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"India must improve its defensive and offensive space capabilities since the 'future lies in having space-based platforms' [1]

- - Air Chief Marshal VR Chaudhari PVSM AVSM VM ADC

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[1] https://www.firstpost.com/world/india-needs-space-based-weapons-says-air-chief-marshal-vivek-ram-chaudhari-12530972.html

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China Plans 500 J-20 Stealth Jets by 2035-38, Should India Consider Su-75 Checkmate till AMCA Arrives

Air Marshal Anil Chopra (Retd)
Director General, Centre for Air Power Studies |
06 August 2023

Source: Eurasian Times| https://www.eurasiantimes.com/china-plans-500-j-20-stealth-jets-by-2035-38-should-iaf-consider/?amp

File Image: Su-57

The three largest air forces in the world, US Air Force (USAF), PLA Air Force (PLAAF), and the Russian Air Force (VVS), already have their home-grown fifth-generation fighters. Many other modern air forces have inducted the Lockheed F-35 and are working on sixth-generation aircraft, individually or in joint ventures.

India, the fourth-largest force and fifth-largest economy, is still at the Light Combat Aircraft (LCA) Mk1 stage. India's fifth-generation fighter, the Advanced Medium Combat Aircraft (AMCA), could take nearly 7-8 years to fly and almost 15 years to induct, or even more.

In India's neighborhood, an immediate threat is China, and it already has 150 Chengdu J-20 "Mighty Dragon." Their second fifth-generation fighter Shenyang FC-31 "Gyrfalcon," is being accelerated.

China no more needs to import fighter aircraft. India is the only major country that could still be a possible buyer of a fifth-generation aircraft.

Even though India walked out of the joint Fifth Generation Fighter Aircraft (FGFA), Russia continues to hope and woo India into buying its fifth-generation fighters.

The US has not formally offered the F-35 aircraft to India, but because they brought two of them to the 'Aero India 2023' at Bengaluru earlier this year, some thought they were throwing a hint.

There is, thus, a need to look at the Russian aircraft in the correct context.

Sukhoi/HAL FGFA

The Sukhoi/HAL FGFA concept was based on the Russian PAK-FA Sukhoi T-50 aircraft. The FGFA was being developed jointly by Sukhoi and HAL for the Indian Air Force (IAF).

The plane was to include 43 India-led improvements, including advanced sensors, networking, and combat avionics. Also, India wanted a two-seater with a pilot and co-pilot or weapon systems operator (WSO).

Russia and India agreed in early 2007 to jointly study and develop the FGFA. By 2010, it was reported that the two sides had agreed on a preliminary design. In December 2010, a memorandum of understanding for the preliminary design of the Indo-Russian fighter was reportedly signed between Hindustan Aeronautics Ltd (HAL) and Russia's Rosoboronexport and Sukhoi.

Around 500 aircraft were initially contemplated, with 200 single-seat and 50 twin-seat for Russia and 166 single-seat and 48 twin-seat for IAF. Single-seat fighters were to be assembled in Russia, and two-seaters by HAL.

HAL negotiated a 25% share of design

and development work, mainly related to critical mission software, navigation systems, cockpit displays, countermeasure dispensing (CMD) systems, etc. Russians were also very optimistically hoping for an export market of another 600.

By 2012, developmental delays had started setting in. In 2012, the FGFA was expected to cost around US$100 million per fighter and development costs of around US$6-9 billion.

India cut the numbers to 144 aircraft. Later, it was also revealed that India could contribute only 15% of the research and development (R&D) work but was a 50% partner for contributing the funds.

Meanwhile, Russia also cut back on its own purchases. By 2016, Indian interest in the project began to fade, and in September 2016, the two nations announced a detailed work-share agreement for joint production and later listed "milestones." But then R&D costs went further, and Russia demanded US$7 billion from India to progress the project.

The 35-ton max takeoff weight aircraft was to have six internal and six external hard points. There were long delays, rising costs, developmental uncertainty, and struggles to deal with various Russian companies in the program. India was also unhappy with the aircraft's stealth, radar, and super-cruise capability.

India withdrew from the program in 2018, but Russia kept hoping the project could be resumed later. In July 2019, Russia offered India to resume participating in its Su-57 program.

In October 2019, the IAF chief RKS Bhadauria stated that the country would not be importing stealth fighters like the Su-57 and instead focus on indigenous efforts such as the HAL AMCA.

The Russians then offered to upgrade the Su-35 with stealth technology (similar to the F-15 Silent Eagle) as a more affordable alternative to the FGFA.

Sukhoi Su-57 Still Only in Small Numbers

The Sukhoi Su-57 'Felon' is a twin-engine stealth multirole fighter aircraft. It is the product of the PAK FA program initiated in 1999. Sukhoi's internal designation was T-50. It was Russia's first stealth aircraft. The first prototype aircraft flew in 2010.

The program faced protracted development delays due to structural and technical issues. The aircraft had to undergo a structural redesign, with changes including increased composite material usage, reinforced airframe, elongated tail "sting," and slightly greater wingspan.

The T-50 was named Su-57 in July 2017. It finally joined Russian Aerospace Force in December 2020. Around 24 have reportedly been built to date—10 for flight testing and 14 for serial production for service.

The aircraft is meant for air superiority and surface strike, including maritime roles. The aircraft is expected to succeed the MiG-29 and Su-27 in the Russian military. Since Russia was short of funds, it sought a foreign partner again.

Initial plans were for Russia to acquire 52 aircraft by 2020 and another 150–160 by 2025 and export 250–300 Su-57. Due to the substantially higher cost of the Su-57 compared to the Su-35S and Su-30SM, the design was placed on hold for mass production until "the need arises," and it was decided to induct more upgraded fourth-generation fighters such as the Su-35S and the

Su-30SM.

In May 2019, Russian President Vladimir Putin announced that 76 aircraft would be purchased and delivered to the Aerospace Forces by 2028. He had got the price hammered down by 20 percent.

The Su-57 is powered by two thrust-vectoring NPO Lyulka-Saturn izdeliye 117, or AL-41F1, augmented turbofans, with 88.3 kN dry thrust and 142.2 kN with afterburner. The IAF had expressed concerns over the reliability and performance of the AL-41F1 for the FGFA.

In early 2023, Russian company UEC Saturn said they were planning a "sixth-generation" engine design for the Su-57. The Su-57 would carry the latest Russian air-to-air and air-to-surface weapons, including the new hypersonic missile with characteristics similar to the Kh-47M2 Kinzhal ALBM.

A 'swarm' teaming experiment had been conducted with a group of Su-35s, with the Su-57 acting as a command and control aircraft. The aircraft has also been tested for operations with the Okhotnik UCAV in teaming mode. Work is underway to make an aircraft carrier variant.

Three aircraft were deployed in Syria, and a Su-57 reportedly fired a Kh-59MK2 cruise missile in combat. Su-57 fighters have allegedly been used in Ukraine, striking targets with long-range missiles in SEAD role, keeping the aircraft outside Ukrainian air defenses. Russia also claims to have used them in an air-to-air role and shot down a Ukrainian Su-27 with a long-range R-37 missile. The first fully operational Su-57 regiment of 24 aircraft is expected to be equipped by 2025.

The war in Ukraine has meant international sanctions and may slow further development. Russia can no longer import semiconductors and high-tech machining equipment from the European Union. Potential export sales could also stall because Russia cannot trade using US dollars.

Meanwhile, Russia is reported to have made the first flight of an upgraded Su-57 aircraft in October 2022. Russia continues to consider India as a potential customer.

After Turkey went out of the F-35 program on procurement of the S-400 missile system, Russia offered the Su-57, but Turkey wants to develop its own fifth-generation aircraft, a TF-X fighter. Algeria has reportedly signed for 14 aircraft as part of the large military deal that also includes the purchase of Su-34 and Su-35 fighters.

First aircraft deliveries are expected around 2028. Vietnam announced its intention to buy Su-57 aircraft to replace their Su-27s but later was critical of the aircraft's workmanship.

Russia has offered Su-57E fighters to the United Arab Emirates. However, the UAE has refrained from signing a contract with Russia to avoid CAATSA sanctions from the United States. Iraq could be another contender.

Sukhoi Su-75 Checkmate

The Sukhoi Su-75 "Checkmate" is a single-engine light tactical stealth fighter aircraft under development by Sukhoi with planned service entry around 2027. The lightweight fighter has evolved from the experience and technologies of the Su-57.

A static mock-up was unveiled at the 2021 MAKS air show. Four prototypes are being built. The maiden flight earlier scheduled for 2023 has slipped to 2024. The aircraft is meant to compete with the Lockheed Martin F-35 Lightning II and

Shenyang FC-31.

Forecast production numbers are 300 planes over 15 years. Aircraft are targeted to cost $25–30 million each. The development could be delayed due to international sanctions and import restrictions on some items.

The funding from the United Arab Emirates supporting the program has dried up due to sanctions. Also, UAE has been seeking to acquire F-35s instead. Similarly, potential exports will be affected since Russia cannot trade using US dollars.

The Su-75 has a diverterless supersonic inlet (DSI), a v-tail, and internal weapons bays; all features to reduce radar signature. The wing area appears large. It will be powered by the Saturn izdeliye 30 engine, the same as for Su-57M.

The cockpit layout is identical to the Su-57 with a glass cockpit. Aircraft will have a low-cost AESA radar. It will carry around 7 tons of armaments. There will be a single-seat, two-seat, and an unmanned variant.

Russians are looking at Argentina, India, Vietnam, and later some African countries as prospective customers.

India's AMCA

The HAL AMCA is planned as a single-seat, fifth-generation stealth, multi-role combat aircraft for the IAF and the Indian Navy, including some sixth-generation technologies.

It is being designed by Aeronautical Development Agency (ADA). A public-private joint venture between DRDO, HAL, and a major private player is expected to produce it. The development cost is around ₹15,000 crore ($2 billion).

DRDO has completed the design of AMCA and is waiting for the "Critical Design Review." Thereafter the Cabinet Committee on Security (CCS) approval is required. DRDO expects that these two activities will take place in 2023. In such a case, DRDO feels the first flight should be possible by 2027 and squadron induction by 2035.

As per HAL, the prototype aircraft is likely to be ready by 2026 & its production could start by 2030. DRDO and HAL have, in the past, been known for overstating capabilities and timelines. Most analysts feel that the timelines are very tight and over-ambitious. In November 2022, IAF Chief Chaudhari advised "prudence."

Some analysts have questioned the project's feasibility based on India's current abilities. Others feel that for a long AMCA would, at best, be a 4.5-generation aircraft. At a maximum takeoff weight of 25,000 kg, it will be desirably smaller than the Su-57.

AMCA is now being developed in two phases. AMCA Mk-1 would be powered by the American GE-414 engine (98 kN) thrust instead of the required 110 kN thrust for super-cruise. Without thrust vectoring, it can't have super-maneuverability either.

On July 15, 2023, India and France agreed to collaborate to develop a combat aircraft engine that would power AMCA Mark-2 as part of the Horizon 2047 document for the India-France strategic partnership. At best, The roadmap will be known by the end of 2023.

It will be India's first attempt at stealth. AMCA will initially have partial stealth and lack some other critical fifth-generation features. India still lacks capabilities on some critical

sensors and their fusion for full 360-degree bubble situational awareness.

Sukhoi Su-35S

The Sukhoi Su-35 is basically an improved Su-27 and was initially called the Su-27M. It incorporated canards and a multi-function radar giving it higher maneuverability and multirole capabilities. The production version was designated Su-35S.

The Su-35S maiden-flight flight was in May 2011. In November 2015, China became the Su-35's first export customer when it bought 24 aircraft for $2 billion.

The Su-35S attained full operational capability (FOC) in late 2018. China did not buy more aircraft as it found limited value addition over the Chinese J-16, which they claim has better radar, avionics, and other equipment. The aircraft has seen combat in Syria and, more recently, in Ukraine. Around seven air-to-air victories have been reported claimed in Ukraine.

The United Arab Emirates, India, Algeria, Turkey, and Iran, among a few others, remain potential customers. Some of these technologies have already been imbibed on the IAF's Su-30MI.

Effectively the aircraft was an interim platform till Su-57 was inducted. Interestingly the aircraft will be a competitor in case IAF's 114 MRFA Request for Proposal (RFP) finally goes out.

Complex Way Ahead – But Get Going India

IAF is tasked to defend the nation. If India has to face up to many fifth-generation aircraft already flying across the northern border, it cannot wait so long.

By AMCA timelines of 2035-38, sixth-generation aircraft will already be flying. China would have inducted nearly 500 J-20s, if not more. Even Pakistan may try and get a few J-20s from China by then.

Russia has been under sanctions. India's oil imports have taken all the Rupees that Russia could absorb and is unwilling to take any more. Some military supplies from Russia, including S-400, are held up due to payment issues.

India already has a huge Russian aircraft basket with nearly 65% of the IAF. India needs to diversify. Russian aircraft are cheap initially, but the life cycle costs are much higher in the long term. Russian fleet serviceability is invariably lower because of complex spare supply procedures and timelines.

India has already been in the FGFA program for some time and is well aware of the technology and work share levels, which are not at all favorable. The Su-57 program has moved very slowly for various technology issues.

With limited flying, the teething problems may take longer to be seen. The sanctions on semiconductor supply would impact Russian avionics and weapons. For all these reasons, the Su-57 option may not be good.

The Su-75, though smaller, is still some distance away. Its first flight timelines may be close to AMCA. But Russia does have the advantage of its own engine and stealth technologies, and the aircraft would be ahead of AMCA.

The aircraft would not be as cheap as predicted. Joining such a program would sound like a death knell for AMCA. Investing the same amount in AMCA would give better returns and improve indigenous capabilities.

Buying a few Su-35S is also a bad idea because

value addition would be low, and another fleet would have been created.

Su-35S is 4th-plus generation aircraft. The already-acquired Rafale would be a better bet. The F-35 is not on offer. With India having an S-400, such an offer gets further restricted. It is not cheap and would require a massive ecosystem for just a few planes.

India is stuck between the jaws of a vice. Timelines and numbers are critical for IAF. So the best option is to put all our nations' energies into the AMCA. Find a partner for critical technologies like aero-engine, stealth, and high-end avionics. Pay for it.

Meanwhile, push indigenous individual technology development. Set up a task force. Get the private sector in at an early stage. Release the program from bureaucrats and hand it over to high salaried technocrat program manager through a special purpose vehicle. Monitor the program at the highest levels.

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Military Reforms—Expediency Should not Trump Logic

Air Vice Marshal Anil Golani (Retd)
Additional Director General, Centre for Air Power Studies | 31 August 2023

Source: ORF | https://www.orfonline.org/expert-speak/military-reforms/#:~:text=At%20the%20same%20time%2C%20however,Indian%20Military%20in%20its%20%27Amrit

'One man's prognosis confounds the other man's prescription.' This is the state of discussion and dialogue in the nation's military fraternity—whether serving or veteran—when it comes to the debate on the military reforms being undertaken to promote optimisation and synergy within the forces. When the government appointed the first Chief of Defence Staff (CDS) on 1 January 2020, and created the Department of Military Affairs (DMA) with the CDS as the Secretary to the Government of India in the Ministry of Defence, it was seen as a far reaching, bold, and decisive step towards transformation. Among the duties and functions of the CDS, apart from being the Principal Military Advisor to the Defence Minister on all Tri Service matters, the CDS was also to function as the Permanent Chairman of the Chiefs of Staff Committee. The mandate of the DMA, inter alia also included, "Facilitation of restructuring of Military Commands for optimal utilisation of resources by bringing about jointness in operations, including through establishment of joint/theatre commands."

Among the duties and functions of the CDS, apart from being the Principal Military Advisor to the Defence Minister on all Tri Service matters, the CDS was also to function as the Permanent Chairman of the Chiefs of Staff Committee.

Optimal utilisation of resources can come through unity of effort in the application of military power. This would happen naturally when the core competency of the land, maritime, and aerospace power is understood with its doctrinal precepts, along with the overall objective that needs to be achieved with the utilisation of the military as an instrument of national power in the given scenario. Joint planning, therefore, becomes a prerequisite for joint operations. Hence, establishment of joint/theatre commands is not an essential or necessary requirement for jointness in operations. This is akin to putting the cart before the horse.

Structures for joint planning have existed for decades. If they have not served their purpose well, then, they either need to be disbanded or strengthened based on logical military thinking and strategy. The CDS, functioning as the Secretary DMA has an advisory role to the Defence Minister, where he is the single point advisor on all Tri Service matters. He also functions as the Permanent Chairman of the Chiefs of Staff Committee, which is placed above the Service Chiefs. This implies a de-facto operational role, even though it is not explicitly mandated in his charter. This is an anomaly that needs to be resolved while discussing the functioning of the joint/theatre commands. Sound logic and clarity of thought must dictate the reorganisation or restructuring of the military; this should not come be compromised for the parochial interests of any single service. There has to be conviction and belief that it is being done in national interest, and it can only happen when biases and affiliations are shed for the larger gain.

The CDS, functioning as the Secretary DMA has an advisory role to the Defence Minister, where he is the single point advisor on all Tri Service matters.

The charter of the CDS also includes, "To ensure optimal utilisation of infrastructure and rationalise it through jointness among the Services," and, "to bring about reforms in the functioning of three Services with the aim to augment combat capabilities of the Armed Forces by reducing wasteful expenditure." There are many static establishments of the three services co-located across the country, governed and managed independently by each service, leading to duplication of resources, manpower, and establishment/infrastructure costs. For instance, the Indian Army manages these establishments through Sub Area and Area HQs that come under the existing regional commands. The Indian Navy also has Area HQs across the country divided into regions and commanded by Flag Officers. The three services could capitalise on the existing Area and Sub Area HQs to manage their static establishments, as well by sparing only requisite and minimal manpower to merge with the Army/ Navy establishments, leading to reduction in both infructuous expenditure and duplication of resources. Similarly, some establishments could be done away with completely to reduce revenue expenditure. For example, the Officers Messes, Medicare Centres, Unit Run Canteens etc. could be combined and subsumed into one establishment.

Future wars will have an increasing employment of the space and cyber domains. Special Forces operations would also play a major

role in skirmishes with our adversaries. There exists a need to develop these Special Forces into full-fledged joint and integrated commands that would function under the CDS. These commands, along with the existing Andaman and Nicobar Command and the Strategic Forces Command, could well serve as test beds for the proposed joint warfighting structures. Operational effectiveness and flexibility should be the raison d'etre for the proposed restructuring rather than creating additional structures with an untested and de novo chain for their command and control. With live threats and active adversaries, the need to deliberate and act on sound logic, with consensus across the services is more important than the expediency to act and regret subsequently. Each nation has its own challenges and, therefore, there exists a need to evolve and organise your own structures keeping the threats, geography, culture, and the political setup in mind. The three services need to define and agree upon a 'problem statement' to guide them in the formulation of joint/theatre commands, which address service-specific concerns and the need to obviate a less than desirable level of acceptance, given our challenges and the desired outcomes. No other nation in the world faces nuclear armed hostile neighbours on either side with unresolved borders. Disruption, therefore, should be minimal and well thought through.

The good part is that the current military leadership is not making statements in haste and there is a sincere attempt at building consensus amongst the service chiefs before arriving at any conclusion.

It is extremely important for the leadership of the day to have the courage and conviction to not only accept what is good in the larger interest of the nation, to think without bias and past perceptions, but also to convey the same in clear and unambiguous terms to the rank and file across the services. The good part is that the current military leadership is not making statements in haste and there is a sincere attempt at building consensus amongst the service chiefs before arriving at any conclusion. A collegiate and consensual 'problem statement' is an inescapable and inevitable requirement to begin with lest the reforms meet the fate of earlier efforts in the past. At the same time, however, reforms within the military and the higher defence organisation are long overdue and infructuous debates that lead to bitterness and rancour in the military and the academic strategic community could well be avoided by articulating the vision and roadmap for the Indian Military in its 'Amrit Kaal' or the 'Golden Period'.

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Theaterisation: National Security Apparatus May Need Tweaking

Nitin A. Gokhale | 14 August 2023

Source: Strat News Global | https://stratnewsglobal.com/articles/theaterisation-national-security-apparatus-may-need-tweaking/

Chief of Defence Staff (CDS) General Anil Chauhan (left) with Defence Minister Rajnath Singh

NEW DELHI: Related to the restructuring of HQ IDS (Integrated Defence Staff) is the possibility of forming a higher defence committee for strategic and political guidance to the military leadership. Assuming that HQ IDS in consultation with the theatre commands will take local and largely tactical decisions, there is still no clarity

on who or which organisation the Vice Chief of Defence Force (VCDF) or Vice Chief of Defence Staff (VCDS) will report to. Models implemented by the Anglo-Saxon nations do offer some clues but given the peculiarity of the Indian context (two or one-and-a-half hostile nations on its borders), a completely new structure drawing from various elements that are in vogue, may have to be evolved.

For instance, in the U.S. structure, the Secretary of Defence (SecDef) exercises direct command and control of the armed forces. The Australians too follow a somewhat similar system with the Chief of Defence Force (CDF) reporting to the Minister of Defence. He also commands the Australian Defence Forces through the Vice Chief of Defence Forces (VCDF). The UK model is however more collegiate. The CDS remains principal military adviser but the Permanent Secretary of Defence (a civilian) is the principal policy adviser with the same status as the CDS. The third parallel office at the top of the heap is that of the VCDS. The three collectively command the British armed forces.

In the Indian context, the U.S. model is unlikely to be considered given that the Raksha Mantri is mostly an experienced and senior politician without substantial experience in matters military.

One option that may have to be considered is to form a higher defence committee comprising key players in the national security apparatus. Can such a committee comprising—for example– the National Security Adviser (NSA), the Cabinet Secretary, the Principal Secretary to the Prime Minister, the CDS and the three service chiefs—be an answer to the conundrum? Other important officials, the Foreign, Home and Defence Secretaries, along with the heads of the Intelligence Bureau (IB) and the Research and Analyses (R&AW) can be permanent invitees.

A higher defence committee may be able to provide the much required civil interface to the military—a necessary prerequisite in a robust democracy like India. Fundamentally, the political class in India is more comfortable with a diffused power structure of the military and it is necessary to provide comfort to the government. Creation of a higher defence committee may require tweaking some of the existing arrangements/ structures such as the National Security Council, the Strategic Policy Group and even the National Security Advisory Board.

It is nobody's case that the role of the CDS or the Chiefs of Staff Committee (CoSC) should be diluted. They must continue to guide the theatre commanders and HQ IDS in policy and functional matters but permission from the proposed higher defence committee and if necessary, the CCS is a must for operational requirements that may need political clearance.

Critics might argue that such an arrangement will add another layer to the chain of command and may delay quick decision-making. But that is a risk that may be necessary to be taken in a functioning democracy.

Whatever the merit of these different arguments, Indian national security managers will have to come to a definite conclusion soon if the theatre commands are to be raised in a given time frame.

As the military brass wracks its brains in laying out the exact contours of HQ IDS, the role of CDS and the three service chiefs, the task of getting a functional and effective structure of

theatre commands is equally vital. Placing the theatre commanders in an appropriate rank and empowering them adequately will be crucial to implementing India's ambitious plans to optimise resources and increase combat effectiveness of its armed forces.

This task is easier debated than achieved though. One proposal is to make theatre commanders four-star officers on a par with Service Chiefs with their retirement age as 62, equivalent to service chiefs. Taking this leap of faith will require both political heft and administrative deftness within the military hierarchy.

One of the foremost challenges would be to subsume/place the current 17 regional commands across the three services and choosing theatre commanders without disturbing existing seniority principle. The second track involves integrating methods, processes and operating procedures, achieving commonality in logistics and human resource policies and assessing annual performance, just to mention a few.

As a former military officer and scholar at the Institute of Defence Studies and Analyses (IDSA) Vivek Chadha has said in a book authored in 2021, "it is felt that theatre commanders should be four-star rank officers with similar seniority as the Service Chiefs. It will facilitate the necessary coordination and command and control within the theatres. This includes command over certain regional commands that could be created or retained. This may include the Andaman and Nicobar Islands or perhaps even areas like Jammu and Kashmir to cater to the specific requirements of countering terrorism. It is also important to co-relate their functioning with existing service chiefs. It is initially envisaged that the Service Chiefs will continue to guide operational aspects as part of the Chiefs of Staff Committee. Over time, their role will shift to raise, train and sustain function. The evolving relationship between the CDS and Service Chiefs suggests that having four-star theatre commanders will not become a constraint for ensuring a smooth functional relationship between them and the Service Chiefs."

Other scholars such as RAdm Sudarshan Shrikhande (retd) have written for us in BharatShakti.in extensively on this debate and have come to a conclusion that eventually:

The Service Chiefs would transit to the primary, but equally vital roles of "Raise/ Train/Sustain" and shed a large part of their operational roles in conflict to HQ IDS/joint theatre commands or JTCs.

All the functions of the SHQs would benefit from the central strategy planning process for overall military strategies in terms of force planning and force-building processes. Among other things, this would help true indigenization and self- reliance without which India cannot be a great power.

An important consequence of integration and jointness could be—rather must be—the rise in effectiveness accompanied by the optimisation of personnel strength.

In his address to the annual DRDO Directors' Conclave, CDS General Anil Chauhan recently talked about the importance of theaterisation of conflict. He said: "The concept of theaterisation is a fundamental change that is on the anvil… Theaterisation involves the creation of tri-service theatre-specific structures for effective response along the entire spectrum of conflict."

If that is the fundamental aim, there would be no better way of handling the business of joint military outputs across the spectrum of peace and conflict than creating joint theatre commands, no matter what it takes.

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Back to the Future: Air Chief's SWOT

Air Power

Analysis of the IAF

Ramananda Sengupta | 02 Septmeber 2023

Source: Bharat Shakti | https://bharatshakti.in/back-to-the-future-air-chiefs-swot-analysis-of-the-iaf/

Several passengers took to social media to say they were stuck on planes on the tarmac waiting to take off

Air Chief Marshal Vivek R Chaudhari, Chief of the Air Staff, is not known for mincing his words. Addressing a packed audience at the United Services Institute auditorium in New Delhi on August 29, he began by noting that he had been asked to deliver a SWOT analysis of the IAF "and a vision of where we are going to be in our 100th year of existence," a decade from now.

(The Indian Air Force was officially established on October 8, 1932, but its first flight took off on April 1, 1933, with six RAF-trained officers and 19 Havai Sepoys, or 'air warriors.')

"But we must remember that when we discuss the future, we must also rewind that many years back. If I am going to talk about where we will be ten years from today, let's go back to where we were ten years ago, to 2013, when we were probably yet to discover the 2G network," he said. "We did not have beyond visual range missiles. Our capabilities were far lower than what we have today. Our concept of warfighting was based on the traditional war-fighting that we had gleaned from our experiences from across the world."

But things have changed dramatically since then, and "in the next ten years, we are going to see such rapid transformation and infusion of technology that it is going to be difficult for me to pontificate on what is going to happen two years down the line."

"So let me begin by taking you through a very broad scan of things, looking at the changes around the world and how this world affects the Indian Air Force's future," he said. One, the world was in a state of increasing flux, switching from bipolar (Soviet Union/US) to unipolar (US) to multipolar (US/China/Russia/India and various other powers and groups). These recent trends had sparked Volatility, Uncertainty, Complexity and Ambiguity, or what he described as a VUCA World.

This lack of a single dominant power also presented an opportunity, and India, which was already a prominent player in world affairs, needed to ensure that all elements of CNP (comprehensive national power) continued to grow and expand.

Referring to the Russia-Ukraine conflict, he said that "Irrespective of international treaties, 'friendship between countries' will always come second to a nation's own security." There was also a decreasing appetite for a global rules-based order, he felt. And while nuclear deterrence is effective, 'self-sufficiency in arms manufacturing

is an absolute necessity', he argued.

Private companies will take sides based on national interests, be it Elon Musk's Starlink or Amazon's massive databases, and this needed to be factored into any future contingency planning.

Noting that "Strong narratives can build influence globally," he felt there can never be adequate soft power without hard power. And finally, anything, be it financial protocols like SWIFT, civilian airspace, social media-based businesses, and even international sporting bodies, can be weaponised.

He added that the Russia-Ukraine war had also driven home key lessons on the importance of Drones or UAVs, the use of Precision Guided Munitions (PGMs) and Stand Off Weapons (SOWs) and the impact of missiles.

Turning to the immediate neighbourhood, he felt the 'No War, No Peace' situation with Pakistan would continue, although new acquisitions of Chinese aircraft like the JF-17 J-10 and radars like the American AN/TPS-77, as well as the possible transfer of hypersonic missile tech could shift Islamabad's policy from a "predominantly defensive to a more aggressive approach."

As for China, its numerical superiority, the PLA's strong Rocket Force (PLARF)/Strategic Support Force (PLASSF), increased spending on R&D (Beijing spent $456 billion on R&D in 2022, compared to India's 50 billion), and its growing economic heft had led to "visible growing Chinese assertiveness in the region and global affairs, matching with its growing economic and military capabilities," he said.

Over the last nine decades, the IAF had taken part in seven wars, of which five –World War II, the 1947-48, 1965, and 1971 wars with Pakistan, and the 1962 border war with China, were total wars because there was no nuclear backdrop, whereas the two subsequent wars with Pakistan (Kargil in 1998 and Balakot in 2019) were limited due to the "nuclear overhang."

The IAF has also been a key player in Humanitarian Assistance and Disaster Relief (HADR) efforts during natural disasters like earthquakes and floods in Srinagar, Bhuj, Uttarakhand, Leh/Ladakh, and internationally during the tsunami and the COVID-19 pandemic.

It had also played a key role in evacuation missions worldwide, like bringing back 800 Indians from Ukraine, airlifting 626 personnel and 24 tonnes of load from Afghanistan following the US evacuation from the country, airlifting 510 personnel and 307 tons of load to help during the earthquake in Turkiye, and flying 12 C-130/4 C-17 sorties to evacuate over 2000 personnel including 67 foreign nationals from Sudan during the civil war there. This involved a dramatic covert night landing by C-130 at Wadi Sayyidna, a 'degraded' airstrip 40 km north of the capital Khartoum that lacked navigational aids and landing lights, to rescue 121 stranded Indians (including a pregnant woman) and their luggage.

India was also moving, albeit slowly, towards Atmanirbharta (self-reliance), he noted, citing the indigenous development/manufacture of the Tejas Light Combat Aircraft, the Dornier 228, Dhruv Light Combat Helicopter, as well as hi-end radars like the Arudhra Medium Power Radar (MPR), Rohini central acquisition radar (3D-CAR) and Low-Level Light Weight Radar (LLLWR), which can be deployed in diverse terrains (plains/ deserts/ mountaintops/ high altitude regions) to detect and track heterogeneous air targets, including helicopters, fighters and UAVs at low

and medium altitudes.

A special mention was made of the medium–lift tactical transport aircraft C-295, to be manufactured by TATA and Airbus Defence and Space in India. This venture, which involves manufacturing over 13400 detailed parts/ 4600 sub-assemblys/ all seven major component assemblies, will benefit 123 MSMEs in over seven states and generate 42.5 lakh manhours, he noted.

Over the years, the IAF had evolved rapidly regarding platform, equipment/radars and weapons, including missiles, and now had formidable force projection capabilities.

Regarding infrastructure, the IAF launched the Air Force Network (AFNET) in September 2010, replacing its old communication network with a dedicated fibre-optic vast area network that offers encrypted, secure bandwidth. Apart from this, 30 IAF airfields had been upgraded under Modernisation of Airfield Infrastructure (MAFI) Installation with Next Generation Hardened Aircraft Shelters, and 42 airfields upgraded with permanent night landing facilities.

Looking at the 'Contours of Future Wars', the IAF Chief felt they would be Multi-domain, Hybrid in nature, involve non-kinetic and kinetic forces and all elements of CNP, and have a shorter OODA (Observe, Orient, Decide, Act) loop. They would also be highly tech-driven, using Manned-Unmanned Teaming, Artificial Intelligence, and the Internet of Military Things.

Then came the SWOT analysis.

Under Strengths, the IAF Chief listed operations exposure and mindset, innovative tactics, techniques, and procedures, Network Centric Warfare capabilities, high training standards and effective Human Resources management, a large number of airfields in the first tier at lower elevation, and a varied inventory which included a mix of western and Russian platforms, weapons and systems.

Weaknesses included the strength of fighter squadrons, shortage of Combat Enablers like Airborne Early Warning and Control platforms and airborne refuellers, infra deficiency, with several airfields yet to be fully upgraded, and limited space assets and capabilities. Other issues included a restricted defence budget, limited indigenisation, R&D and logistical capabilities, obsolescence issues and a long gestation period for new procurements.

Opportunities included:

The ability to transcend From Air Force to Air and Space Force. (In response to a question later, he said as part of the new theatre command systems, the French and American systems were being studied to decide whether Space merited a separate Command or should be a part of the Air Force).

- Enhanced Foreign Cooperation (Exercises/ Exchanges/Diplomatic Signalling);
- Harnessing of Niche Technology and big data,
- Boost to indigenised production/export capability.
- Alternative sources of energy;
- Enhanced jointness in planning and execution and
- Realignment of strategic orientation and thought process.

Under threats, he listed the 'Collusive Threat' from China/Pak, increasing Asymmetry with

China, the possibility of Saturation Strikes By PLARF/PLAAF, Non-Kinetic Domain Threats, Operations in an environment of Denial, maintenance and spares for Russian Equipment and the sub-optimal exploitation of Air Power.

Looking ahead, he felt the need to shift from "threat-based and demanded" to "capability demanded" force requirements, the establishment of joint structures for training and operations while maintaining service-specific core competencies, enhancing strategic thought, civil-military-academia interaction, and establishment of in-house think tanks.

In the Q&A session that was moderated by the USI DG General BK Sharma, the Air Chief skilfully avoided politically loaded questions and those that referred to the nuclear forces, politely insisting that those were beyond his purview.

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Hundreds of Flights Disrupted as UK Air Traffic Control Experienced 'Technical Issue'

28 August 2023

Source: Times of India | https://timesofindia.indiatimes.com/world/uk/hundreds-of-flights-disrupted-as-uk-air-traffic-control-experiencing-technical-issue/articleshow/103138905.cms?from=mdr

Several passengers took to social media to say they were stuck on planes on the tarmac waiting to take off

LONDON: Hundreds of flights were disrupted on Monday as a 'technical issue' hit the UK air traffic control.

The National Air Traffic Service (NATS) of Britain had to impose restrictions on aircraft movement on Monday due to an ongoing technical issue that the service is actively addressing.

A spokesperson for NATS stated, "We are currently encountering a technical problem, and to ensure safety, we have introduced traffic flow limitations. Our engineers are diligently working to identify and rectify the issue."

The NATS did not give an estimate of how long it would take to fix the problem, or what had caused it.

According to reports, many flights are likely to be delayed by at least 12 hours.

London Luton Airport is collaborating with the authorities to comprehend the implications and anticipate when regular operations will recommence. Likewise, British Airways announced its close cooperation with NATS to comprehend the consequences of the situation.

Dublin Airport disclosed that the air traffic control problems have led to delays and cancellations of certain flights to and from the Irish capital. The airport advised passengers scheduled to travel on that day to verify the status of their flights with their respective airlines beforehand.

Numerous travelers used social media to share their experiences of being grounded on airplanes, waiting to take off on what is a busy travel day due to the UK's public holiday on Monday.

One individual, who was a witness for Reuters, reported being held on the tarmac in Budapest. They mentioned that the pilot informed passengers about a widespread computer breakdown that had led to the closure of all UK airspace. Passengers

were reportedly facing an anticipated delay of 8 to 12 hours.

Scottish airline Loganair said there has been "a network-wide failure of U.K. air traffic control computer systems."

"Although we are hopeful of being able to operate most intra-Scotland flights on the basis of local co-ordination and with a minimum of disruption, north-south and international flights may be subject to delays," it said.

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Pentagon Open to Host F-16 Training for Ukrainian Pilots in the U.S.

Eleanor Watson | 17 August 2023

Source: CBS News | https://www.cbsnews.com/news/pentagon-f-16-training-ukrainian-pilots-in-the-u-s/

The Biden administration is willing to host training on F-16 fighter jets in the United States for Ukrainian pilots if additional capacity is needed, the Pentagon told CBS News on Thursday.

"The U.S. is prepared to support the training effort in coordination with the coalition, and is willing to host training for Ukrainian pilots within the U.S. if the capacity of training is reached in Europe," Pentagon Press Secretary Brig. Gen. Patrick S. Ryder said in a statement.

Denmark and the Netherlands are leading a coalition of countries in training Ukrainian pilots on fighter jets, after President Biden gave the green light in May for European allies to provide training on F-16s. Since then, the U.S. has deferred to Denmark and the Netherlands on plans.

Two U.S. officials told CBS News on Thursday that the Biden administration gave Denmark and the Netherlands assurances that the U.S. would expedite third-party transfer requests of F-16s so that Ukraine receives the jets once training is complete.

A State Department spokesperson said the intention is for Ukraine to take full advantage of its new capabilities as soon as the first set of pilots completes their training.

The Pentagon has said before that the F-16s are meant to help Ukraine in the long-term, and that training led by the coalition was not meant to help with Ukraine's current counteroffensive.

The Biden administration resisted calls for over a year from Ukraine for F-16s, saying air defense and ammunition were more needed for the current fight. Eventually, the administration overcame its reluctance just as it did with other weapons, like Abrams tanks.

Even though the administration has now approved training on the F-16s, it will still likely take some time for the jets to make a difference for Ukraine.

Gen. Mark A. Milley, chairman of the Joint Chiefs of Staff, said earlier this summer that if the goal was to match or surpass Russian airpower, it will take billions of dollars and significant time.

"That's going to take years to train the pilots, years to do the maintenance and sustainment, years to generate that degree of financial support to do that," Milley said at a news conference in July.

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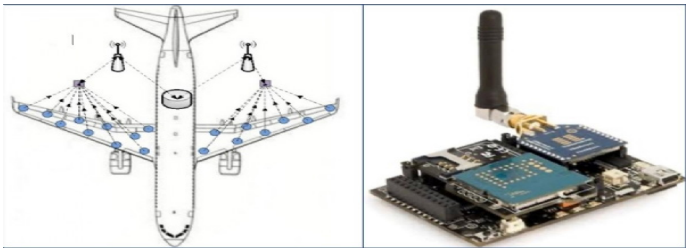
IAF's Group Captain Gets two patents in the field of Cyber-Physical Systems

Sayantani Biswas | 23 July 2023

Source: News Bharati | https://www.newsbharati.com/Encyc/2023/8/1/IAF-Group-Captain-Gets-two-patents-in-the-field-of-Cyber-Physical-Systems.html



Group Captain Sundeep Desai of the Indian Air Force (IAF) has made important contributions to the fields of Cyber-Physical Systems (CPS) and Cyber Security, obtaining two patents that showcase his creative work. On July 29th, the IAF proudly announced this accomplishment, acknowledging the officer's skill and devotion to improving information and network security within the military sector.

The first patent, titled "Framework of Trust Evaluation for a Plurality of Nodes Deployed in Wireless Sensor Networks," presents a novel technique to creating trust in digital systems that is analogous to how humans create trust in one another. This ground-breaking technology has the potential to transform encryption in digital communication networks, greatly improving network security and protecting vital military secrets.

The second patent, titled "A Method of Trust Evaluation of a Node by Itself in Any Digital Environment," is similarly unusual and has the potential to change the way digital systems build consciousness. With the execution of this invention, digital systems may be able to self-evaluate and identify friendly systems inside the network, bringing resilience and self-awareness to the IAF's digital infrastructure. This self-evaluation capacity would strengthen the IAF's defense against possible threats by providing enhanced security against cyber intrusions and assaults.

IAF leaders have voiced their respect for Group Captain Sundeep Desai's pioneering innovations, recognizing their potential to dramatically improve the military domain's information and network security matrix. These two patents might be useful assets during conflict, enhancing the Indian Air Force's information and network security and bolstering the nation's defense against cyber attacks.

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Indian Air Force to Carry Out Mega Training Exercise 'Trishul' Near Pakistan and China Border During G20 Summit

01 September 2023

Source: Open India | https://www.opindia.com/2023/09/iaf-to-carry-out-mega-training-exercise-trishul-near-pakistan-and-china-border/

Ahead of the G20 Summit in New Delhi, the Indian Air Force has launched an elaborate training exercise recognized as 'Trishul.' Interestingly, the exercises will take place in the northern region, close to China and Pakistan's borders.

According to the reports, the training mission will be a massive event, with large fleets of

fighter aircraft participating, including the Rafale, Mirage 2000, and Su-30MKIs.

The military drills will also include heavy-lift transport planes and choppers such as the Chinook and Apache. Garud Special Forces are also participating in the drills, in which all elements of air power are expected to be used.

The drill is scheduled to take place from September 4 to 14, overlapping with the G20 meeting, which will take place from September 9 to 10. The drills will take place in the northern sector, which includes Ladakh, Himachal Pradesh, Jammu & Kashmir, and Punjab.

The current assertion comes as the IAF prepares to conduct Tarang Shakti, a multi-lateral exercise, in October and November. Fighter planes, military transport aircraft, mid-air refuellers, and airborne warning and control system (AWACS) aircraft will also be participating in the event.

Six air force units from different countries will take part in the event, with numerous others serving as observers. The air forces of the United States, the United Kingdom, France, and Australia are among those expected to participate in the exercise. Previously, the Indian Air Force participated in the INIOCHOS exercise, which was hosted by the Hellenic Air Force at the Andravida air base in Greece.

It also held a joint military exercise with the United States in April under the guise of Cope India 2023. The drills took place at three bases across the country- Kalaikunda, Panagarh, and Agra.

The current event will take place along the borders of China and Pakistan from September 4 to 14 ahead of the G20 Summit in New Delhi. A report by News18 states that Operation Trishul has been deliberately planned ahead of the G20 Summit to showcase its power and strength on all fronts.

It says that the effort is intended to counter any border misadventure. These regions pose special threats. “China has been on high alert on the Leh-Ladakh border for the past three years, with substantial deployment. Every day, drones carrying weapons and drugs approach the Punjab border. Meanwhile, there is an infiltration worry along the Line of Control (LoC) from Pakistan,” the report said quoting government sources. The event will be monitored by the National Security Advisor.

It was reported earlier that China on August 28 released the 2023 edition of its territorial map as per its imagination, claiming Indian territories such as Arunachal Pradesh and parts of Ladakh (Aksai Chin region) as its own. Apart from Indian territories, China also included Taiwan and the contentious 9-dash line in the South China Sea.

India is all set to host the G20 Summit on 9th September and 10th September. China is one of the G20 countries. Chinese President Xi Jinping is set to visit Delhi for the G20 Summit.

Reportedly, the Trishul exercise will be one of the most significant air maneuvers conducted by the IAF in recent years. It will also include the deployment of critical assets from the Western Air Command, as well as resources from other commands, making it an extensive and comprehensive training event

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IAF Erects Air Defence Shield for Delhi-NCR for G20 Summit

Rajat Pandit | 31 August 2023

Source: Times of India | https://timesofindia.indiatimes.com/india/iaf-erects-air-defence-shield-for-delhi-ncr-for-g20-summit/articleshow/103257376.cms?from=mdr&utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

NEW DELHI: The IAF is going full steam ahead in making the airspace over the Delhi-National Capital Region as impregnable as possible, with fighter jets, surface-to-air missile systems, anti-drone systems, airborne early-warning and control systems (AEW&C) and other sensors being deployed for the G20 summit on September 9-10.

"The IAF's ODC (operations direction centre), which will liaise with the JCAC (joint control and analysis centre) and other agencies involved, will have the composite air picture at one place to detect threats, ranging from small, slow-moving objects like drones to large, fast-moving aircraft," a source said.

"If a threat is conclusively established, the ODC will decide what is the best method, or which particular weapon system should be used, to neutralize it," he added.

While similar "air defence" arrangements are made to tackle any aerial threat from hostile aircraft, helicopters and drones during the Republic Day, Independence Day and other occasions every year, the scale of preparations for the G20 summit is "much larger and intensive", the sources said.

Frontline fighters like the Rafales, Mirage-2000s and Sukhoi-30MKIs will patrol the skies, even as air-bases in the region like Ambala, Bareilly, Sirsa, Bhatinda, Gwalior and others will also maintain ORPs (operational readiness platforms) round-the-clock.

This involves two to three fighters being kept combat-ready in blast pens adjoining the runway at an airbase for immediate take-off whenever an alarm is sounded.

Similarly, a wide array of surface-to-air guided weapon systems have been deployed to protect the Delhi-NCR. These include MR-SAMs (medium-range surface-to-air missile systems), jointly developed with Israel, which are designed to destroy hostile aircraft, helicopters, cruise missiles and drones at a range of 70-km.

"The fully-indigenous Akash air defence missiles, which have an interception range of 25-km, are also being deployed. Netra AEW&C aircraft and other sensors, including enough low-level transportable radars, in turn, will continuously scan the airspace in and around Delhi-NCR to detect any inimical movement in the skies," the source said.

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Russia Puts Advanced Sarmat Nuclear Missile System on 'Combat Duty'

02 September 2023

Source: Aljazeera | https://www.aljazeera.com/news/2023/9/2/russia-puts-advanced-sarmat-nuclear-missile-system-on-combat-duty

A Sarmat intercontinental ballistic missile blasts off during a test launch in 2018 from the Plesetsk launch pad in northwestern Russia [File: Russian Defence Ministry Press Service via AP Photo]

Moscow has put into service an advanced intercontinental ballistic missile that Russian President Vladimir Putin has said would make Russia's enemies "think twice" about their threats, according to reported comments by the head of the country's space agency.

Yuri Borisov, the head of the Russian space agency Roscosmos, said Sarmat missiles have "assumed combat duty", according to Russian news agency reports on Friday.

"The Sarmat strategic system has assumed combat alert posture," the state-run TASS news agency quoted the Roscosmos chief as saying.

"Based on experts' estimates, the RS-28 Sarmat is capable of delivering a MIRVed warhead weighing up to 10 tonnes to any location worldwide, both over the North and South Poles," TASS said in its report.

White House National Security Council spokesman John Kirby said on Friday that he was not in a position to confirm reports that Russia had put the Sarmat on combat readiness.

Putin said in February that the Sarmat – one of several advanced weapons in Russia's arsenal – would be ready for deployment soon.

In 2022, some two months after Russian troops invaded Ukraine, Putin said the Sarmat would "reliably ensure the security of Russia from external threats and make those, who in the heat of aggressive rhetoric try to threaten our country, think twice".

The Sarmat is an underground silo-based missile that Russian officials say can carry up to 15 nuclear warheads, though the United States military estimates its capacity to be 10 warheads.

Known to NATO military allies by the codename "Satan", the missile reportedly has a short initial launch phase, which gives little time for surveillance systems to track its takeoff.

Weighing more than 200 tonnes, the Sarmat has a range of some 18,000km (11,000 miles) and was developed to replace Russia's older generation of intercontinental ballistic missiles (ICMBs) that dated from the 1980s.

Russia test-fired the Sarmat missile in April 2022 in the Plesetsk region of the country, located some 800km (almost 500 miles) north of Moscow, and the launched missiles hit targets on the Kamchatka peninsula, in Russia's far east region.

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Space

Satellite Hack on Eve of Ukraine War was a Coordinated, Multi-Pronged Assault

Christian Vasquez and Elias Groll | 10 August 2023

Source: Cyberscoop | https://cyberscoop.com/viasat-ka-sat-hack-black-hat/

Spacecraft launch. Elements of this image furnished by NASA. (Getty Images)

LAS VEGAS — The cyberattack that crippled satellite communications on the eve of the Ukraine war was more broad than initially understood and carried out by attackers with detailed knowledge of the compromised system, an executive with Viasat, whose modems were targeted in the attack, revealed during a talk Thursday at the Black Hat cybersecurity conference in Las Vegas.

When hackers attacked Viasat as Russian forces prepared to stream across Ukraine's border, they relied on a piece of malware that wiped the contents of thousands of targeted modems. That component of the attack has been fairly well understood, but on Thursday, Mark Colaluca, vice president and chief information security officer at Viasat Corporate, revealed a second, previously unknown component of the attack and said that the company remains under assault.

That secondary line of attack used "highly technical knowledge of our network" and the networking protocols it relies on to "target specific terminals to not let them back on the network," Colaluca said.

U.S. government and Ukrainian officials have blamed Russia for the attack on the Viasat KA-SAT network that shut down communications that Kyiv relied on for commanding troops and thousands of European used for internet access. And the secondary attack revealed on Thursday showed that once Russian hackers had disrupted internet access in the first place they used sophisticated methods to try and prevent it from being restored.

The attack on Viasat signaled that cyber operations would play a significant role in the war between Russia and Ukraine. After the U.S. blamed Moscow for hitting the Viasat network, the Cybersecurity and Infrastructure Security Agency and the FBI released an alert, and the National Security Agency released recommendations to protect satellite communications. Meanwhile, cyber experts pored over the wiper malware dubbed Acid Rain used in the attack and the event has become something of clarion call for improving the cybersecurity of space systems.

In his appearance on Thursday, Colaluca spoke alongside Kristina Walter, who leads the National Security Agency's efforts to protect the cybersecurity of the U.S. defense industrial base. Walter said that in the run-up to the invasion of Ukraine, her agency anticipated that defense contractors might be targeted for cyberattack, but an assault on a satellite internet provider caught the NSA by surprise.

"This was not something we were expecting," she said.

The KA-SAT satellite was launched in

December 2010 and provides broadband internet and satellite television to Europe and parts of the Middle East. At the time of the attacks, the satellite communications network served between 110,000 to 120,000 modems with a mix of commercial, government clients and aviation customers, according to Colaluca.

Around 6:00 p.m. on Feb. 23, 2022, one day before the invasion, an attacker made multiple attempts to log into a VPN that Viasat administrators used to access servers in northern Italy that control the satellite internet network. The attacker at first failed to break into the network but hours later found a credential that worked.

With access to the computer system used to communicate with modems scattered throughout Europe and the Middle East, the attacker proceeded to send a piece of malware — dubbed Acid Rain — that left 40,000 to 45,000 modems inoperable. Ukrainian cybersecurity officials said the attack caused a "huge loss in communications" at the start of the invasion.

The second phase of the attack wasn't discovered until later. Not only did Russian hackers deploy the wiper malware, they also flooded Viasat servers with requests that quickly overwhelmed their networks. Viasat servers received more than 100,000 requests in a five minute time span. That meant that anytime a modem would get kicked off the network it couldn't reconnect because the server could not respond, Colaluca said.

The hackers targeted specific terminals, but the company has not been able to determine exactly which modems were targeted. "It appeared to be that the attackers had specific targets in mind," Colaluca said.

The attacks on Viasat systems persisted beyond February of last year. The network requests that crippled its server continued for several weeks after the date of the invasion, and over the past year the company has observed "several incidents in the RF domain," Colaluca said, referring to the radio frequencies used by the company's satellite to communicate with its base stations.

Colaluca would not provide details on what that radio frequency attack entailed but said that improvements in its security posture appeared to thwart the attack.

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ISRO Conducts Drogue Parachute Deployment Tests for Gaganyaan Mission

11 August 2023

Source: ISRO | https://www.isro.gov.in/Drogue_Parachute_Test.html

Vikram Sarabhai Space Centre (VSSC)/ ISRO, successfully conducted a series of Drogue Parachute Deployment Tests at the Rail Track Rocket Sled (RTRS) facility of the Terminal Ballistics Research Laboratory, Chandigarh, during August 8-10, 2023. The tests were conducted in collaboration with Aerial Delivery Research and Development Establishment (ADRDE)/DRDO.

The Gaganyaan mission entails the safe transportation of astronauts to space and back. A crucial component of this mission is the deployment of drogue parachutes, which play a

pivotal role in stabilizing the crew module and reducing its velocity to a safe level during re-entry.

Drogue parachutes, packed within pyro-based devices known as mortars, are ingeniously designed to eject the parachutes into the air upon command. These conical ribbon-type parachutes, boasting a diameter of 5.8 meters, employ a single-stage reefing mechanism, ingeniously minimizing canopy area and mitigating opening shock, ensuring a smooth and controlled descent.

During the three comprehensive tests conducted at the RTRS facility, a range of real-world scenarios were simulated to rigorously evaluate the performance and reliability of the drogue parachutes. The first test simulated the maximum reefed load, marking a groundbreaking introduction of reefing in a mortar-deployed parachute within India. The second test emulated the maximum disreefed load, while the third test showcased the deployment of the drogue parachute under conditions mirroring the maximum angle of attack experienced by the Crew Module during its mission.

These successful RTRS tests serve as a critical qualification milestone for the drogue parachutes, confirming their readiness for integration into the upcoming Test Vehicle-D1 mission. Notably, earlier this year, the RTRS tests of Pilot and Apex cover separation parachutes were also conducted, further accentuating the progress of the Gaganyaan mission's parachute system development.

The intricate parachute sequence for the Gaganyaan crew module's deceleration system encompasses a total of 10 parachutes. The sequence commences with the deployment of two Apex cover separation parachutes, followed by the stabilization achieved through the deployment of two drogue parachutes. Upon release of the drogue parachutes, the mission transitions into the extraction phase, with three Pilot chutes individually extracting three main parachutes, a pivotal step in reducing the Crew Module's speed to safe levels for a secure landing.

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US Space Force Creates 1st Unit Dedicated to Targeting Adversary Satellites

Brett Tingley | 15 August 2023

Source: Space.com | https://www.space.com/space-force-1st-targeting-squadron

The patch of the 75th Intelligence, Surveillance and Reconnaissance Squadron revealed at the unit's activation ceremony on Aug. 11, 2023. (Image credit: USSF/iStock/Getty Images Plus)

The United States Space Force has activated its first and only unit dedicated to targeting other nations' satellites and the ground stations that support them.

The 75th Intelligence, Surveillance and Reconnaissance Squadron (ISRS) was activated on Aug. 11 at Peterson Space Force Base in Colorado. This unit is part of Space Delta 7, an element of the U.S. Space Force tasked with providing intelligence on adversary space capabilities. It'll do things like analyze the capabilities of potential targets, locate and track these targets as well as participate in "target engagement," which presumably refers to destroying or disrupting adversary satellites,

the ground stations that support them and transmissions sent between the two.

Lt. Col. Travis Anderson, who leads the squadron, said in a Space Force statement that the idea of a dedicated space targeting unit has been years in the making. "Today is a monumental time in the history of our service," Anderson said. "The idea of this unit began four years ago on paper and has probably been in the minds of several U.S. Air Force intelligence officers even longer."

The unit's patch was also unveiled at its activation ceremony, revealing it to be adorned with a grim reaper that has a delta shape for a nose. According to a Space Force statement, the delta represents "historic ties to the earliest days of the U.S. Air Force space community" as well as "all variations of space vehicles" that support the U.S. military.

Master Sgt. Desiree Cabrera, 75th ISRS operations superintendent, said the new unit will revolutionize the targeting capabilities of not just the Space Force, but also the entire U.S. military: "Not only are we standing up the sole targeting squadron in the U.S. Space Force, we are changing the way targeting is done across the joint community when it comes to space and electromagnetic warfare."

The 75th ISRS will also analyze adversary space capabilities including "counterspace force threats," according to the Space Force's statement. Counterspace forces refer to adversary systems aimed at preventing the U.S. from using its own satellites during a conflict.

These systems range from ground-based lasers that can blind optical sensors on satellites to devices that can jam signals or conduct cyberattacks to hack into adversary satellite systems.

These aren't limited to America's adversaries; the U.S. Space Force has conducted multiple training exercises to practice its own "live fire" satellite jamming and "simulated on-orbit combat training."

As militaries worldwide become increasingly reliant on space-based assets like navigation and communication satellites, early warning missile tracking systems and targeting sensors, the Space Force's and other nations' militaries will no doubt be increasing their abilities to monitor both defensive and offensive adversary capabilities in Earth's orbit.

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At Halfway Mark into Chandrayaan-3 Expedition on Moon, ISRO Reports a Picture-Perfect Mission

30 August 2023

Source: Indian Express | https://indianexpress.com/article/india/at-halfway-mark-into-chandrayaan-3-expedition-on-moon-isro-reports-a-picture-perfect-mission-8916832/

The Indian Air Force Tejas performs at the opening ceremony of the Singapore Air Show on February 15, 2022.

Halfway into its 14-day expedition on the moon after a “textbook landing” on August 23, scientists at the Indian Space Research Organisation (ISRO) have described the performance of the

mission as being on par with expectations with various elements in the mission achieving their milestones in the first seven days.

While there had been some concerns over the functioning of a navigation camera located on the 32-kg Rover Pragyan that emerged from the Lander a few hours after the landing on August 23, the concerns have been erased in the last two days with the camera sending back clear images of its navigation path on the moon and a clear image of the Lander on the moon.

On August 26, three days after the landing, the ISRO chairman had indicated during a visit to ISRO by PM Narendra Modi, that there were some issues with the data processing and time lag in data transfer from the Rover to the Lander and the Lander to the Earth that were delaying pictures.

"Images take a lot of time to be transmitted to Earth due to data rate and processing," ISRO Chairman S Somnath told the PM. The PM was shown the latest images from the Lander camera but there were no images from the Rover till August 27 – four days after the landing. The PM was told that the Rover "will turn later in the day (August 26) and look at the Lander and take more pictures."

Some scientists expressed concern that the early images from the Rover camera were unclear and more images of enhanced quality were awaited.

On August 28, ISRO, however, put out the first image clicked by the Rover's navigation camera stating that "On August 27, 2023, the Rover came across a 4-meter diameter crater positioned 3 meters ahead of its location. The Rover was commanded to retrace the path. It's now safely heading on a new path."

On Wednesday, ISRO also put out an image of the Lander that was clicked by the Rover's camera in keeping with the statement made by the ISRO chairman during the PM's visit.

"Pragyan Rover clicked an image of Vikram Lander this morning. The 'image of the mission' was taken by the Navigation Camera onboard the Rover (NavCam). NavCams for the Chandrayaan-3 Mission are developed by the Laboratory for Electro-Optics Systems (LEOS)," ISRO said in a statement on social media Wednesday.

Since the picture-perfect landing of the Lander Module on August 23, the different stages of ISRO's first successful landing mission on the moon have gone as planned.

"Of the mission objectives – demonstration of a Safe and Soft Landing on the Lunar Surface is accomplished, demonstration of Rover roving on the moon is accomplished, and conducting in-situ scientific experiments is underway. All payloads are performing normally," ISRO stated three days after the landing on August 26.

"All the key aspects of the mission have happened," a scientist in the mission said Wednesday.

B N Ramakrishna, the director of the ISRO Telemetry, Tracking and Command Network centre, from where the Lander and the Rover are being tracked, described the mission as "going super".

ISRO has over the last week announced the establishment of communications between the Lander and the Chandrayaan-2 orbiter, between the Lander and the Mission Operations Center at ISTRAC, and between the Rover and the Lander.

ISRO has also announced the switching on of three instruments on the Lander – Rambha-Langmuir Probe (to measure the near-surface plasma – ions and electrons – density and changes with time), ChaSTE – Chandra's Surface Thermo Physical Experiment (to measure thermal properties of the moon near the south pole) and ILSA – Instrument for Lunar Seismic Activity.

The switching on of the two payloads on the Rover – APXS (Alpha Particle X-ray Spectrometer) to derive the chemical composition of the lunar surface, and LIBS (Laser-Induced Breakdown Spectroscope) to determine the elemental composition of the lunar soil – has also been confirmed by ISRO.

The first observations from the ChaSTE instrument on the Lander on the temperature of the surface of the moon were reported on August 27 by ISRO.

On August 29, ISRO reported that "the Laser-Induced Breakdown Spectroscope (LIBS) instrument onboard the Rover unambiguously confirms the presence of Sulphur (S) in the lunar surface near the south pole, through first-ever in-situ measurements."

The Chandrayaan-3 mission has a 14-day nominal life span on account of the Lander and the Rover being solar-powered and one day on the moon being equal to 14 days of sunlight on the Earth.

The day Chandrayaan-3 landed on the moon on August 23 was the first of 14 Earth days of sunlight on the moon and night will fall over the moon on September 6 when the batteries of the Lander and Rover will not be charged for 14 (Earth) days as temperatures fall to the region of below 100 degree Celsius on the surface of the moon.

Although the nominal life of the mission is 14 days, the mission could see an extended lease of life if the batteries of the Rover and Lander revive when the sun rises again on the moon.

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Global Aerospace Industry

Ukraine Will Get F-16 Fighter Jets from the Dutch and Danes After the US Agrees to Allow Transfers

Mike Corder, Samya Kullab nd Jan M. Olsen | 19 August 2023

Source: AP News | https://apnews.com/article/russia-ukraine-war-moscow-drones-8268c5de812e5d852cc28443a00123f7

THE HAGUE, Netherlands (AP) — The United States has given its approval for the Netherlands and Denmark to deliver F-16s to Ukraine, officials in Washington and Europe said Friday, in a major gain for Kyiv, even though the fighter jets are unlikely to affect the war any time soon.

It was not immediately clear when the first F-16s might enter the conflict, but Ukrainian pilots will first have to undertake at least six months of training on the aircraft, according to officials.

Ukraine has long pleaded for the sophisticated fighter to give it a combat edge. It recently launched a long-anticipated counteroffensive against the Kremlin's forces without air cover, placing its troops at the mercy of Russian aviation and artillery.

Even so, Air Force Gen. James Hecker, commander of U.S. air forces in Europe and Africa, told reporters in Washington he did

not expect the F-16s to be a game-changer for Ukraine. Getting F-16 squadrons ready for battle could take "four or five years," he said.

But in eastern Ukraine, attack helicopter pilots welcomed the news. They said Russia has a clear advantage in the skies, but the introduction of better fighter jets could dramatically shift the balance of power Kyiv's way.

Ukrainian air forces supporting infantry are using decades-old Soviet-era planes, which are vulnerable to air-to-air missile attacks from Russian fighter jets, Capt. Yevgen Rakita, a spokesman for the 18th Army Aviation Brigade, told The Associated Press.

"A modern war cannot be won without aviation" capabilities, Rakita said.

In making the decision on F-16 deliveries, Washington aims to ensure warplanes can be provided to Ukraine as soon as its pilots complete training, according to a U.S. administration official who was not authorized to comment and spoke to the AP on condition of anonymity.

U.S. national security adviser Jake Sullivan said U.S. Secretary of State Anthony Blinken sent a letter to his Dutch and Danish counterparts earlier this week, offering formal assurance that the U.S. would fast-track approval of all requests from third parties to transfer F-16s to Ukraine.

Danish Defense Minister Jakob Ellemann-Jensen said Friday that the training of Ukrainian pilots is starting this month.

A coalition of 11 Western countries — the Netherlands, Belgium, Canada, Denmark, Luxembourg, Norway, Poland, Portugal, Romania, Sweden and the United Kingdom — pledged in July to train Ukrainian pilots to fly F-16s.

Denmark will hand over some of its F-16s only after receiving its new F-35 jet fighters. The first four F-35s are due to be delivered on Oct. 1.

Washington's blessing for the plane donations to other countries is needed because the aircraft are made in the United States.

Ukraine's Western allies have at times moved slowly on granting Kyiv the military support it has requested.

President Joe Biden's authorization last May for allies to train Ukrainian forces on how to operate the warplanes, and eventually to provide the aircraft themselves, was preceded by months of debate in Washington and quiet talks with allies, officials said.

The administration had concerns that the move might escalate tensions with Russia. Also, U.S. officials argued that learning to fly and logistically support the advanced F-16 would be difficult.

Though delivery is likely months away, Washington says the F-16s — like the advanced U.S. Abrams tanks — will be crucial for Ukraine's long-term security.

Ukraine has been relying on older aircraft, such as Russian-made MiG-29 and Sukhoi jets. F-16s have newer technology and targeting capabilities. They are also more versatile, experts say.

In other developments:

— Russian air defenses stopped drone attacks on central Moscow and on the country's ships in the Black Sea, officials said Friday, blaming the attempted strikes on Ukraine. It was not possible to verify the claims.

— A Hong Kong-flagged cargo ship that set sail this week along a temporary Black Sea

corridor established by Ukraine for merchant shipping safely reached the coast of Istanbul on Friday. The voyage was closely watched to see whether the Russian navy would allow the Joseph Schulte container vessel to pass unmolested.

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To Fill a Critical Gap, Indian Air Force Looks to Buy Six Mid-Air Refuellers

Amrita Nayak Dutta | 30 August 2023

Source: Indian Express | https://indianexpress.com/article/india/to-fill-a-critical-gap-iaf-looks-to-buy-six-mid-air-refuellers-8915461/

An IAF IL-78 MKI carries out air-to-air refuelling. (Image source: @IAF_MCC)

The Indian Air Force (IAF) is set to revive the process of procuring six mid-air refuellers after failing to make any headway during two earlier attempts over the last two decades.

Highly placed Defence officials told The Indian Express that the request for proposal to procure six mid-air refuelling aircraft, also known as tankers, should be floated within six months to invite bids from interested Defence majors.

This is the IAF's third attempt since 2007 to buy the tankers. Two of its earlier tenders were scrapped due to pricing disputes.

Officials said the IAF is looking to procure six "pre-owned" aircraft — these can be modified into tankers — to meet its requirement of refuellers so that they can serve for 25 to 30 years.

"Several global companies will let go of their older aircraft models in the next three to four years as they make the transition to advanced aircraft with new engines. There will be an adequate number of pre-owned aircraft available in the market which can be modified into tankers," a Defence official said.

The IAF is looking for an Indian maintenance partner for the tankers.

Once inducted, the refuellers will fill a critical capability gap in the IAF's inventory and will prove to be a vital strategic asset and force multiplier as they will allow fighter aircraft to stay airborne longer.

The six aircraft will be procured in addition to another tanker which the IAF would take on lease from interested global vendors to meet its training needs, the process for which has already been initiated. The IAF also provides limited refuelling efforts to the Navy's MiG-29K fighter aircraft.

"It might take two to three years to start the deliveries of the tankers. Meanwhile, the one tanker to be leased will be used for immediate training requirements of the force," the official said, adding that it cannot, however, be used in operations.

Currently, the IAF operates a fleet of six Russian Ilyushin-78 tankers procured in 2003-04, but at any given time only three to four are serviceable. Their maintenance and serviceability issues were also brought out in an August 2017 report of the Comptroller and Auditor General (CAG) that studied their operations from 2010 to 2016. The tankers were bought in 2003-2004 at Rs 132 crore per aircraft.

The need to procure six additional tankers

– in line with the IAF's laid down long-term procurement plans – have significantly gone up in the last few years as the force looks to induct a range of fighter aircraft with the capability of receiving fuel in air to build up its depleting number of squadrons.

The Airbus A330 multi-role tanker transport and the Ilyushin Il-78 had both fought in the past to secure a contract.

Last year, state-owned Hindustan Aeronautics Limited (HAL) also signed an agreement with Israel Aerospace Industries (IAI) to convert the Boeing-767 passenger aircraft into tankers in India.

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BEL Inks MoU with Israel Aerospace Industries

02 September 2023

Source: PSU Connect | https://www.psuconnect.in/news/bel-inks-mou-with-israel-aerospace-industries/39091

New Delhi: Bharat Electronics Limited & IAI sign MoU to tap opportunities in Short Range Air Defence Systems' domain Navratna Defence PSU Bharat Electronics Limited (BEL) and Israel Aerospace Industries (IAI), Israel's leading aerospace and defence company, have inked an MoU for co-operation in addressing India's requirements in the domain of Short Range Air Defence Systems.

The MoU was signed by Mr K V Suresh Kumar, Director (Marketing), BEL, and Mr Avi Elisha, VP and General Manager, Missile Systems Division, IAI, in the presence of Mr Bhanu Prakash Srivastava, CMD, BEL, in Bengaluru yesterday.

The partnership marks yet another significant step towards cementing the synergy between the two companies which have a long history of association. BEL and IAI are engaged in several joint development/production/product support programmes for the Indian Defence forces.

The MoU aims at leveraging IAI and BEL's capabilities and is in sync with the 'Atmanirbhar Bharat' and 'Make in India' policies of the Government of India.

Mr Bhanu Prakash Srivastava, CMD, BEL, said: "BEL considers IAI, Israel, as a key strategic partner. This MoU is envisaged to boost the cooperation between the two companies in the field of Short Range Air Defence Systems. It will empower the Indian industry to make significant contributions towards equipping our forces with state-of-the-art Short Range Air Defence Systems."

Mr Boaz Levy, IAI's President and CEO, said: "BEL and IAI have a successful partnership in the field of Air Defence in India.

Together, we are providing the Indian Armed Forces with high-end Air Defence capabilities that meet their high-end operational requirements on one hand and 'Make in India' requirements on the other. Hence, it is only natural that we expand this cooperation to the Short Range Air Defence domain."

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Indian Aerospace Industry

US Congress Clears Historic Deal to Jointly Make Jet Engines for Indian Air Force

31 August 2023

Source: India Today | https://www.indiatoday.in/india/story/us-congress-clears-landmark-india-us-fighter-engine-deal-2428982-2023-08-31

In a major push for India-US defence cooperation, the United States Congress has cleared GE Aerospace's agreement with state-owned Hindustan Aeronautics Limited to produce fighter jet engines for the Indian Air Force.

The deal was struck between India and the US during Prime Minister Narendra Modi's state visit to the United States in June.

Now, the US Congress has given its nod to the Biden administration to pursue the GE jet engine deal with India, paving the way for the implementation of the agreement with Hindustan Aeronautics Limited (HAL) that includes unprecedented technology transfer, manufacturing of jet engines in India and licensing arrangements.

Why a Game Changer?

Under this deal, GE Aerospace will transfer 80 per cent of its technology to India for the production of F414 fighter jet engines. This technology transfer is aimed to enhance the operational performance of the Light Combat Aircraft (LCA) MKII. The pact entails the joint production of GE Aerospace's F414 engines in India, under the Air Force's Light Combat Aircraft Mk2 program.

The partnership is considered a "big game changer" by HAL Chief CB Ananthakrishnan, as it forms the basis for future indigenous engines that will power military jets.

The deal also includes the co-production of 99 jet engines, which will be less costly due to the technology transfer.

The F414 engines are renowned for their reliability and performance.

GE Aerospace, which has been on Indian soil for over four decades now, will also get a boost to its volume of facilities here, including providing engines, avionics, services, engineering, manufacturing, and local sourcing.

The US giant has previously said it would continue to collaborate with the Indian government on the AMCA Mk2 engine program.

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Self-Reliance in Aircraft and Helicopter Engine Technology – The India Story

Sarabjeet S Parmar | 16 August 2023

Source: Bharat Shakti |https://bharatshakti.in/self-reliance-in-aircraft-and-helicopter-engine-technology-the-india-story/

On 15 August 1947, India was born with a handful of ordnance factories built during British rule to manufacture arms and ammunition to meet the requirements of the Raj. It resulted in a heavy dependency on imports to furnish the Indian Armed Forces with the requisite capacity and capabilities to defend the newly born nation starting with the 1947 war with Pakistan. India fought all the conflicts, apart from the 1999 Kargil conflict, with its neighbours with comparatively obsolete or aged equipment and technology. It is the valour of the Indian Armed Forces and leadership on the battlefield that always carried the day.

In the contemporary world, with

munitions being fired from stand-off ranges and manoeuvres assisted by unseen assets, especially air and space, there is an unprecedented requirement for state of the art and indate generational equipment. The gap between the ability of India's defence industry to provide such equipment is large, and most of it stems from the absence of a sound domestic defence industrial base which can provide such equipment.

The past bi-polar global security relations and bracketing of India with the erstwhile USSR, internal prioritised budgeting, and the inability of defence related Public Sector Units to bridge the gap, especially hi-technology equipment, has landed India with a military capable of defending the nation, but with huge gaps, which are filled by procuring expensive assets. Although there are efforts on by a now-growing domestic defence industry to fill the gaps, there is a long road ahead.

Fixed-wing aircraft and helicopters and the engines that propel them fall in the category of state of the art and indicate generational equipment. India's quest to manufacture a fixed-wing aircraft designed and built in India predates that of a helicopter and can be considered partially successful with the Tejas series, while the manufacture of a helicopter is a more recent story.

Notwithstanding the various variants that have been tested and are currently in service, like the Advanced Light Helicopter, the helicopter engine remains a more elusive equipment. The story of the Kaveri engine that was to power the Light Combat Aircraft Tejas project is well known. The designing and development of a turbofan for the engine started in 1986 by the Gas Turbine Research Establishment of India's Defence Research and Development Organisations met a series of setbacks, including technology challenges fuelled by the gambit of international relations and sanctions that arose from the 1998 nuclear tests conducted by India.

These sanctions imposed a stop to the transfer of critical technology and components by the USA. The same applied to missile engines, and in 1992, the US led global sanctions on the Indian Space and Research Organisation. Interestingly India had explored a US engine for its missile programme three years before the ISRO sanctions but had rejected the deal due to the high price and no offer for technology transfer. Today, though any deal may seem to revolve on the issues of cost and amount of technology transfer, the security environment and relations based on strategic partnerships provides a better platform to engage in developing an indigenous aircraft and helicopter engine manufacturing industry.

A helicopter engine is considered a more complex piece of equipment as compared to an aircraft engine; hence it would require more due diligence from the domestic stakeholders, especially the industry. After Prime Minster Modi's visit to the US and France, India has two offers on the table. The US offer to co-produce General Electric's F-414 engine with Hindustan Aeronautics Limited can be considered a starting point for India's own efforts. However, two aspects must be kept in mind. First, General Electrics in 1986 had worked on India's LCA project with the Aeronautical Development Agency and the Hindustan Aeronautics Limited first with the F-404 engines and then with both F-404 and F-414 engines.

A General Electric press release dated 01 October 2010 mentioned delivery of the F414-GE-INS6 engine for powering the Tejas, and the same engine once again finds mention in some reports regarding the latest agreement. Hence, arises the question of the vintage and variant of the F-414 engine technology being offered.

Secondly, how much technology transfer would be considered, and what exactly would co-production entail? The devil is always in the details, and India should maximise gains from the offer.

The agreement with France looks at manufacturing engines for both aircraft and helicopters, which is part of Horizon 2047 that looks at setting up a roadmap to steer the bilateral relationship up to 2047.

Apart from other military hardware, the agreement looks at supporting industrial cooperation for the Indian Multi-Role Helicopter programme planned to be powered by a Safran Engine. This engine is expected to be developed with Hindustan Aeronautics Limited, with technology transfer a part of the agreement. Like General Electric, Safran has a presence in India and has been engaging the Indian Defence industry. Safran has a foothold in the helicopter engine industry in India and is the leading supplier of turbine engines for helicopters flown by the Indian Armed Forces, with more than 1500 helicopter engines in service.

The Shakti engine, co-developed by Safran and Hindustan Aeronautics Limited, was initially selected for the Advanced Light Helicopter and could also be used in the Light Combat Helicopter. Interestingly, as per the Safran website, there is a joint venture between Safran and Hindustan Aeronautics Limited that produces components for CM56 and LEAP engines for CFM International, which is a 50/50 joint venture between Safran and General Electrics.

Though these engines are for commercial aircraft, it may complicate India's approach, and to avoid a possible conflict of interests, both present and future, between the US and France, India would have to tread a balanced path to ensure that the maximum is extracted and a path towards indigenous engine manufacturing is started.

India has diversified its arms and technology imports based on its approach to strategic autonomy and growing strategic partnerships with several nations. French deals are considered a package deal with little to no caveats, especially where delivery of ordnance is concerned. Both these agreements would be a shot in the arm towards Atmanirbharta and would also keep India's options of best choices open. Hence, while negotiating the finer details, India would have to ensure that the dice in the gambit of international relations and strategic autonomy always rolls out a six.

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Antrix Gets Immunity: Lessons for Indian Space 2.0

Harini Madhusudan | 21 August 2023

Source: Interstellar News | https://interstellar.news/antrix-gets-immunity-lessons-for-indian-space-2-0/

On 1 August 2023, the US Court of Appeals ruled that the Antrix Corporation "enjoyed immunity under the Foreign Sovereign Immunities Act." The ruling essentially reversed the confirmation provided in November 2020, by the District Court of Seattle, in exercising personal jurisdiction over Antrix when they had claimed immunity under the Foreign Sovereign Immunities Act 1976. With this new ruling, all of the Devas' shareholders' attempts to claim compensation or rewards under various US jurisdictions were nullified. Devas Multimedia had pursued the case, trying to enforce the International Chamber of Commerce (ICC) arbitration against Antrix in the US, France, the UK, Germany, Mauritius and the Netherlands.

The commercial arm of ISRO, Antrix Corporation, got into a commercial arbitration case with Devas Multimedia with the ICC after they terminated the deal based on an agreement made in 2005. Devas' base argument was that the Antrix-Devas satellite deal was wrongfully terminated. In September 2015, the ICC ordered Antrix Corporation to pay a compensation of USD 1.2 billion to Devas Multimedia after the Indian government, in February 2011, announced that the deal could not go forward. The Indian decision cited that the S-band spectrum was for the security purposes of the country and that the agreement to provide commercial mobile services through ISRO's GSAT 6 and 6A (now dedicated satellites for the Indian Navy and the Indian Army) could not be allowed. In July 2023, the Hague Court announced that the American investors of Devas could not claim the enforcement of the ICC ruling of USD 1.2 billion, stating that Devas was fraudulently incorporated. The Supreme Court of India also declared Devas Multimedia as fraudulent. In the Netherlands, Devas Multimedia had sought to seize the assets in the form of contract receivables of Antrix. The Dutch courts upheld the decisions/orders of the National Company Law Tribunal and the Supreme Court of India and rejected the requests of Devas Multimedia.

Background to the Flawed Antrix-Devas Deal

It started with a memorandum of understanding between Antrix and Forge Advisors LLC, a US-based corporation from Virginia. The deal was to jointly try and implement new satellite applications across multiple sectors like education, agriculture, telecommunications or media. Forge Advisors further worked towards an Indian joint venture and named it DEVAS (Digitally Enhanced Video and Audio Services).

In 2005, Antrix signed an agreement with Devas, where the latter would develop a platform capable of delivering multimedia and information services through satellite. Antrix would provide the space segment for offering the services. For this, Devas brought an investment of 579 crore INR. The proposal

indicated that the service would be launched by the end of 2006. However, around the time of the 2G controversy in 2011, Antrix terminated the agreement on the grounds of force majeure, which means that a party failed to fulfil a contract due to unforeseen circumstances.

Following the deal's termination, Devas initiated a commercial arbitration before the ICC tribunal. Its Mauritius investors initiated a Bilateral Investment Treaty (BIT) arbitration under the India-Mauritius BIT, and Deutsche Telekom, a German company, invoked BIT proceedings under India-Germany Bilateral Investment Treaty. The BIT arbitrations are legally and conceptually distinct from the commercial arbitrations of the ICC. These deliberations were conducted parallel to each other. In 2020, the case with Mauritius held the Indian government responsible for indirect expropriation. It stated that the termination violated fair and equitable treatment (FET) and awarded Devas approximately USD 111.30 million in compensation. In 2017, the tribunal in Deutsche Telecom also held India responsible for the breach of FET and awarded Devas about 101 million dollars in compensation. India challenged both awards in their respective arbitration courts, and they upheld the BIT compensation awards.

Lessons from the Avoidable 12-year Legal Dispute

Antrix had entered into the deal with a company that had been formed merely one year before the contract was signed. There also emerged concerns over the corruption allegations against the deal where the slots on the S-band spectrum were offered at throwaway prices. However, the annulment of the deal did not mention the concerns over the corruption related to the deal but sufficiently stated that the cancellation was due to the need for S-band allocation for strategic needs of defence, paramilitary forces, and the railways. Further, during the BIT arbitrations, India did not raise the issue of fraud or corruption as a jurisdictional objection until 2016, despite finding several anomalies in a 2012 Comptroller Auditor General report, where the Devas-Antrix contract, such as the agreement that promotes the interest of an individual private entity at the cost of public interest. In 2016, when the Indian judicial authorities requested a stay to the proceedings stating the anomalies in the Devas-Antrix contract, they were rejected as being mistimed.

This failure of timely regulation resulted in a longer duration of addressing the matter. In this case, the finance ministry has played a pivotal role in the investment treaty arbitration. But for a robust litigation strategy, it is important to work towards establishing law firms with fair expertise in representing a case for India. A good example would be the US Office of the Assistant Legal Adviser for International Claims and Investment Disputes, where the office coordinates international claims disputes. Domestically, it was essential to fastback the criminal proceedings against Devas.

The National Company Law Appellate Tribunal (NCLAT) and the Supreme Court verdicts that upheld the decision of the National Company Law Tribunal (NCLT) to wind up Devas and liquidate its assets send mixed signals to the investment environment in India. But the case of Devas should be seen as an exception where it has proven to be a fraudulent strategy. It also brings to the question of what would

happen to the investors who were unaware of the fraud and invested later in the deal. The failure of due diligence before investing will be a lesson for India's investors, industries, startups and investment promoters.

A number of other lessons can be derived from this case when it comes to issues dealing with one nation's resources, assets and intellectual property in a zone with multiple jurisdictions. In this case, the commercial entities still functioned in national jurisdictions, and the deliberations were based on national laws. With the increased number of private space companies and the international collaborative efforts by these companies, it is imperative that such cases may re-emerge. Additionally, the newer cases may not always relate to military security but often would be detrimental to economic security. Dispute mechanisms must be established to predict such cases and remain prepared to address them when they arise.

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Technology Development

Charting the Skies of Tomorrow

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

August-September 2023

Source: SPs Airbuz| https://www.spsairbuz.com/story/?id=1370&h=Charting-the-Skies-of-Tomorrow&s=08

Mobility has traditionally been the central pillar of all socio-economic development since times immemorial. It facilitates movement of goods and services, jobs, and education etc. Air allows fastest means of transportation. Air travel is no more a luxury reserved for the wealthy and privileged, but for fast moving masses. It is fast becoming highly accessible and also affordable. With greater urbanisation, there is increased demand for flights, and airports. The air mobility systems are getting stretched. The increased flights also mean greater cabon emissions and the cascading impact on climate. The sustainable mobility has to factor in many aspects, and all players must have a clear roadmap and achievable targets. To meet the increased requirements, and also balance the environmental needs air-mobility needs support of technology. The key issues are efficiency, flight safety, security, and making the experience enjoyable for passengers.

From electric air taxis to autonomous flying

technologies, a new era of urban air mobility is taking shape, promising greener and quieter flights, shorter commutes, and enhanced convenience

Airlines worldwide carry nearly 4.3 billion passengers a year and 60 million tonnes of freight on 40 million commercial flights. Meaning transporting over 10 million passengers and around $18 billion worth of goods. With over 1,00,000 commercial flights around the world each day, it means 450 departures per hour. Air is one of the safest and most reliable modes of transportation. Currently, worldwide, 74 per cent live within 100 km of an airport. The demand for air transport will increase by an average of 4.3 per cent per annum over the next 20 years. By mid-2030s there will be over 2,00,000 flights per day. Aviation is no more just mobility between continents and cities, but also urban mobility within cities. Doubling of passenger and cargo numbers by 2036, will mean demand for pilots, engineers, air traffic controllers and other aviation-related jobs.

Technology Development Overview

Aviation is already known as a driving force of global technology development and innovations. Newer lighter, yet stronger materials, efficient and quieter engines, artificial intelligence (AI) supported autonomous devices and platforms, robotics and block chain, hybrid fuels and electric aircraft are initiatives under active engagement. New technologies are looking at hydrogen fuel, electric flying, eVTOLs, futuristic airships, commercial supersonic jets, autonomously-flying aircraft, and space-travel jets. Passenger comfort, congestion reduction and time saving, and coordination with surface transportation means is also important. Sustainable air mobility will require all this and more. International Civil Aviation Organisation (ICAO) is closely following the United Nations 2030 Agenda for Sustainable Development. Alternative fuels can significantly support of the environmental protection. Big Data could increase safety, efficiency and sustainability. Digital technologies are changing the landscape of airline industry to make travel experiences more personalised, valuable and memorable.

Engine Technologies

Aircraft engines need to produce more power while consuming less fuel, produce less noise and reduce emission levels. Adaptive, efficient, variable cycle, versatile engine technology is being pursued by the United States efficient adaptive cycle for next generation aircraft. Initially designed for military engines, some these technologies will be relevant for future airline engines. Currently fighter engines are optimised for high speed and commercial engines for high fuel efficiency. The new engines will be designed to meet both these requirements. Other new technologies related to engines include those to shorten engine development cycle, reduce engine weight, enhance reliability, increase component life and reduce maintenance requirements. Ultra-high bypass turbofans, open rotor engines, use of alternative fuels, relocating engines on the body of the aircraft such that engine noise is deflected upwards are some design considerations. Growth of computer technology and the microelectronics revolution allowed fullauthority electronic digital active controls on aircraft engines. Magnetic bearings suspend the rotating members eliminating friction and

lubrication requirements. Real time analysis helps diagnostics, and the 'Life Cycle Cost'. 3D printing and additive manufacture is creating spares on demand.

Sustainable Aviation Fuel (Saf)

SAF is a liquid fuel currently used in commercial aviation which reduces CO2 emissions by up to 80 per cent. It can be produced from a number of sources (feedstock) including waste oil and fats, green and municipal waste and non-food crops. It can also be produced synthetically via a process that captures carbon directly from the air. It is 'sustainable' because the raw feedstock does not compete with food crops or water supplies, or is responsible for forest degradation. It is estimated that SAF could contribute around 65 per cent of the reduction in emissions needed by aviation to reach net-zero in 2050. This will require a massive increase in production in order to meet demand. The largest acceleration is expected in the 2030s as policy support becomes global, SAF becomes competitive with fossil kerosene, and credible offsets become scarcer.

There are still several challenges associated with SAF, such as limited availability and higher costs. All major carriers in the world has launched own SAF initiatives. It can be blended with fossil jet fuel. SAF must be produced in far greater sums to make a meaningful difference in climate change and keep up with global jet fuel demands. SAF is still a fledgling industry, with roughly only 20 million gallons (75 million litres) of production capacity in 2020, which accounts for less than 0.05 per cent of the world's aviation fuel use.

Autonomous Flying Technologies

Accurate three-dimensional position technology, collision avoidance sensors, high speed computing, quick-reaction controls, autopilots have made it possible driverless cars which are mushrooming. There also new developments in autonomous flying technologies. Their introduction as part of the unmanned urban air mobility has already begun.

Autonomous control systems are reaching a point where several air taxis and associated regulatory regimes are being developed. Autonomous flight is coming to civil aviation sooner than anyone thinks, and it may prove to be a surprising boon for flyover country. While public perception problem remains an issue, a Swiss bank UBS report estimated that autonomous planes could save the air transportation industry more than $35 billion per year. For the past few years, Xwing has been running automated test missions, and plans to introduce and operate these vehicles by late 2025. They expect autonomous aircraft to be transporting human passengers by the end of this decade.

Electric Aircraft

The aircraft powered by electricity reduce the environmental effects of aviation, providing zero emissions and quieter flights. Electricity may be supplied by a variety of methods, the most common being batteries. Most have electric motors driving propellers or turbines. Between 2015 and 2016, Solar Impulse 2 completed a circumnavigation of the Earth using solar power. Electric VTOL aircraft or personal air vehicles are being considered for Urban Air Mobility. Electric commercial

airliners could lower operating costs. The NASA Electric Aircraft Testbed (NEAT) is used to design, develop, assemble and test electric aircraft power systems. The UK budget carrier EasyJet announced it was developing an electric 180-seater for 2027 with Wright Electric. The single aisle, short haul airliner targets 50 per cent lower noise and 10 per cent lower costs. Israel Aerospace Industries plans to develop a short-haul electric airliner, building on its small UAS electric power systems. On May 28, 2020, the MagniX electric-powered nine-passenger Cessna 208B eCaravan flew on electric power, and is working towards commercial operation certification. In September 2022, Swedish electric airplane maker Heart Aerospace unveiled significant design updates to its first electric aircraft. The new airplane design, called the ES-30, is a regional electric airplane with a capacity of 30 passengers and it replaces the company's earlier 19-seat design, the ES-19. It is driven by electric motors powered by batteries, which allows the airplane to operate with zero emissions and low noise. On March 22, 2021, Toulouse-based Aura Aero announced the development of its ERA (Electric Regional Aircraft), a 19-passenger electric aircraft, planned to be certified in 2026.

Air Taxis (Evtol)

An electric vertical take-off and landing (eVTOL) aircraft is a variety of VTOL (vertical take-off and landing) aircraft that uses electric power to hover, take off, and land vertically. This has been possible thanks to advances in electric propulsion (motors, batteries, fuel cells, electronic controllers) and the emerging need for new aerial vehicles for urban air mobility that can enable greener and quieter flights. Electric and hybrid propulsion systems have also the potential of lowering the operating costs of aircraft. Manufacturers such as Airbus, Boeing, Embraer, Honda, Hyundai, and Toyota, as well as several start-up companies are working on these. Many eVTOL's concept are for Air Taxi application. Pipistrel, an Uber Elevate partner, is working on a five seats air taxi. Volocopter, proposed its air taxi service on the Volocopter 2X.

Hydrogen Powered Aircraft

Hydrogen-powered aircraft use hydrogen fuel that can either be burned in a jet engine or another kind of internal combustion engine, or can be used to power a fuel cell to generate electricity to power an electric propulsor. It cannot be stored in a traditional wet wing, and hydrogen tanks have to be housed in the fuselage or be supported by the wing. Hydrogen, which can be produced from low-carbon power and can produce zero emissions. Boeing and Airbus plan to launch a first commercial hydrogen-powered aircraft by 2035, and scaling up through 2050, by when they could account for a third of aviation's energy demand. Gaseous hydrogen may be used for short-haul aircraft, and liquid hydrogen for long-haul aircraft. Hydrogen's high specific energy means it would need less fuel weight for the same range, ignoring the repercussion of added volume and tank weight. The economics of cost of producing hydrogen have to be worked out.

On January 19, 2023, ZeroAvia flew its Dornier 228 testbed with one turboprop replaced by a prototype hydrogen-electric powertrain in the cabin, consisting of two fuel cells and a lithium-ion battery for peak power. On March 2, 2023, Universal Hydrogen flew a Dash 8 40-passenger testbed with one engine

powered by their hydrogen-electric powertrain. The company has received an order from Connect Airways to convert 75 ATR 72-600 with their hydrogen powertrains. In December 2021, the UK Aerospace Technology Institute (ATI) presented its FlyZero study of cryogenic liquid hydrogen used in gas turbines for a 279-passenger aircraft design with 9,720 km of range. Pratt & Whitney wants to associate its geared turbofan architecture with its Hydrogen Steam Injected, Inter Cooled Turbine Engine (HySIITE) project, to avoid carbon dioxide emissions, reduce NOx emissions by 80 per cent, and reduce fuel consumption by 35 per cent compared with the current jet-fuel PW1100G, for a service entry by 2035. In February 2022, Airbus announced a demonstration of a liquid hydrogen-fueled turbofan, with CFM International modifying the combustor, fuel system and control system of a GE Passport, mounted on a fuselage pylon on an A380 prototype, for a first flight expected within five years.

Supersonic and Hypersonic Civil Flight Projects

To date, the only supersonic airliners in regular service have been Concorde and the Tupolev Tu-144. The last passenger flight of the Tu-144 was in June 1978 and it was last flown in 1999 by NASA. Concorde's last commercial flight was in October 2003. Several companies have each proposed a supersonic business jet, which may bring supersonic transport back again. Drawbacks and design challenges such as excessive noise on take-off, sonic booms, development costs, expensive maintenance, high fuel consumption, extremely high emissions, and increased cost per seat. Despite these challenges, Concorde claimed it operated profitably.

The age of space tourism offers tantalising glimpses of suborbital adventures, opening the doors to a new frontier in human exploration and leisure

Yet new platforms are under development. Lockheed and Boeing are working on supersonic and hypersonic flight along with NASA. Boom Technology has been developing a 40-passenger supersonic jet capable of flying Mach 1.7. That will be quieter and 30 per cent more efficient than the Concorde and will be able to fly Los Angeles to Sydney in 6 hours. It is planned to go into service in 2029. FAA and ICAO are working on lifting bans in the early 2020s. The Lockheed Martin X-59 QueSST X-plane is supporting technology development. According to published reports, the market for supersonic airliners costing $200 million could be 1,300 over a 10-year period, worth $260 billion. Russians are also working on Supersonic Business and commercial jets. The Spike S-512 is a self-funded twinjet design aiming to cruise at Mach 1.6 over water for 11,500 km, with 22 passengers in a windowless cabin. NASA plans to fly the Lockheed Martin X-59 Quiet Supersonic Transport (QueSST) low-boom flight demonstrator for ICAO standards in 2025. Exosonic Inc was awarded a contract to develop a supersonic jet which could be used as Air Force One. Virgin Galactic with Rolls-Royce unveiled the concept of a Mach 3 capable twinjet delta wing aircraft that can carry up to 19 passengers. The supersonic Tupolev Tu-444 or Gulfstream X-54 have also been proposed. The German Space-Liner is a suborbital hypersonic winged passenger spaceplane project under preliminary development. Boeing unveiled in 2018 a Mach 6 passenger airliner that could

cross the Atlantic in 2 hours or the Pacific in 3 at 1,00,000 ft altitude. A reusable demonstrator could be flown as early as 2023 or 2024 for a potential entry into service from the late 2030s.

Space Travel

The trio of billionaire-led rocket companies, Bezos' Blue Origin, Branson's Virgin Galactic, where tickets for a suborbital spaceflight start at $4,50,000; and Elon Musk's SpaceX, which in September launched an all-civilian spaceflight, with no trained astronauts on board. Inaugural Virgin Galactic flight in 2021 reached about 53 miles, while Blue Origin flies above the 62-mile mark. SpaceX rockets go up to 120 miles above Earth. In fact, we'll see the launch of affordable space tourism industry within just a few years. Virgin Galactic had announced the launch of its commercial passenger service, which is now delayed to late 2023. Voyages are scheduled to begin departing from Florida in 2024, at a cost of $1,25,000 per person.

Way Ahead

Advancements in technology are impacting every aspect of aviation industry, from aircraft design to aircraft operations. From passenger handling to passenger comfort. From operational efficiency to flight safety and security. From saving passenger time to airlines costs. Some technologies will take time. SAF production has to go up considerably. Supersonic and hypersonic airliners are still some distance away. Space travel must become cheaper. Expectations for an electric aviation future continue to rise, but the level of technology readiness, including certification, still requires significant work. While hydrogen flying is considered by many to be the holy grail of cleaner aviation. But the energy source is still in its nascent days. It could take at least another quarter century until hydrogen becomes a market-ready technology for commercial aviation. It can be seen that many major new air travel technologies have to reach the level of market maturity.

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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."

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