maverick — which shows actor Tom Cruise manoeuvering the craft to evade enemy's surface-to-air missiles whilst fulfilling a seemingly impossible mission — the F/A-18 Bock III Super Hornet is being touted as a "game-changer" for Indian military, if acquired.

The F/A-18 has been the leading aircraft for the US Navy for nearly four decades. It is designed as both a fighter and attack aircraft and Block III is its latest version. Currently, the US Navy has over 700 F/A-18s, which are operational worldwide. The original Block I Hornet was introduced into service in 1984.

The version under consideration by the IAF— the F/A-18 Block III Super Hornet — is a twin-engine, carrier-capable, multirole fighter aircraft.

Block III comes in two versions, the F/A-18 E which is a single-seater and the double-seater F/A-18 F. Both versions have been built for high-loading and high-stress operations.

A major upgrade in the Block III, from the earlier F/A-18, is its "advanced cockpit system", which is operated via a customisable 10×19-inch touch screen. Essentially, this system has replaced hard displays in the cockpit with iPad-like features. This enables smoother flight operations and decision-making, giving the pilot more time to assess the battlefield.

Further, to store weapons, Block III has an "enclosed, external weapons pod built to carry up to 2,500-pounds of weapons". From the pod, various missiles and bombs can be fired, which include the "AIM 9X Sidewinder air-to-air missile, the AIM 120 Advanced Medium-Range Air-to-Air Missile (AMRAAM), the AGM-154 Joint Standoff Weapon (an air-to-ground missile), the Small Diameter Bomb and the Mark-84 bomb, among others".

Block III has a life of approximately 10,000 flying hours. However, the drawback is that the F/A-18s lack stealth capabilities.

Boeing is waiting for the IAF to come out with its technical requirements before deciding

whether they will offer the Super Hornet or the F-15 EX.

F-15 EX

The F-15 EX is the upgraded replacement of the F-15C. It is referred to as the "Eagle-II". The F-15 EX is also developed by Boeing and is another contender from their portfolio for the MRFA.

The original F-15s were first deployed by the United States Air Force in the mid-1970s. Today's version includes multiple upgrades and enhancements.

Specifically, the F-15EX includes enhancements to "manoeuvrability, acceleration, durability, computing power, and weapons carriage ability of the F-15C".

According to Boeing, the F-15 EX "includes a best-in-class payload, range and speed". Payload refers to the carrying capacity of a jet, including cargo, munitions, etc.

An article published in the Air Force Magazine claimed that the advanced specs of the Eagle-II entail "digital fly-by-wire flight controls, a large area display glass-cockpit, and an APG-82 AESA radar".

Further, the F-15EX is built with an open mission system software, which allows the operating network of the fighters to undergo rapid upgrades and capability enhancements. Ensuring it is never outdated from the latest standards in the industry.

The Congressional Research Service (CRS), a public policy research institute of the US Congress, explains that the F-15EX have "stronger airframes, more powerful processors and advanced flight control systems" than any other fighter operated by the United States Air Force.

The F-15EX is capable of firing AMRAAM. The US Air National Guard conducted a successful firing of the AIM-120D AMRAAM from the F-15EX over the Gulf of Mexico in February 2022.

The F-15 EX also boasts a flying life of 20,000 hours, much longer than the average flying time of fighters, which ranges between 6,000-to 8,000 hours.

F-21

The F-21s are a product of the US defence conglomerate Lockheed Martin.

The F-21 is an adapted and advanced version of the F-16 and is specially tweaked by the manufacturer to cater to the needs of the IAF. The F-16 is commonly called the "Fighting Falcon". However, the F-21 is a fighter on paper and has not been manufactured yet.

The F-21 has been touted as a multi-role fighter. From the original, the F-21 retains the nose-mounted radar fit, wide-view canopy, and a single-engine installation.

The F-21 comprises both single-seater and double-seater variants. It includes three underwing hardpoints (the area on an airframe that is used to carry external and internal load). Two of these hardpoints are for reserve fuel tanks, which can be used in case travel ranges increase.

Further, the F-21 also comes with wingtip missile hardpoints, which like the F-15EX support the AIM-20D AMRAAM. It also entails a triple launcher to fire these AMRAAM missiles.

The F-21 is equipped with a retractable fuel probe, an essential element for IAF fighters to

ensure smooth fuelling at their bases.

Saab JAS-39 Gripen

The Saab JAS-39 Gripen is a light, single-engine, multirole fighter aircraft manufactured by Swedish aerospace and defence company, Saab AB.

It was introduced into the Swedish Air Force in 1996 and is described as an "affordable non-stealth aircraft". According to an article published in The Express, UK, the Swedish Air Force currently operates between 1,000 to 2,000 of these fighters.

The JAS-39 was the first fighter to be loaded and capable of firing the Meteor air-to-air missile, a beyond visual range (BVR) weapon, capable of striking targets up to 150 kilometres.

Different variants of the Gripen can carry different loads of meteor missiles. The Gripen-C can carry four, whereas the Gripen E can carry seven.

Alluding to the modern operating system that the Gripen runs on, Saab's website explains, "Gripen's unique avionics architecture is the definition of smart. It means we can reconfigure the inside of Gripen without affecting the airframe. Or put another way, we can rapidly upgrade Gripen's avionics whenever new technology becomes available."

Beyond Sweden, the Gripen is currently operational in the Czech Republic, Hungary, South Africa, and Thailand.

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GE Aerospace Inks Pact with HAL to Co-Produce Engines in India to Power Tejas Fighters

22 June 2023

Source: Bharat Shakti | https://bharatshakti.in/ge-aerospace-inks-pact-with-hal-to-co-produce-engines-in-india-to-power-tejas-fighters/

In an exciting development for the domestic defence industry, GE Aerospace has officially entered into a Memorandum of Understanding (MOU) with Hindustan Aeronautics Limited (HAL) to co-produce fighter jet engines in India. This pact aligns with the Indian Air Force's Light Combat Aircraft Tejas Mk2 program. The landmark deal will allow the joint manufacture of GE Aerospace's F414 engines for fighter jets of the Indian Air Force. This collaboration marks a significant achievement during the official state visit of Indian Prime Minister Narendra Modi to the United States.

GE Aerospace remains actively engaged with the US government to obtain the essential export authorisation required for this venture, said GE in its statement. "This is a historic agreement made possible by our longstanding partnership with India and HAL," said H. Lawrence Culp, Jr., Chairman and Chief Executive Officer of GE and CEO of GE Aerospace.

"We are proud to play a role in advancing President Biden and Prime Minister Modi's

vision of closer coordination between the two nations. Our F414 engines are unmatched and will offer important economic and national security benefits for both countries as we help our customers produce the highest quality engines to meet the needs of their military fleet," he further observed.

Today's agreement marks a significant step forward for GE Aerospace in fulfilling its pledge to manufacture 99 engines for the Indian Air Force under the LCA Mk2 program, claims the US aerospace company. This achievement positions the company favourably to establish a comprehensive range of products within India, encompassing the renowned F404 engine that presently propels the LCA Mk1 and LCA Mk1A aircraft. Moreover, GE Aerospace has been chosen to lead the prototype development, testing, and certification of the AMCA program, utilising our cutting-edge F414-INS6 engine. Additionally, GE will continue collaborating with the Indian government regarding the AMCA Mk2 engine program, the statement stated.

In 1986, GE joined forces with the Aeronautical Development Agency and HAL to advance India's Light Combat Aircraft (LCA) by supplying F404 engines. Over time, GE Aerospace's F404 and F414 engines have played a vital role in the progression and implementation of the LCA Mk1 and LCA Mk2 programs. 75 F404 engines have already been supplied, and an additional 99 engines have been ordered specifically for the LCA Mk1A. As part of an ongoing development initiative for the LCA Mk2, eight F414 engines have already been delivered, according to the company. GE's presence in India includes its research and technology centre, the John F Welch Technology Centre at Bengaluru, which opened in 2000 and its Multi-modal Factory at Pune, which opened in 2015.

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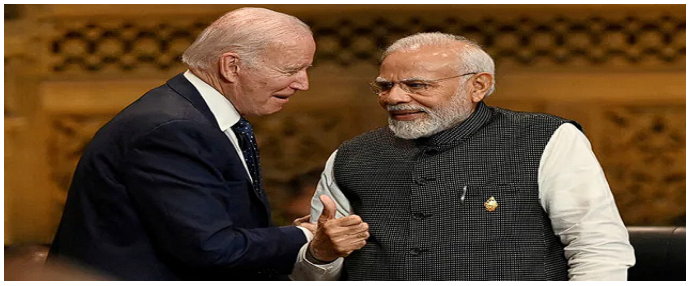
'Breakthrough Moment for Indo-US Ties': General Atomics CEO on MQ9B Drone Deal

26 May 2023

Source: Bharat Shakti | https://bharatshakti.in/breakthrough-moment-for-indo-us-ties-general-atomics-ceo-on-mq9b-drone-deal/



Prime Minister Narendra Modi and US President Joe Biden announced the much-awaited mega deal of General Atomics MQ-9B HALE UAVs on 22 June in Washington. The White House Joint Statement said, "President Biden and Prime Minister Modi welcomed India's plans to procure General Atomics MQ-9B HALE UAVs. The MQ-9Bs, which will be assembled in India, will enhance the ISR (intelligence, surveillance, and reconnaissance) capabilities of India's armed forces across domains. As part of this plan, General Atomics will also establish a Comprehensive Global MRO facility in India to support of India's long-term goals to boost indigenous defence capabilities."

San Diego-based General Atomics will also set up a global maintenance and repair facility in India "to support India's long-term goals to boost indigenous defence capabilities," the

statement said.

Reacting to the drone pact, Vivek Lall, the Chief Executive of General Atomics Global Corporation, called the decision to acquire MQ-9B reaper drones for the Indian Armed Forces a breakthrough moment for the India-US strategic partnership. He said, "PM Modi and President Biden have significantly enhanced the relationship by deciding to acquire MQ9B for the Indian military. This is a breakthrough moment for the India-US partnership, and General Atomics is pleased to be a major contributor in taking it to the next level."

On 15 June last week, the Ministry of Defence approved the acquisition of MQ-9B armed drones from the US during a Defence Acquisition Council meeting chaired by Defence Minister Rajnath Singh. The procurement of these drones holds significance as the Indian government aims to use them to ramp up its surveillance apparatus along the frontier with China and the Indian Ocean region (IOR).

Although the Indian Defence Ministry has not yet disclosed the number of drones to be acquired, with varying estimates ranging from 31 to 18, there was no official word from the Ministry on the Defence Acquisition Council (DAC) about the inter-governmental agreement. But sources in the MoD said the induction of the 31 high-altitude, long-endurance (HALE) Predator-B drones – 15 for the Indian Navy, 8 each for the Army and Air Force have been planned.

It is worth noting that the QUAD countries (US, India, Japan, & Australia) have all operated or currently operate the MQ-9Bs SeaGuardian drones. India presently leases MQ-9Bs for intelligence-gathering operations.

The Navy has deployed two unarmed MQ-9B SeaGuardian drones, on lease from General Atomics from September 2020, for surveillance missions in the Indian Ocean Region. These drones boast an impressive range of 5,500 nautical miles and can remain airborne for up to 35 hours. Their primary purpose has been to conduct surveillance missions, including monitoring troop deployments and infrastructure upgrades along the borders with China. These deployments hold particular significance due to the ongoing military standoff between India and China in eastern Ladakh.

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10 Facts about India's MQ9B Predator Drones Deal

Shishir Gupta | 29 June 2023

Source: Hindustan Times | https://www.hindustantimes.com/india-news/india-mq9b-predator-drone-deal-defence-ministry-united-states-china-101688039452428.html

India will acquire MQ 9B Predator drone from the US.

India is set to negotiate with the United States on the acquisition of MQ9B HALE drones, with New Delhi seeking a competitive deal in the procurement through a foreign military sale process, sources in the defence ministry said.

As India goes ahead to acquire the Predator drones, here are 10 things to know about this deal.

1. According to sources, the ministry has only accorded the Acceptance of Necessity

to acquire 31 MQ 9B HALE Drones, and no serious negotiations have begun now.

2. As of now, only the United States has these drones. China has been trying to acquire it but has not been able to do so. Once procured, these drones will give India new capabilities. The country's adversaries are worried and may try to scuttle the acquisition process, sources added.

3. The next step in the process includes Letter of Request to the Biden administration and getting the Letter of Offer and Acceptance from US govt. This letter will be granted by the US government after approval from the US Congress.

4. Following this, the Contract Negotiation Committee (CNS) will finalise the terms of agreement before it goes for approval by the Cabinet Committee for Security (CCS). Only then the actual price and terms of the contract will be known, sources added.

5. US defence firm General Atomic has offered India 31 MQ9B drones at a price of $ 3.072 billion, which is subject to negotiations. Some of them will be bought off the shelf and some made in India.

6. According to sources, the requirement of 31 drones for the three Services is based on a scientific study of India's needs and requirements while taking into consideration the geographical and maritime neighbourhood and recommended by Integrated Defence Services.

7. The procurement will involve some transfer of technology (ToT). New Delhi is looking at a minimum of 15-20 per cent ToT. The government will negotiate more and will get some critical technologies.

8. The sources added that the acquisition is not against 'Aatmanirbhar Bharat' as the Defence Research Development Organisation (DRDO) is developing Tapas, a drone in MALE category. The MQ9B is a high altitude drone and has long endurance

9. The Indian Navy is already working with ADE and DRDO on TAPAS and the technology also has applications in civilian use – in developing unmanned flights.

10. This agreement will help establish India as a hub for manufacturing drones, sources added.

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Technology Development

Russian S-350 Makes First AI-Assisted Kill

26 May 2023

Source: Indian Defence Industries | http://indiandefenceindustries.in/s-350-makes-first-ai-assisted-kill

The ongoing Russo-Ukrainian conflict is throwing out many firsts. There is a new addition to this long list, an artificial intelligence(AI) assisted interception by Russian surface-to-air system.

According to a report by Russian news agency Sputnik, quoting a well informed source,

the S-350 'Vityaz' intercepted a Ukrainian aircraft all by itself without a man-in-the-loop with the assistance of AI.

"For the first time in the world the Vityaz performed the fully automated detection, tracking and destruction of Ukrainian air targets in combat; the surface-to-air missiles downed several Ukrainian warplanes and unmanned aerial vehicles," said the source to Sputnik, as quoted in the report.

"The automatic mode was implemented on the basis of the principle that a person does not cancel the decisions of the SAM's artificial intelligence elements within the framework of the emerging air combat situation, namely, an operator just did not interfere in the running of the system, thus confirming the operation algorithm chosen by the machine," the source added.

After the AI- assisted kill by Turkish armed drone in Libya, this is another case of AI-assisted weapon launch. The S-350 is the most recently developed SAM system of the Russian forces.

In May 2019, Russian armed forces inducted the S-350 in its arsenal. Based on the S-300PS, the S-350 Vityaz, armed with 9M96E/E2 missiles, is capable of intercepting aerial targets in all direction up to 120km. It is designed to intercept, tactical and strategic aircraft, cruise missiles, unmanned aerial systems and all other kinds of aerial threats. It can also intercept tactical ballistic missiles.

According to Rosoboronexport, the system "is capable of simultaneously repelling strikes of various types of air attack weapons from any direction (circular mode) in the entire range of altitudes of their flight - from extremely low to high altitudes." It is designed to defend administrative, industrial and military facilities from massive strikes of modern and advanced air attack weapons.

The S-350E is designed to replace S-300PS medium-range anti-aircraft missile systems which are in service for over three decades. The development of Vityaz began in 2010 and development tests were concluded in 2019. The system went into mass production the same year.

Armed with highly manoeuvrable 9M96E/E2 missiles, with a top speed of around 5 mach, the S-350 can intercept any kind of aerial targets between 5 m to 30 km of heights. This makes it one of the most suitable anti-cruise missile systems.

The S-350 missile system consists of 1/2 50N6A multifunctional passively electronically scanned array radar systems which provide 360 coverage, 50K6A command post, 50P6 launchers with 12 9M96E missiles. It can also fire 9M100 a short-range, IR-passive missile with a maximum range of 10 km. The system is mounted on BAZ-6909 8x8 chassis.

In 2020, Almaz-Antey had said that it will deliver four S-350 systems by 2023 to Russian forces.

The arrival of S-350 in the conflict at this juncture makes it very interesting as the British Strom Shadow air-launched cruise missile is expected to make its entry in the war from Kiev's side. Britain confirmed deliver of the 250 km range deep strike stealth cruise missile to Ukraine on May 11. France is also delivering Scalp EG, the French version of the Storm

Shadow.

The coming months are expected to witness a dual between S-350, a cruise missile killer, against Anglo-French Storm Shadow/ Scapl-EG which according to UK Defence Secretary Ben Wallace would "allow Ukraine to push back Russian forces."

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Commentary

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

The Centre for Air Power Studies (CAPS) is an independent, non-profit think tank that undertakes and promotes policy-related research, study and discussion on defence and military issues, trends and developments in air power and space for civil and military purposes, as also related issues of national security. The Centre is headed by Air Marshal Anil Chopra, PVSM AVSM VM VSM (Retd).

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