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"Not having an adequate Air Force in the present state of the world is to compromise the foundations of national freedom and independence.

- Winston Churchill

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# **Opinions and Analysis**

### **Time to Reboot Aeronautical Industry**

Air Vice Marshal Manmohan Bahadur (Retd) Former Additional Director General, Centre for Air Power Studies | 02 Jan 2023

Source: Tribune India | https://www.tribuneindia. com/news/comment/time-to-reboot-aeronauticalindustry-466459



TRAILBLAZER: C-295 will be an ideal replacement for IAF's An-32 aircraft. PTI

THE C-295 transport aircraft acquisition project of the IAF has been a long time coming and has been hailed as a 'trailblazer'; what is a bit overwhelming, though, is that it has been

projected as a panacea for the ills that affect our aircraft industry environment. Let's take stock.

It is indeed a good thing to happen. That it took more than seven decades after the establishment of the Hindustan Aeronautics Limited (HAL) is what calls for serious introspection, which if not

done will ensure continuance in the same old pit of foreign dependency.

When the HAL was set up, there were great hopes of an indigenous aircraft industry taking root. Dr Kurt Tank, famous German aeronautical engineer, was brought in to kick-start India's foray into modern fighter aircraft design. But his product, HF-24 Marut, remained a symbol of India's aeronautical dreams and didn't achieve much for want of a suitable engine. This was also indicative of the lack of an overarching plan for developing India's aeronautical R&D and manufacturing ecosystem.

No aircraft manufacturing project would be economically viable only on domestic orders. While the C-295 would be an ideal replacement for IAF's An-32 aircraft when they are phased out, the number would still be insufficient unless export customers are found. Incidentally, the fact that 15 additional C-295 are now being ordered for the Navy and Coast Guard shows that we have not learnt from past experience; if these 15 had been added in the original order of 56 aircraft, it would have resulted in a reduction of the cost per machine due to the increased number.

The conversation should not be limited to mere production of C-295. For the project to be really successful, the Tatas (the Indian

The solution to end foreign<br/>dependency in the aviation sectormdependency in the aviation sectorRis not simple, but there are optionsafavailable. All that is required isTa clutch of professionals who arethempowered, an aviation 'nationalmflight plan' and political will to bringofabout the required changes. Thedeconversation should not be limited tommere production of C-295 transportin

manufacturer) must move into R&D so that the question 'what after C-295?' gets addressed. This is what that should engage the company's leadership since moving into the bigger league of aviation products requires decades of planning and action.

The Chinese aviation industry started with a small Russian trainer aircraft, Yak-

18, in the 1950s but over time has graduated to 150-seat C919 and the under-development 280-seat C929, both of which would challenge Airbus and Boeing products. Their military transport aircraft Y-20 matches America's

C-17 Globemaster in performance and is the base aircraft for flight refuellers and airborne warning and control system (AWACS). Similarly, Embraer, the Brazilian aircraft company which started in 1969 (HAL was founded in 1940) with a small turboprop, has now graduated to 140-seat commercial carriers, the Tucano series of trainer and counter insurgency aircraft and the C-390 Millennium medium-lift transport aircraft. These success stories are indicative of well-thought-out and researched strategic plans; the Indian C-295 project heads, thus, have their work cut out.

The aviation sector requires a steady supply of skilled professionals. Anecdotal evidence exists that aviation technology as a subject had fallen on hard times since young engineering graduates had stopped opting for it due to lack of a worthwhile aviation industry. Now that there is light (hopefully) at the end of the proverbial tunnel, the government must redouble its efforts at ensuring quality education in specialised aviation institutes so that aerospace engineering becomes enticing for the youth. The Tatas can help by sponsoring students in engineering colleges and catching them young. In fact, the Department of Space's Indian Institute of Space Science and Technology, which is a feeder for the ISRO, should serve as a model for dedicated universities of aeronautical sciences.

Media reports indicate that a maintenance repair and overhaul (MRO) ecosystem would be created as a follow-up of the C-295 project. Such yawn-inspiring statements on India becoming an MRO hub have been made for decades, but the fact is that the huge civil aviation fleet still sends its aircraft abroad for MRO. There are myriad other nuts and bolts issues of civil aircraft manufacturing that require the government's attention. To state only two — if just one airline, Aerospace Newsletter

Air India, is planning to buy 300 aircraft, shouldn't the Chinese model of demanding the assembly of such huge numbers in India be made a criterion in the selection process, like the Chinese have done with Airbus and Boeing? And shouldn't there be a civil certification agency like the Federal Aviation Administration in the US and the Centre for Military Airworthiness and Certification in India for the military?

And finally, an aviation czar may be needed to ensure inter-ministerial synchronisation that would be imperative for such an onerous task. That entity can help the government take a call on whether certain divisions of HAL can be opened to the time-and-cost-conscious private sector. As a suggestion, the HAL's helicopter division is an ideal candidate so that programmes such as the ALH (advanced light helicopter) Dhruv, light utility helicopter and the light attack helicopter are further developed and marketed successfully — and not come a cropper like the disastrous ALH Dhruv sale to Ecuador. The Indian Multi-Role Helicopter (IMRH) programme has been hanging fire since 2005 or so. The IAF's huge Miseries fleet of over 250 helicopters would be due for replacement in the coming decades; can the ingenuity and nimbleness of the private sector be harnessed for IMRH as a replacement? Can HAL divest itself of the small aircraft segment like the HTT-44 and IJT-16 trainer aircraft and stay focused on the fighter fleet? These are all radical suggestions that perhaps cannot be implemented for the fundamental reason that there is not one private entity in the country with HAL's infrastructure and technical expertise to absorb the knowhow to ensure a seamless transition. There would have to be government hand-holding for a gradual switch once an all-encompassing plan is made for diversification.

The solution to end foreign dependency in the aviation sector is not simple, but there are options available. All that is required is a clutch of professionals who are empowered, an aviation 'national flight plan' and political will to bring about the required changes — else, as they say in the Indian military, its 'jaise the' (as you were).

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## **Air Power**

### Russian, Chinese Bombers Land At Each Other's Airfields After Joint Patrols

Thomas Newdick | 30 Nov 2022

<u>Source: The Drive | https://www.thedrive.com/the-</u> war-zone/russian-chinese-bombers-land-at-eachothers-airfields-after-joint-patrols



A photo of a PLAAF H-6K bomber provided by the Japanese Ministry of Defense. JASDF

Long-range bombers from Russia and China have conducted "joint patrols" over the Sea of Japan and the East China Sea, with South Korean and Japanese fighter jets being scrambled to intercept them. While combined bomber missions of this kind are by no means unprecedented, today's exercises included Russian and Chinese aircraft landing on each other's airfields, for the first time in this type of exercise, in a sign of expanding cooperation.

At least some of the Russian aircraft involved landed at an undisclosed Chinese airbase, reportedly in Zhejiang Province, as evidenced by multiple videos showing Russian Aerospace Forces (VKS) Tu-95MS Bear-Hs over China. Clearly, the distinctive drone of the bomber's huge turboprops captured the attention of many observers.

It's unconfirmed whether the Russian aircraft were refueled at the Chinese base, but that seems likely, and they later returned to their home stations. Chinese aircraft reciprocated, making visits to an airfield in Russia. Regardless, this may well have been the first time ever that Tu-95 bombers have visited China, although Chinese bombers have previously deployed to Russia for exercises in that country.

Meanwhile, an official video from the Russian Ministry of Defense shows the Tu-95MS bombers departing Ukrainka Air Base, in the Amur Oblast of Russia's Far East, although it's unclear if this is the same airfield that the PLAAF bombers visited.

As well as the Tu-95MS aircraft, the bomber drills involved People's Liberation Army Air Force (PLAAF) H-6Ks. While the designs of both of these aircraft date back to the early years of the Cold War, they have been successively upgraded, and the latest versions are armed with a range of advanced air-launched cruise missiles.

While the Tu-95MS is familiar as one of the key nuclear-capable assets within Russian Long-Range Aviation, the nuclear status of the H-6K is a little less clear. The Pentagon's latest report on the Chinese military describes the similar, but newer, H-6N variant as Beijing's "first nuclear-capable air-to-air refuelable bomber."

According to the Russian Ministry of Defense, the Tu-95MS aircraft were in the air for around eight hours and were escorted, for at least some of

this time, by VKS Su-30SM and Su-35S Flanker multi-role fighters.

"At some stages of the route the strategic missile carriers were accompanied by foreign fighters," Russia's defense ministry added, apparently in reference to the Republic of Korea Air Force (ROKAF) fighters, including F-15K Slam Eagles, that were scrambled in response. South Korea's military said that these jets were launched after two Chinese and six Russian military aircraft entered its air defense zone.

Seoul's Joint Chiefs of Staff (JCS) said that two PLAAF H-6s "repeatedly entered and left" the Korea Air Defense Identification Zone (KADIZ) off the country's southern and northeast coasts, beginning at around 5:48 AM local time, this morning. The Chinese bombers initially

entered from an area 78 miles The latest long-range bomber drills northwest of Leo Islet, a submerged rock and ocean research center south of the southern island of Jeju, before leaving the KADIZ at 6:13 AM.

The KADIZ is not part of Seoul's airspace, but South Korea expects foreign aircraft operating here to identify themselves. It's not clear if the Russian and Chinese aircraft had their transponders on or made efforts to check in with air traffic control authorities, but Russian military aircraft, in particular, frequently ignore these protocols.

At 6:44 AM the PLAAF bombers reentered the KADIZ from an area northeast of the southern port city of Pohang and exited the zone again at 7:07 AM.

Subsequently, according to the JCS account, the two PLAAF bombers re-entered the KADIZ at 12:18 PM after flying from an area 124 miles northeast of Ulleung Island. This time they were accompanied by four Tu-95MS and two Su-35S aircraft from the VKS. These are said to have remained in the KADIZ for 18 minutes before departing, at 12:36 PM.

"Our military dispatched air force fighter jets ahead of the Chinese and Russian aircraft's entry of the KADIZ to implement tactical measures in preparation for a potential contingency," the JCS said in a statement.

At no time did the Russian and Chinese aircraft violate South Korea's sovereign airspace.

At the same time, it's important to note that the KADIZ is not recognized by Russia. China, meanwhile, pointed to the fact that the KADIZ

> does not constitute South Korean territorial airspace and that it is appropriate for other countries to exercise freedom of movement in these areas.

As well as the ROKAF, fighter jets from the Japan Air Self-Defense Force were scrambled to respond. The Japanese Ministry of Defense said its fighters met the two Chinese bombers as they flew from the East China Sea, passing through the Tsushima Strait, into the Sea of Japan.

A map provided by the Japanese defense ministry also shows that a pair of aircraft presumed to be PLAAF J-16 Flanker multi-role fighters — escorted the bombers, at least for a time, while they were over the East China Sea. A pair of photos released by the Japanese Ministry of Defense today clearly show J-16s. Meanwhile, another two unidentified Chinese fighters also spent some time accompanying the bombers while they transited the Tsushima Strait.

# saw Japanese and South Korean fighters scramble to intercept Tu-95MS and H-6K missile-carriers.

According to a report from Reuters, Tokyo said that the H-6s were also joined by two Russian drones of a type that was not disclosed, although there is no further corroboration of this and it's unclear if Russia even operates an unmanned aerial vehicle with the requisite range to venture this far. Perhaps, after all, these were misidentified Chinese drones. Indeed, we have seen Chinese UAVs in these areas in the past.

Joint exercises by Russian and Chinese military aircraft in the Asia Pacific region have taken place on various other occasions in the past, most recently in May, when Seoul's JCS confirmed that Russian and Chinese aircraft had entered the KADIZ.

Russian and Chinese aircraft entering the KADIZ have also led to some tense incidents in the past, most notably in 2019, when ROKAF fighters fired hundreds of warning shots toward Russian military aircraft during joint aerial drills with China, although Moscow disputed that this ever happened.

In December 2020 an especially large formation of Russian and Chinese aircraft entered the KADIZ, with two Tu-95MS and four H-6K bombers accompanied by at least 13 other VKS aircraft, including several Su-35S fighters, according to a statement from Seoul's Ministry of Defense. You can read more about that episode here.

There have been other high-profile examples of joint military maneuvers involving Russian and Chinese forces in recent years. The People's Liberation Army (PLA) and Russian Army took part in the ZAPAD/INTERACTION drills in 2021, with the latter portion of this being conducted on Chinese soil for the first time. According to the latest Pentagon report on China, PLA and Russian forces "underwent theoretical and systems training, weapon swaps, and a culminating exercise to further understanding and cooperation between the two militaries."

Aside from this, the degree of Chinese support made available for Russia's war in Ukraine remains murky. Beijing has consistently maintained an ambiguous position and has not openly acknowledged providing assistance to Russia. However, there have been suggestions that China may well be more deeply involved than it makes out, with recent speculation that flights between the two countries by An-124 heavy transport aircraft could be connected to the movement of military supplies.

While the Russian Ministry of Defense was at pains to point out that the latest air exercise was "not directed against third countries," the political relevance of such close military cooperation has not been entirely lost.

In recent weeks, Beijing has indicated that it's willing to work more closely with Moscow on an economic level, with President Xi Jinping declaring he was ready to "forge a closer partnership" with Russia as regards energy. China is already a major customer of Russian oil and gas, and an expansion of this relationship would help address Moscow's lost revenues due to sanctions over its war in Ukraine.

Alongside continuing military partnerships, increased cooperation in the energy sector is likely to further sour relations between Beijing and Washington. While existing sanctions on Russia don't prevent China from buying its oil and gas, President Joe Biden has nonetheless warned Beijing of unspecified consequences if it

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continues to assist Putin in dodging sanctions.

All in all, signs of increasing proximity between the Russian and Chinese armed forces could hardly come at a worse time for the United States, as it deals, on the one hand with the crisis in Ukraine and, on the other, its own deteriorating relations with Beijing. For South Korea, too, mired at it is in a particularly tense period of relations with North Korea, joint Russian/Chinese bomber patrols off its coast are a very unwelcome distraction.

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### **Turkey's New Fighter-Like Drone Takes Flight... for a Few Seconds**

Stetson Payne | 03 Dec 2022

Source: The Drive | https://www.thedrive.com/ the-war-zone/turkeys-new-fighter-like-drone-takesflight-for-a-few-seconds



Twitter Screencap

The Turkish 'Kizilelma' drone got airborne over the runway at the Akinci Flight Training and Test Center in Tekirdag Province. Baykar's Chief Technology Officer Selcuk Bayraktar said the test was completed successfully, not indicating whether the very brief flight was planned or accidental.

We recently wrote about the Kizilelma's emergence for ground testing and the design's potential future, which you can read all about here.

The canard-sporting drone with some stealthy

attributes looked decently stable in ground effect over the runway before touching back down during a high speed, nose-up run.

If this was a spur-of-the-moment takeoff and not planned, the test team is probably thankful it avoided an embarrassing and costly mishap. Nearly 50 years ago, the YF-16 prototype had a much more exciting misadventure on a highspeed ground run.

With the Kizilelma clearly itching to get airborne, its official first flight of substantial duration may not be too far away.

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# End of HIMARS? Russian Air Defenses Units Receive 'New Software' That Can Track & Knock Out US-Supplied MLRS

Ashish Dangwal | 02 Dec 2022

Source: Eurasiantimes | https://eurasiantimes. com/end-of-himars-russian-air-defenses-unitsreceive-new-software-that-can-track-knock-out-ussupplied-mlrs/



Pakistan shows domestic Shahpar-2 Combat UAV. (Photo credit: Twitter/@KanaanAhmed5)

The commander of one of the air defense units based in the Zaporozhye made this announcement on December 2.

The HIMARS system delivered by the US has proved to be a 'game changer' for Ukraine to thwart Russian aggression. The HIMARS system, in the opinion of most experts, has had the most Return to Contents Page significant impact on the Russia-Ukraine war.

However, experts now assert that the employment of new software enables Russian air

defense units to make calculations that are nearly 100% more precise, enabling them to swiftly shoot down HIMARS missiles.

RIA Novosti quoted the Russian air defense commander as saying, "if at the initial stage the Russian air defense forces did not understand

what the HIMARS MLRS missiles were, then after the firmware of the new program, they became a "normal target."

"We freely see, observe and destroy without problems," he

added. He said that the unit under his command had been successful in shooting down roughly 10 HIMARS rockets, including four in the last month.

Alexei Podberezkin, the director of the Center for Military-Political Studies of MGIMO, told Sputnik radio, "In principle, even before the new software, 75-80 percent of the missiles that were launched by HIMARS systems were shot down, but not 100 percent."

But the HIMARS missiles could now be shot down with near-perfect certainty thanks to more accurate calculations, he added. Meanwhile, Russia did not reveal when they updated the domestic air defense systems with this new software.

Previously, it was reported that Moscow is also deploying its own MLRS, the Tornado-S, to counteract the HIMARS.

Similar to the American HIMARS, the Russian Tornado-S is a Multiple Launch Rocket System used to attack targets at greater distances

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and inside hostile territory.

The Tornado-S is thought to perform much better than the US M142 HIMARS. For instance, the US M142 HIMARS is capable of launching six 227mm GPS-guided rockets with a range of 80 kilometers and an accuracy of five to ten meters.

In comparison, Russian ground forces 9A54 Tornado-S systems have the same precision as

> HIMARS while firing twelve 300mm GLONASS-guided rockets at a distance of 120 kilometers. The Tornado-S is also faster and more efficient, with a launch readiness time of

just three minutes.

system

The Russian air defense troops have

reportedly received new software that

enables them to quickly detect and

shoot down US-supplied HIMARS

rocket

launch

multiple

(MLRS) missiles

### US Awards Lockheed \$431M HIMARS Contract

On December 1, the US Department of Defense announced that Lockheed Martin had received a \$430 million contract to manufacture additional High-Mobility Rocket Artillery Systems (HIMARS).

According to the US Department of Defense, the full-rate production contract is intended to meet "an urgent need" to support the US Army and its international allies. The announcement did not mention the number of multiple rocket launchers that would be produced.

According to an official statement released by the Pentagon, this is the first contract for HIMARS production since the system was given to Ukraine in April. The agreement will end on December 31, 2025.

The US Defense Department has also not disclosed which foreign allies will get the new HIMARS systems. The production work will be

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carried out in Alabama, Arkansas, Florida, Texas, and other states across the US.

Since the start of the Ukraine war, the US has delivered 20 HIMARS to Ukraine and pledged another 18 in the coming years. The weapon's success in neutralizing hostile assets led Ukrainian Minister of Defense Oleksii Reznikov to refer to it as a "game-changer."

HIMARS has established itself as a crucial weapon that has increased Ukraine's capacity to attack ammo depots, bridges, and other critical targets that undermine Russia's ability to resupply soldiers.

A land-warfare specialist told EurAsian Times that Russia's incapability to counter HIMARS effectively is mostly due to inefficiency and aging equipment. Having said that, it is still too early to decode how Moscow's capabilities will evolve due to the new 'HIMARS killer' software.

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# N. Korea Fires Unspecified Ballistic Missile Toward East Sea: S. Korean Military

### *31 Dec 2022*

Source: Yonhap News Agency | https://en.yna.co.kr/ view/AEN20221231000451325



This undated file photo released by the Korean Central News Agency shows a North Korean missile launch. (For Use Only in the Republic of Korea. No Redistribution) (Yonhap)

SEOUL, Dec. 31 (Yonhap) -- North Korea fired an unspecified ballistic missile toward the East Sea on Saturday, the South Korean military said.

The Joint Chiefs of Staff announced the launch. It did not provide other details immediately.

The launch came after South Korea successfully conducted a test flight of a solid-fuel space launch vehicle the previous day as part of efforts to strengthen its space-based reconnaissance and surveillance capabilities.

On Dec. 23, the North fired two short-range ballistic missiles into the East Sea, less than a week after its launch of two medium-range ones..

### IAF Test-Fires Extended Range Version of Brahmos Missile from SU-30MKI Aircraft

### Radhika Bansal | 04 Jan 2023

Source: 100Knots | https://www.100knots.com/ iaf-test-fires-extended-range-version-of-brahmosmissile-from-su-30mki-aircraft/



The Indian Air Force (IAF) successfully testfired the Extended Range Version of Brahmos Air Launched missile against a ship target from a frontline SU-30MKI aircraft. The maiden test of the extended range of the Brahmos Air Launched missile was conducted on May 12 earlier this year, the force said.

A statement from the IAF Thursday read, "The missile achieved the desired mission objectives in the Bay of Bengal region. With this, IAF has achieved a significant capability boost to carry out precision strikes from SU-30MKI aircraft against land or sea targets over very long ranges. The extended range capability of the missile coupled with the high performance of the SU-30MKI aircraft gives the IAF a strategic reach and allows it to dominate the future battlefields."

While the Air Launched version of the BrahMos Supersonic Cruise Missile has been tested multiple times in the recent past, the Extended Range Version is said to have the capability of striking targets located at around 350 kilometres compared to around 290 kilometres for the initial version.

The first test of the initial version of the

Brahmos Air Launched Cruise Missile was conducted in 2017, making it a significant addition to the IAF's operational capabilities from standoff ranges.

Stand-off range missiles are the ones which are launched at a distance sufficient to allow the attacking party to evade defensive fire expected from the target area. For the firing of Brahmos from Sukhoi-30 MKI, the missile is gravity dropped from the fuselage of the fighter jet, and the two-stage missile's engine is then fired up and it propels towards the intended target at the sea.

Brahmos is the heaviest weapon to be deployed on India's Sukhoi-30 MKI fighter aircraft, which has been modified by HAL to carry these weapon systems.

A combination of the names of the Brahmaputra and Moskva rivers, BrahMos missiles are designed, developed and produced by BrahMos Aerospace, a joint venture company set up by the Defence Research and Development Organisation (DRDO) and Mashinostroyenia of Russia. The first test launch of the initial version of Brahmos took place in 2001.

Various types of the BrahMos, including those which can be fired from land, warships, submarines and Sukhoi-30 fighter jets have already been developed and successfully tested and inducted since then.

Cruise missiles such as BrahMos, called "standoff range weapons", are fired from a range far enough to allow the attacker to evade defensive counter-fire. These are in the arsenal of most major militaries in the world. The BrahMos has three times the speed, 2.5 times the flight range and higher range compared to subsonic cruise missiles.

The sophisticated missile is already inducted into the Army and Navy. Many Brahmos missiles are now deployed along the Line of Actual Control (LAC) facing China. On November 30, the Army test-fired the extended-range Brahmos from the Andaman and Nicobar Islands.

An 800-km range variant of BrahMos, which is a conventional (non-nuclear) missile that flies almost three times the speed of sound at Mach 2.8, is also undergoing "developmental trials" at present. The air-breathing BrahMos has emerged as the "prime conventional strike weapon" for the armed forces over the years, with contracts worth over INR 36,000 crore already inked till now.

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#### Aerospace Newsletter

### Space

### US Senate Passes Legislation to Mandate Space Debris Removal

### 27 Dec 2022

Source: Space Watch | https://spacewatch. global/2022/12/us-senate-passes-legislation-tomandate-space-debris-removal/



Credit: NASA Orbital Debris Program Office

The US Senate has passed the Orbital Sustainability (ORBITS) Act to direct NASA to establish a program to remove orbital debris. The passing was via unanimous consent, and it was introduced by Senator John Hickenlooper, the chairman of the Senate Commerce Committee's space subcommittee, in September.

According to SpaceNews, the bill would direct NASA, working with other Government agencies and the private sector, to publish a list of debris objects "that pose the greatest immediate risk to the safety and sustainability of orbiting satellites and on-orbit activities." The ORBITS Act would also require NASA to establish an active debris removal remediation program. As a result, it would make awards "for the development of technologies leading to the remediation of selected orbital debris" identified in the list. This would include demonstration missions to remove the debris. The bill would allow NASA and other agencies to acquire debris removal services.

Besides the provisions on active debris

removal, the bill would require the National Space Council to update the Government's existing Orbital Debris Mitigation Standard Practices, with future updates every five years. It directs the Commerce Department to work with other agencies on standard practices for space traffic coordination.

"This bill will jumpstart the technology development necessary to remove the most dangerous junk before it knocks out a satellite, crashes into a NASA mission, or falls to the ground and hurts someone," Senator Maria Cantwell said in a statement after the bill's passage. Furthermore, Hickenlooper added, "I'm over the moon that our ORBITS Act passed, and we can start cleaning up this space junk."

According to SpaceNews, the bill does not authorize any specific funding for NASA or other agencies to perform active debris removal or other activities. It only notes that such work would be subject to appropriation. However, the bill received support from many companies and organizations.

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## Iran Plans Satellite Launches in Coming Months: Minister

18 Dec 2022

<u>Source: Space War | https://www.spacewar.com/</u> reports/Iran\_plans\_satellite\_launches\_in\_coming\_ months\_minister\_999.html



Iran prepares to launch "at least two satellites" into space by late March, Telecommunications Minister Issa Zarepour said Sunday, just over a month after successfully testing a launcher.

The United States has repeatedly voiced concern that such launches could boost Iran's ballistic missile technology, extending to the potential delivery of nuclear warheads.

But Iran insists it is not seeking nuclear weapons and that its satellite and rocket launches are for civil or defence purposes only.

"Nahid 1 and Nahid 2 satellites are being prepared," Zarepour was quoted as saying by official news agency IRNA.

Nahid is the name given to a series of telecommunications satellites developed by the Iranian Space Research Center.

According to Zarepour, "we will have launches by year's end," March 20 in the Persian calendar.

In early November, Iranian state television announced the "successful suborbital launch of

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the satellite launcher named Ghaem-100".

The Ghaem-100 rocket was manufactured by the aerospace organisation of the Islamic Revolutionary Guard Corps and it is the country's first three-stage solid-fuel satellite launcher, the channel added.

Iran successfully put its first military satellite into orbit in April 2020, drawing a sharp rebuke from Washington.

In August this year, another Iranian satellite, named Khayyam, was launched by Russia on a Soyuz-2.1b rocket from Baikonur Cosmodrome in Kazakhstan.

Iran's space agency said the device was constructed by Russia under Iran's supervision.

The US alleged at the time that the Khayyam

would enable "significant spying capabilities" and that a deepening Russia-Iran alliance amounted to a "profound threat" to the world.

Iran's space agency rejected those allegations,

countering that the purpose of Khayyam was to "monitor the country's borders", and help with the management of natural resources and agriculture.

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## Pakistan Approaches China for Intel on Indian Air Force Bases

Srinjoy Chowdhury | 04 Jan 2023

Source: Times Now | https://www.timesnownews. com/world/pakistan-approaches-china-for-intel-onindian-air-force-bases-article-96733561



Representational Image.

Pakistan wants to know what the Indian Air Force (IAF) is up to and has asked China for detailed satellite images of at least six frontline bases. Pakistan's request for information on 22 "targets' in India was recently made through

> SUPARCO, or Space and Upper Atmosphere Research Commission, associated with Dr Abdus Salam, Pakistan's only Nobel laureate in Physics.

> Subsequently, Dr Salam was badly treated in Pakistan

because he was an Ahmediyya.

SUPARCO has requested CNSA, or China National Space Administration, with which it has a ten-year agreement.

Among the 22 targets are active IAF bases in the northern and western sectors like Srinagar, Adampur, Ambala, Bathinda, Sirsa and Bhuj. They are part of the IAF's Western and South Western Command.

Under the Space Cooperation Outline Agreement signed in 2021 between SUPARCO and CNSA, China can supply satellite images

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to Pakistan. What Pakistan has sought are submetre resolution images, a technical ability it may not have. One-metre-resolution images are commercially available but remain expensive, but 0.6-metre-resolution images are less easy to access. The Pakistan Air Force (PAF) wants to know what the IAF is doing in the six bases.

SUPARCO, expectedly enough, is headed by a Pakistan Army officer and has an annual budget of over \$US 30 million. India has satellites in space with the ability to provide sub-metre resolution photographs. Meanwhile, Pakistan continues to expand its air force and is strengthening its Mirpur base.

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# **Global Aerospace Industry** Technical Problems Ground Myanmar's JF-17 Fighter Jets Bought

### From China

### 25 Nov 2022

Source: Irrawaddy | https://www.irrawaddy. com/news/burma/technical-problems-groundmyanmars-jf-17-fighter-jets-bought-from-china. html



Regime chief Min Aung Hlaing inspects a JF-17 at an airbase

Most of the newly acquired Chinese and Pakistan-made JF-17 fighter jets that the Myanmar regime has taken delivery of have been grounded due to technical malfunctions, according to analysts and former Myanmar Air Force pilots who monitor the junta's air capabilities.

The JF-17 fighters—lightweight multi-role combat aircraft jointly manufactured by China and Pakistan—that the Myanmar Air Force has added to its fleet have structural cracks and other technical issues, they told The Irrawaddy.

The aircraft, which are supposed to be capable of interception, ground attack and bombing missions, have turned out to be unfit for service, and the Myanmar military lacks the technical expertise to fix the problems, they added.

Myanmar reportedly inked a deal in early 2016 to procure 16 JF-17s from China at a cost of US\$25 million each. A first batch of six aircraft

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were delivered to the Myanmar Air Force in 2018, but details about the other 10 are not yet clear. The deal made Myanmar the first country outside China and Pakistan to buy JF-17s.

Myanmar regime chief Min Aung Hlaing put four of the malfunctioning JF-17 fighters into commission at a ceremony at the Meiktila air base in December 2018. Two more were commissioned in December 2019 as the Air Force celebrated the 72nd anniversary of its founding.

Jointly manufactured by Pakistan Aeronautical Complex and Chengdu Aerospace Corporation of China, the JF-17 was initially designed to balance India's Air Force. They are equipped with Western avionics and powered by the Russian Klimov RD 93 aeroengine, and set up on a China-made airframe, according to analysts. They can be armed with air-to-air mid-range guided missiles, 80-mm and 240-mm rockets, and 500-lb bombs.

The critical part of the JF-17 avionics is the China-made KLJ-7 Al radar, which has poor accuracy and maintenance problems, analysts say. The aircraft does not even have an effective beyond-visual-range (BVR) missile or airborne interception radar.

Malfunction of the Weapon Mission Management Computer has caused launch zones of BVR air-to-air missiles to shrink during combat exercises, according to experts.

Furthermore, the airframe is vulnerable to damage, especially in its wingtips and hardpoints, when the aircraft encounters strong gravitational forces, according to a former pilot of the Myanmar Air Force.

### **Problems After Purchase**

As the avionics and electronics installed in JF-17s are made with parts from Western countries, the Myanmar military purchased the fighter jets through middlemen between 2015 and 2020. Following the coup, the European Union imposed sanctions against the Myanmar military and arms brokers, and the Air Force now has no spare parts for the JF-17s, according to analysts and former pilots.

The trade embargo also makes it impossible for the Myanmar military regime to directly buy missiles and bombs for its JF-17s. The regime meanwhile has forged a partnership with the Pakistan military, sending weapons system officers from the Air Force and Air Defense units to Pakistan for training from time to time.

For the Myanmar Air Force to carry out deadly air strikes on ethnic armed revolutionary organizations and civilians, it mainly needs airto-surface missiles, and it reportedly held talks with Pakistan to order these as well as bombs and rockets. Around May this year, a cargo plane from Pakistan loaded with JF-17 spare parts landed in Myanmar.

Technicians from the Pakistan Air Force made a secret visit to Myanmar in September during which they set up a JF-17 simulator for pilots of the Myanmar Air Force at Pathein air base, and also solved some technical problems. A JF-17 weapons system officer however said the weapons system of the JF-17 is too technically complex for Myanmar pilots to handle, according to former pilots.

#### **Current Situation**

Thanks to the JF-17s' poor accuracy, the Myanmar Air Force still can't use them for combat four years after they were commissioned. This has led the Air Force to rely on Russian-made Yak-130 and MiG-29 fighter jets and China-made

# Return to Contents Page K-8 fighters, said analysts.

While the Myanmar Air Force has spent a large sum to procure malfunctioning aircraft from China and Pakistan, arms broker Dr. Naing Htut Aung has earned millions of US dollars from the deal, The Irrawaddy has learned.

At the 72nd anniversary event for the Myanmar Air Force, Min Aung Hlaing boasted that the Myanmar Air Force started with Tiger Moth planes, but now has hangars filled with modern aircraft including supersonic jet fighters, transportation aircraft, and assault and transportation helicopters.

He made no mention of the Air Force's unusable JF-17 fighters.

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### F-35 Will Get New Radar Under Massive Upgrade Initiative

*Emma Helfrich* | 03 Jan 2023

Source: The Drive | https://www.thedrive.com/ the-war-zone/f-35-will-get-new-radar-undermassive-upgrade-initiative



USAF

After a mysterious radar designation emerged online in news stories about the F-35 Lightning II program, the internet quickly began debating whether it was a typo or a new capability altogether. Now, The War Zone has official confirmation that the fifth-generation stealth fighter will, in fact, be getting a new radar designated as the AN/APG-85.

One of the first mentions of the AN/APG-85 appeared in a Defense News article published in April of last year. Reporter Stephen Losey noted that \$921 million had been added to the U.S. Air Force's wishlist for Fiscal Year 2023 (FY2023) to procure seven more "Block 4 F-35As with the APG-85 radar from Lot 17." Then, in a separate article authored last December, Losey wrote of the radar again in the same context. The references were later highlighted and questioned by the @ MIL\_STD Twitter account.

The War Zone reached out to both the F-35 Joint Program Office (JPO) and Lockheed Martin, for any information about this puzzling new designation. While we're still waiting to hear back from Lockheed Martin, the JPO did respond and offered what they could without revealing classified details.

"The U.S. Air Force, Navy, and Marine Corps are jointly developing and integrating an advanced radar for the F-35 Lightning II, which is capable of defeating current and projected adversarial air and surface threats," said the F-35 JPO. "This advanced radar will be compatible with all variants of the F-35 aircraft."

To clarify whether this meant that all F-35 A/B/C variants from all blocks would be compatible with the new radar, or if only Block 4 A/B/C variants would be, The War Zone followed up with the JPO. Their response explained that the AN/APG-85 is currently slated to be installed only on all Block 4 A/B/C jets. This would also line up with Air Force FY2023 unfunded priority list presentation slides, cited by @MIL\_STD on Twitter as well, that make note of the radar along with the same aforementioned Block 4 F-35 procurement effort.

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# Egypt Purchases New Boeing CH-47F Chinooks to Modernize Fleet

#### 04 Jan 2023

Source: Indian Defence Review | http://www. indiandefencereview.com/news/egypt-purchasesnew-boeing-ch-47f-chinooks-to-modernize-fleet/



The U.S. Army has awarded Boeing a contract to produce 12 new CH-47F Chinooks for the Egyptian Air Force. With this \$426 million foreign military sale, Egypt will replace its fleet of CH-47D aircraft with the modern F model, and benefit from its advanced multi-mission capabilities.

"The F-model aircraft will enhance Egypt's Chinook capabilities and help effectively accomplish its heavy-lift objectives," said Ken Eland, vice president and H-47 program manager. "Boeing's partnership with the Egyptian Air Force remains strong as we continue to work together to modernize their fleet."

The CH-47F is an advanced multi-mission helicopter for the U.S. Army and international defense forces. It contains a fully integrated, digital cockpit management system, Common Avionics Architecture System cockpit and advanced cargo-handling capabilities complementing the aircraft's mission performance and handling characteristics.

"Boeing is committed to supporting the defense modernization mission of the Egyptian armed forces and ensuring the best capability for Egypt's national defense and security,"

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added Vince Logsdon, vice president, Boeing st International Business Development.

Team Chinook is led by the U.S. Army, who with 19 allied international customers, collectively operate a fleet of more than 950 aircraft.

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# **Indian Aerospace Industry**

# MTAR, IN-SPACe India Ink Pact for Development of All-Liquid Small Satellite Launch Vehicle

### 12 Dec 2022

Source: Economic Times | https://economictimes. indiatimes.com/news/science/mtar-in-space-indiaink-pact-for-development-of-all-liquid-small-satellitelaunch-vehicle/articleshow/96172013.cms?utm\_ source=contentofinterest&utm\_medium=text&utm\_ campaign=cppstnts/



MTAR signs MoU with IN-SPACe India for designdevelopment of small satellite launch vehicle

A MTAR Technologies on Monday said that it has signed a pact with with IN-SPACe India for design and development of a two-stage to lowearth orbit all-liquid small satellite launch vehicle. "MTAR has signed an MoU (memorandum of understanding) with Indian National Space Promotion and Authorization Centre (IN-SPACe) for design and development of a two-stage to lowearth orbit all-liquid small satellite launch vehicle powered by semi cryogenic technology with a payload capacity of 500 kilogram," a company statement said.

Both the parties have entered into a framework MoU for various requirements, including avionics, sub systems testing, facilitation of launch etc, and any other requirements that might emerge during the course of design, development and launch phase. The MoU shall remain in force for three years.

"MTAR has consistently embraced innovation to indigenise new technologies for India. Now the company is taking a leap forward to graduate from precision engineering to complete system integration by initiating the development of a twostage to low-earth orbit all-liquid small satellite launch vehicle project to address a payload of 500 kg in the low-earth orbit. The company has adopted all-liquid route to leverage more than three decades of expertise in manufacturing liquid propulsion engines," said Parvat Srinivas Reddy, managing director of MTAR Technologies Ltd.

The MTAR has seven strategically based manufacturing units including an export-oriented unit each based in Hyderabad, Telangana. It caters to civil nuclear power, space, defence and clean energy sectors. The company has a long-standing relationship of over four decades with leading Indian organisations and global OEMs.

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# First Private Launchpad & Mission Control Center Established in ISRO Campus at SDSC, SHAR

#### 28 Nov 2022

Source: ISRO | https://www.isro.gov.in/first\_private\_ launch\_mission\_control.html



The A private launchpad and mission control center is established within the ISRO campus at Satish Dhawan Space Center (SDSC),SHAR, Sriharikota, for the first time. The launchpad is designed and operated by a private company, an Indian space-tech start-up, Agnikul.

The facility was inaugurated on November 25, 2022 by Shri S. Somanath, Chairman, ISRO & Secretary, Department of Space (DOS). Senior ISRO officials including the directors of various ISRO centers also attended the function. On the occasion, Shri.S.Somanath expressed pleasure over the establishment of the first private launch pad in the country and endorsed that, now, India can travel to space from one more space platform.

Srinath Ravichandran, Co-founder & CEO, Agnikul mentioned that the ability to launch from one's own launchpad while still working with ISRO's launch operations teams is a privilege that ISRO & IN-SPACe have granted and that he is deeply grateful for the same. Moin SPM, Co-founder, Agnikul thanked ISRO and IN-SPACe for the consistent support for realising Agnikul's launchpad inside Sriharikota and acknowledged that the new reforms brought by DOS truly accommodate everyone's dream of going to space.

Establishment of this private launchpad marks a significant step in opening the Indian space sector to private players and affirms the commitment of ISRO/DOS for facilitating the same. The current facility has a launchpad and a mission control center. The latter is about 4 km away from the launchpad. The system compliant to support liquid stage-controlled launches, monitor key flight safety parameters by ISRO's range operations teams during launches and share the data with ISRO's Mission Control Center.

Agnikul plans to guide & control their upcoming launches from this facility. In their first launch, a 2-stage launch vehicle, Agnibaan is intended to carry a payload of up to 100 kg to around 700 km altitude.

#### **About Agnikul Cosmos**

Agnikul Cosmos Private Limited is a Chennai-based start-up incubated at the Indian Institute of Technology, Madras (IIT Madras). It was founded in 2017 by Srinath Ravichandran, Moin SPM & Prof. SR Chakravarthy (from IIT Madras). Agnikul aims to make space accessible and affordable. It aspires to support the Honourable PM's vision of enabling building of Aatmanirbhar Bharat. It became the first Indian company to sign an agreement with ISRO. The agreement signed in December 2020 under the IN-SPACe initiative sanctioned Agnikul the access to ISRO's expertise and facilities to build Agnibaan vehicles and the Launchpads

## Dhruva Space Looking to Raise \$ 20-25 Million for Satellite Infra

29 Nov 2022

Source: Tech.Hindustan Times | https://tech. hindustantimes.com/tech/news/dhruva-spacelooking-to-raise-20-25-mn-in-2-years-for-satelliteinfra-facilities-71669624701285.html



Dhruva Space launched two amateur radio communication nanosatellites as part of ISRO's PSLV C54 mission. (Representative image) (Unsplash)

Dhruva Space, which has sent two tiny satellites recently, is looking to raise USD 20-25 million in the next one to two years to create infrastructure facilities here to be able to launch satellites weighing upto 100Kg, Abhay Egoor, co-founder and CTO of the city-based startup said. He also said after the successful launch of Thybolt 1 and Thy bolt 2-the tiny satellites into space, the firm is now currently working on a satellite weighing about 30 kg which will be broadly catering to communications and scientifi capplications, on their P30 platform

"We are looking to raise or invest about USD 20 to 25 million over the next 1-2 years where this amount of capital would be used to invest and build an infrastructure facility for assembly, integration and testing of satellites up to 100 kg class. We are exploring setting up the same facility in Hyderabad. We are already in conversation with parties," Egoor told PTI. He said the decade-old firm has raised USD 8 million funding so far.

Replying to a query, Egoor said Dhruva Space is already a revenue generating company and does

not require any funding for the missions which the fi rm is currently working, but may require for other verticals of the company. He said the firm is moving to larger satellite platforms which are already in development and hopeful of putting slightly larger satellites than what was already launched, in the orbit by mid or late next year and the work on development of that is going on very well.

"The ones which flew out yesterday are very tiny with the size of a small tiffin box (10x10x 5 Cm) and each of them weighing less than 1kg. In comparison to this, next year what we are going to launch on our P30 platform approximately weighs about 30kg," he explained. Dhruva Space, founded in 2012, is active across Space, Launch, and Ground segments, and supports civilian and defence clients worldwide. It offers satellites coupled with Earth stations and launch services as an integrated solution or individually as technology solutions to power space-based applications on Earth and beyond.

# General Atomics and Bharat Forge Seal Strategic Partnership to Manufacture Aerostructure In India

### 04 Jan 2023

Source: Bharat Shakti | https://bharatshakti.in/ general-atomics-and-bharat-forge-seal-strategicpartnership-to-manufacture-aerostructure-in-india/



General Atomics Aeronautical Systems, Inc. (GA-ASI), a subsidiary of General Atomics, an American technology major, announced its strategic partnership with the leading Indian defence company, Bharat Forge Ltd., to manufacture main landing gear components, subassemblies, and assemblies of remotely piloted aircraft. The move is expected to result in significant capability-building for both companies and provide an impetus to the large Indian unmanned aircraft industry and develop a manufacturing ecosystem for high-end drones.

"GA-ASI is eagerly looking forward to working with Bharat Forge in the critical field of aerostructure manufacturing," said Vivek Lall, Chief Executive of General Atomics Global Corporation.

With over five decades of experience in manufacturing a wide range of high-performance, critical safety components, Bharat Forge offers full-service supply capability from concept to product design, engineering, manufacturing, testing, and validation, a press release stated.

"Bharat Forge's expertise in the field of forging is known globally, and their outstanding contributions in the aerospace sector have inspired us to work together to build the next generation of the world's most advanced unmanned aerial vehicles," said Lall.

Baba Kalyani, Chairman and Managing Director of Bharat Forge Limited, said, "Aerospace is a high 'Technology Intensive' domain, which relies on Product Integrity, Reliability, and Zero Defect.'

"This is a culture by itself and demands a strong focus on people and processes. As part of our Aerospace Growth Strategy, our collaboration with GA-ASI is a strong testimony of our culture in Bharat Forge Aerospace to assimilate and demonstrate the same, as partners to General Atomics, in making India Atmanirbhar," Kalyani said.

Bharat Forge Limited has a state-of-the-art, digitally integrated manufacturing, assembly, and testing facility for aerospace components and systems. It manufactures structural and engine parts and subsystems for aircraft and engines for both civil and military applications. Its impressive portfolio includes aircraft turbine and compressor manufacturing; high-end aero engine components like blades, discs, and shafts; and airframe components, including aircraft landing gear, in keeping with the latest technology and design trends while maintaining high-quality standards, according to the company's hand-out.

# **Technology Development**

### United Plans Supersonic Passenger Flights by 2029

Andrew Jones | 23 Nov 2022

Source: BBC | https://www.bbc.com/news/ technology-57361193



A digital model of the new Overture aircraft in United livery

Supersonic passenger flights ended in 2003 when Air France and British Airways retired Concorde.

The new Overture aircraft will be produced by a Denver-based company called Boom, which has yet to flight-test a supersonic jet.

United's deal is conditional on the new aircraft meeting safety standards.

### What is Supersonic Fight?

Supersonic flight is when an aircraft travels faster than the speed of sound.

At an altitude of 60,000ft (18,300m), that means flying faster than 660mph (1,060km/h).

A typical passenger jet may cruise at about 560mph (900km/h) but Overture is expected to reach speeds of 1,122mph (1,805km/h) - also known as Mach 1.7.

At that speed, journey times on transatlantic routes such as London to New York can be cut in half.

Boom says Overture would be able to make the trip in 3.5 hours, shaving three hours off the flight.

Concorde, which entered passenger service in 1976, was even faster with a maximum speed of Mach 2.04 - about 1,350mph (2180km/h).

#### What are Some of the Challenges?

There are two major concerns with supersonic passenger travel: noise and pollution.

Travelling faster than the speed of sound causes a sonic boom, which can be heard on the ground as a loud thunderclap or explosion. It's where the company Boom got its name.

The boom limits where the planes can fly. Typically they must lower their speed until they are out over the ocean, away from citizens who may be disturbed by the loud bang.

Boom says it is confident that its plane will not be any louder than other modern passenger jets while taking off, flying over land and landing. It also hopes improvements in aircraft design since Concorde will help it reduce and mitigate the sonic boom.

The other big issue is fuel consumption.

"In order to fly supersonic, you will need more power, you will need more fuel," Kathy Savitt, Boom's chief commercial officer, told the BBC.

But she expects Overture to be operated as a "net-zero carbon aircraft".

#### Can Supersonic Travel Really be 'Sustainable'?

Central to Boom's plan is for Overture to run entirely on sustainable aviation fuel (Saf).

That can take the form of "posh biodiesel" made out of everything from waste animal fat from the farming industry to specially grown highenergy crops, explains Dr Guy Gratton, associate professor of aviation and the environment at Return to Contents Page Cranfield University.

But one big problem is that "the world is very far from having anything like the production capacity needed" to produce enough biofuel to power the entire aviation industry, he says.

Boom predicts "power-to-liquid" processes where renewable energy such as wind power is used to produce liquid fuel - will make up the shortfall.

"We expect that to be commercialised well before it's needed for our purposes," explains Boom's Raymond Russell.

"There are billions of dollars of both airline commitments and investments across the sector."

But it remains an industry that needs to be scaled up.

### Is there Demand for Supersonic Travel?

Despite the enormous cost of Concorde's development more than 50 years ago, it is thought to have been profitable for British Airways in its final years of operation.

Concorde was seen as a luxurious way to travel with tickets costing more than a first class seat on a regular jet.

Today, the wealthiest travellers may favour private business jets, says Dr Gratton.

Rather than travel first class on a commercial jet with the public, the rich can charter compact private planes that fly on demand, directly to-andfrom their airports of choice. Avoiding the checkin desk and luggage carousel can shave time off travelling too.

Ms Savitt said Boom's research suggested passengers wanted speed and that faster planes could "deepen human connections and make better business relationships".

Unlike Concorde, the company expects Overture to be profitable for airlines even if tickets are sold for the same price as a "regular business-class fare".

Ultimately, it is up to United to set its prices - but it will want to see a return on its \$200m-perplane (£140m) investment.

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### **Commentary**

- Shahed-136: Challenging the Air Defence Systems - <u>https://chanakyaforum.com/</u> <u>shahed-136-challenging-the-air-defence-</u> <u>systems/</u>
- Eight lessons air forces are learning from the war in Ukraine - <u>https://www.aerotime.</u> <u>aero/articles/eight-lessons-air-forces-are-</u> <u>learning-from-the-war-in-ukraine</u>

## **Further Reading**

- British Roadblock in Tejas way to Argentina, and how New Delhi likely to fix it - <u>https://</u> <u>airpowerasia.com/2022/12/08/british-roadblock-</u> <u>in-tejas-way-to-argentina-and-how-new-delhi-</u> <u>likely-to-fix-it/</u>
- India's missile test alert got Chinese research vessel to change course - <u>https://theprint.in/</u> india/indias-missile-test-alert-got-chineseresearch-vessel-to-change-course-now-its-<u>back/1249362/</u>

- 3. ICAO gives India's aviation safety highest ever ranking; global ranking jumps from 102 to 48 now, above China & Turkey - <u>http://timesofindia.indiatimes.com/</u> articleshow/95963096.cms?from=mdr&utm\_ <u>source=contentofinterest&utm\_</u> medium=text&utm\_campaign=cppst
- F-35 deliveries halted after Texas mishap; new contract finalized - <u>https://www.</u> <u>defensenews.com/air/2022/12/30/f-35-</u> <u>deliveries-halted-after-texas-mishap-new-</u> <u>contract-finalized/</u>
- 5. Who should call the shots in a theatre command—Air Force, Army, Navy? Let the context decide - <u>https://theprint.in/opinion/</u> <u>who-should-call-the-shots-in-a-theatrecommand-air-force-army-navy-let-thecontext-decide/1294429/</u>
- JASDF spots Chinese WZ-7 UAVs flying into Western Pacific - <u>https://www.flightglobal.</u> <u>com/military-uavs/jasdf-spots-chinese-wz-</u> <u>7-uavs-flying-into-western-pacific/151500.</u> <u>article</u>
- 7. On a Building Spree-PLA strengthens its facilities in the Tibet Autonomous Region
  <u>https://forceindia.net/feature-report/on-a-building-spree/</u>

"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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#### **Centre for Air Power Studies**

P-284 Arjan Path, Subroto Park, New Delhi - 110010 Tel.: +91 - 11 - 25699131/32 Fax: +91 - 11 - 25682533 Email: capsnetdroff@gmail.com Website: www.capsindia.org

Supervised by : AVM Anil Golani (Retd) Editor & Content : Gp Capt T H Anand Rao

Composed by Mr Rohit Singh Tel.: +91 9716511091 Email: rohit\_singh.1990@hotmail.com