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National Seminar on “50 Years of Indo-Pak war: Victory in the Air” and release of Book titled “The 1971 Indo-Pak Air War: Reflections and Projections”

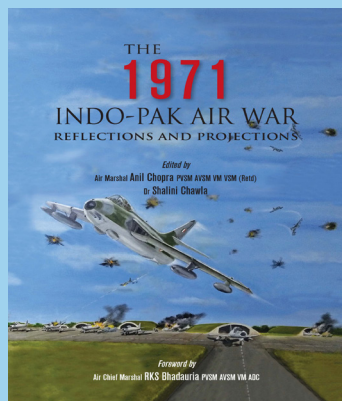
Source: Ministry of Defence (PIB Delhi) | 25 AUG 2021, 5:02 PM

Air Chief Marshal RKS Bhadauria PVSM AVSM VM ADC Chief of the Air Staff (CAS) inaugurated a hybrid seminar cum webinar themed “50 Years of Indo-Pak war: Victory in the Air” organised by the Centre for Air Power Studies (CAPS) at New Delhi today, as part of the commemorative activities for Swarnim Vijay Varsh celebrations.

CAS was welcomed by Air Marshal Anil Chopra PVSM AVSM VM VSM (Retd), Director General CAPS. A book titled “The 1971 Indo-Pak Air War: Reflections and Projections”, recording the 1971 operations was also released by CAS on the occasion.

Beginning his address, CAS conveyed deep gratitude and appreciation to the veterans of 1971 and stated that speaking in their presence was a singular honour for him. He also acknowledged the contribution of Gp Capt Shamsul Alam, Swadhinta Padak, Bir Uttam (Retd) as one of the pioneering members of Kilo Flight of Bangladesh Air Force and thanked him for joining the seminar virtually. Recounting the 1971 Indo-Pak war, CAS highlighted aspects of the joint application of war strategy which were instrumental in achieving a resounding victory. CAS touched upon key highlights of the air campaign and recalled the crucial role played by IAF in blunting and destroying the enemy’s offensive, its forces and centres of gravity. Thanking CAPS for organising the Seminar, CAS expressed confidence that the event and the book release would not only refresh memories but also enhance our understanding of the war while inspiring the future generations.

The hybrid seminar brought together eminent military historians, veterans, air warriors and scholars who through the day’s proceedings deliberated on various aspects of the war that changed the course of history in the sub-continent.



“Airpower has become predominant, both as a deterrent to war, and--in the eventuality of war--as the devastating force to destroy an enemy’s potential and fatally undermine his will to wage war.”

— Omar Bradley

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Opinion and Analysis

Theaterisation Under the Overhang of Naam, Namak Aur Nishan

Air Vice Marshal Anil Golani (retd)

Additional Director General, Centre for Air Power Studies | 31 July 2021

Source: Bharat Shakti | <https://bharatshakti.in/theaterisation-under-the-overhang-of-naam-namak-aur-nishan/>

While Why does a nation of 1.3 billion people, a multicultural, multiethnic and chaotic democracy with shades of excellence individually, continue to fail us collectively in joint endeavours for the national good? A question that begs for answers from our 1.3 million-strong military community, which boasts of many legends and stories of indomitable valour and courage, is the one that has been the subject of much acrimony and public debate in the recent past: “Theaterisation” of existing silos of the Army, Navy and the Air Force. While it is a given that each service has its unique ethos, culture, doctrine and operational philosophy and the endeavour to achieve its goals and objectives is non-negotiable, universally across the services, why can they not see eye to eye for the greater national good?

At the national and strategic level, one has to rise beyond turf wars and battles for a command of theatres to be able to see what best serves

The military officers’ deep commitment to their service creates an environment where the merit in an argument often loses out to the pursuance of service-specific interests. Such a deep commitment to one’s service no doubt provides the glue that binds military men together.

the national interest. The officers and men of each service come from the same stock, joining each service at a young and impressionable age, growing in the organization and imbibing the service ethos and culture which gets so deeply ingrained that it becomes difficult, though not impossible, to shed as years go by. It is a truism that one’s views and opinions are based on perceptions and these, in turn, get formed by what one sees and hears. Professional knowledge and acumen at the tactical level, for individual service-related warfighting, is not only essential but mandatory if one has to be successful as in a war you cannot be ‘runners up.’

However, as one grows in service every professional has to rise beyond the tactical level to see how the punch can be made stronger and lethal for the adversary. This is where maturity and sagacity come in and this has to be visibly acknowledged and displayed by the senior leadership at the helm. There is sound reason and logic for Brigadiers and above in the Indian Army to shed their regimental loyalty and affiliation to the uniform that they wear. This change was initiated for the greater good to enable senior officers to not only think of themselves as representing the Indian Army as a whole and not their specific regiments but also rise beyond parochial affiliations to think at the strategic level.

The problem however is that this change

remains in the wearing of uniform only and therefore superficial, while platitudes are expressed to display the shedding of regimental affiliations. These regimental affiliations serve extremely well up to the battalion level where “Naam Namak aur Nishan” is the ethos followed by the soldiers who willingly make the supreme sacrifice in order to strive for the good name of their country (Naam), the salt that they have partaken (Namak) and the glory of the regimental standard (Nishan).

The pride that the regiment feels when one of their rises in service to star ranks is akin to the joy of proud parents seeing their wards doing well in life. However, if one were to turn this around to ensure one’s wards succeed when you are in a position to do so, it would invariably be at the cost of some deserving people losing out. In the larger scheme of things, this does not bode well for meritocracy.

If one were to look at numbers and the land borders that the nation has to defend, the primacy of the Army cannot be underscored. If one has to learn from the history of conflicts, even then there is no doubt that boots on the ground are an inescapable necessity to hold conquered territory. Since warfighting began on land the primacy of the Army as the “senior service” also remains irrefutable. However, if one were to imply leadership of the Army to wars and future conflicts then it’s missing the wood for the trees. Maybe simplify this sentence a little bit.

Any future conflict will have to be fought in unison and therefore the ability to understand each other’s weaknesses and strengths is imperative before structures get created with specific land, maritime or air defense domains, along with single service-specific leadership roles. If we are unable to shed our loyalties to regimental affiliations, pray how would we be able to rise

However, as officers climb up the hierarchical ladder, an absolute commitment to one’s service needs to be replaced by a greater commitment to finding the right methodology for all three Services to be holding the national flag together.

above the pursuance of single service interests? There exists an immense trust deficit at the senior leadership level which basically stems from our perceptions; right or wrong is not important as long as the individual’s service benefits!

What then is the solution? To begin with, there has to be a deeper and better understanding of how future wars would be fought. The domains of cyber, space, communications, drones, artificial intelligence etc., are going to be an inalienable part of any future conflict. These domains would spread across the country without confining themselves to any particular theatre. It is only when all the stakeholders understand the core traits of each domain. The resources that are available, plan jointly, have faith and trust in the capability and capacity of their own teams, would there be a reasonable chance of gaining victory.

If, however, we first create structures based on domains – land, sea or air, and then impose service-specific leadership, the trust and faith in the rank and file would not automatically ensue. Any organization that does not trust its leadership

is bound to fail. The cost of failure of the military, which in any case is the last arrow that a nation has in its quiver would prove to be fatal and a loss that any nation can ill afford. There has to be a deliberate and detailed analysis of the nature of future wars, our capabilities and capacity, how do we plan jointly and then execute seamlessly through leadership that is not only aware of each service's strengths and limitations but is also empathetic to their concerns. Only then would we be able to truly and fully safeguard the nation, abiding by the credo of "Naam, Namak aur Nishan" wherein the "Nishan" would symbolise the national flag instead of the regimental colours.

If wise counsel and astute leadership were to prevail then there should first be a white paper that should clearly and unambiguously lay down a road map for the changes that are apparently seen to be being thrust down upon an unwilling service. Resistance to change is natural and instinctive, but if there is logic in the process and sound understanding of the manner of implementation including a cost-benefit analysis for the nation at large then there would be no reason to prevent it from happening.

The mettle of true leadership lies in treating every crisis as an opportunity to rise beyond parochial interests, for the larger good of the nation, and etching your contributions in history as those by sagacious leaders. Worth quoting William Shakespeare's Julius Caesar – a discussion about military strategy between Brutus and Cassius – "There is a tide in the affairs of men, which when taken at the flood, leads on to fortune; Omitted,

all the voyage of their life is bound in shallows and in miseries. On such a full sea are we now afloat. And we must take the current when it serves, or lose our ventures." Thus, let us resolve to vindicate the faith reposed by the nation in its military.

The Kabul Escape And Fascinating Stories Behind Evac Missions

Air Vice Marshal Manmohan Bahadur (retd) |

18 August 2021

Source: NDTV | <https://www.ndtv.com/opinion/opinion-the-kabul-escape-and-fascinating-stories-behind-evac-missions-2512948>

The gut-wrenching video of Afghan nationals running alongside, and some climbing, an American C-17 aircraft as it attempts a take-off from Kabul would be the Afghanistan equivalent of the photo of a CIA Bell 205 taking on evacuees from the US Embassy rooftop in Saigon in 1975. Both are iconic images of desperate people trying to escape to safer destinations. Behind each image is a story of twists and turns and political games that nations, sometimes not on the best of terms, play.

I was the Assistant Chief of Air Staff looking after transport and helicopter operations of the Indian Air Force (IAF) between 2009 and 2011; my directorate was responsible for emergency evacuations and humanitarian assistance missions ordered by the government.

On 26 February 2010, terrorists attacked a guesthouse in Kabul where, among others, Indian

Army medical and education corps personnel were staying. Eighteen people, including nine Indians, were killed and many injured. The IAF was ordered to bring back the dead and injured.

An Il-76 aircraft was positioned at Delhi for getting passports for the crew made on an emergency basis (that's a story for another time), as also for taking on replacements for those deceased and injured in the missions in Kabul. The Ministry of External Affairs was working alongside to get overflight clearance from Pakistan; a circuitous route (over the Arabian Sea and then Iran) avoiding our western neighbour would be very time consuming.

The overflight clearance request requires names of the crew, passengers, passport details etc. - and it was communicated to Islamabad. Then came the agonising wait, which only stretched as more and more queries came on specific passengers. The Pakistanis didn't budge an inch when it came to some of the passengers, mainly military replacement personnel.

Since saving lives was more important, those people were offloaded and the aircraft took off. Unfortunately, a similar scene played out with passengers being brought back - so much for having a "friendly" neighbour.

This time around, as the Taliban took over Kabul, our C-17s actually took the longer Arabian Sea and Iran route to bring back our diplomats and other personnel. Whether this was due to a refusal by the Pakistanis to give overflight clearance, or we avoided asking altogether because of past

experiences, is not known.

But it brings to focus the intricacies involved when a military aircraft has to use the airspace of another nation. What if it has to transit the airspace of five nations to deliver relief material? The rule is the same - - clearance is taken from each country for a specific aircraft and for specific days.

If, for whatever reason - bad weather, aircraft unserviceability - even one country's entry-exit time cannot be adhered to, fresh clearance has to be taken all over again.

When ethnic riots led to a humanitarian situation in Kyrgyzstan in 2010, an IL-76 was planned to overfly five nations to deliver relief material. It was a Thursday departure and our embassy in one of the countries (no names) was crying hoarse asking for details to be expedited. Why? Because in that country the clearance was personally given by the head of state, who could not be disturbed on the weekend and would be available only after 10 am on Sunday!

Military flights are game for political shenanigans too. Once, a Union Minister was scheduled to fly to China in an Air Force aircraft for a regional conference. Word came to me from our VIP Squadron person responsible for getting visas that the Chinese embassy was insisting on a stapled visa for the captain of the flight as he was from Jammu and Kashmir which, per them, was "disputed territory". I spoke to the Joint Secretary in the Foreign Ministry on what the Chinese were up to and their embassy was told, in no uncertain

terms, that the captain of the aircraft would not be changed and the visit would be cancelled if the visa was not given to this officer.

Beijing blinked as India's absence from the conference would have been an embarrassment.

So, if there is a toss-up between using IAF aircraft and civilian registered aviation assets, it is always operationally easy to launch missions with the latter - file a flight plan and get airborne.

It is not for nothing that the Air India fleet was at the forefront of the Kuwait evacuation in 1990, and so was the case in the Yemen airlift in 2011. And what a fine job they did. But certain niche operations can only be done by the IAF, as was the case with the recent flights from Kabul and so many more earlier. One must remember that a nation's air power comprises both military and civilian assets. But one thing is certain - India can be proud of its air power. It will deliver against all odds.

Chinese S-400 systems across LAC, forces India to rethink air defence

Shishir Gupta | 23 June 2021

Source: Hindustan Times | <https://www.hindustantimes.com/analysis/chinese-s-400-systems-across-lac-forces-india-to-rethink-air-defence-101624417959950.html>

The PLA has upgraded Hotan air base in Xinjiang and Nyingchi air base in Tibet. Both bases are just across the LAC in Ladakh and Arunachal Pradesh respectively with the PLA deploying S-400 squadrons to protect them from Indian aerial threat.

Chief of Defence Staff (CDS) General Bipin

Rawat on Tuesday said that air defence was becoming more and more complex in the larger context of the proposed setting up of an air defence theater command. He said there were large use of air space, not limited to just aircraft and helicopters.

The on-going stand-off with the People's Liberation Army (PLA) on China in East Ladakh with the presence of two S-400 squadrons of anti-aircraft systems at Hotan air base in Xinjiang and Nyingchi air base in Tibet, just across Ladakh and Arunachal Pradesh respectively, has forced the national security planners into a rethink about air defence and counter-measures. To add to this increasingly complex scenario are armed UAVs, swarm drones, missiles and rockets, which are now part of stand-alone weapon systems of the PLA.

While India is expected to get five squadrons of S-400 systems from Russia starting December 2021, the potency of the anti-aircraft system is such that it can target a fighter 400 kilometres away. This means that any aircraft that gathers height and stabilises for shooting down a target becomes a target of this weapon system itself. Perhaps, this is the reason why the Indian Air Force (IAF) is relying on Hammer air-to-ground missile on Rafale fighter as a future weapon as the missile does not need to be fired from a height; it just hugs the mountain features, zooms to a height when approaching the target and then destroys it top down at an ninety degree angle with the capacity of last minute target adjustments using three different guidance systems apart from GPS. The IAF has already tested the Hammer missile and is already in its inventory with the French even offering joint development and

production of this long range potent weapon.

With the air defence system under challenge from a technologically advanced adversary in the north, the fundamental question that is being asked is should India invest in more aircraft and helicopters or stand-alone systems that will dictate future wars. While the IAF has been mandated to have 42 aircraft squadrons, each with 18 aircraft, the present strength is around 30 with the potential of six more squadrons to be added.

With Rafale capable of doing more than twice the number of sorties than a Russian MiG and the S-400 system a game changer in air defence, does IAF need 42 squadrons? Perhaps the answer lies in India raising more armed UAV, rocket and missile regiments that can suppress the troop and air defences of the adversary. It is for these very reasons that the Indian military is soon approaching the government for acquisition of armed Predator drones from the US on government to government basis. The US has also offered to train Indian personnel on cybersecurity as the defence systems are vulnerable to cyberattacks from adversaries acting on behalf of enemies of Indian state.

It is quite evident that the war scenarios are changing with aircraft carriers, air bases and huge military cantonments all under threat from long distance missiles. The future lies in long range radars that can pick up enemy posture deep within its territory and a rapid response missile that obliterates the potential threat. India has to think China not Pakistan as the principal adversary has changed.

Air Power

Chinese H-6 bomber intrudes into Taiwan's ADIZ

Eric Chang | 20 August 2021

Source: Tiwan News | <https://www.taiwannews.com.tw/en/news/4273477>

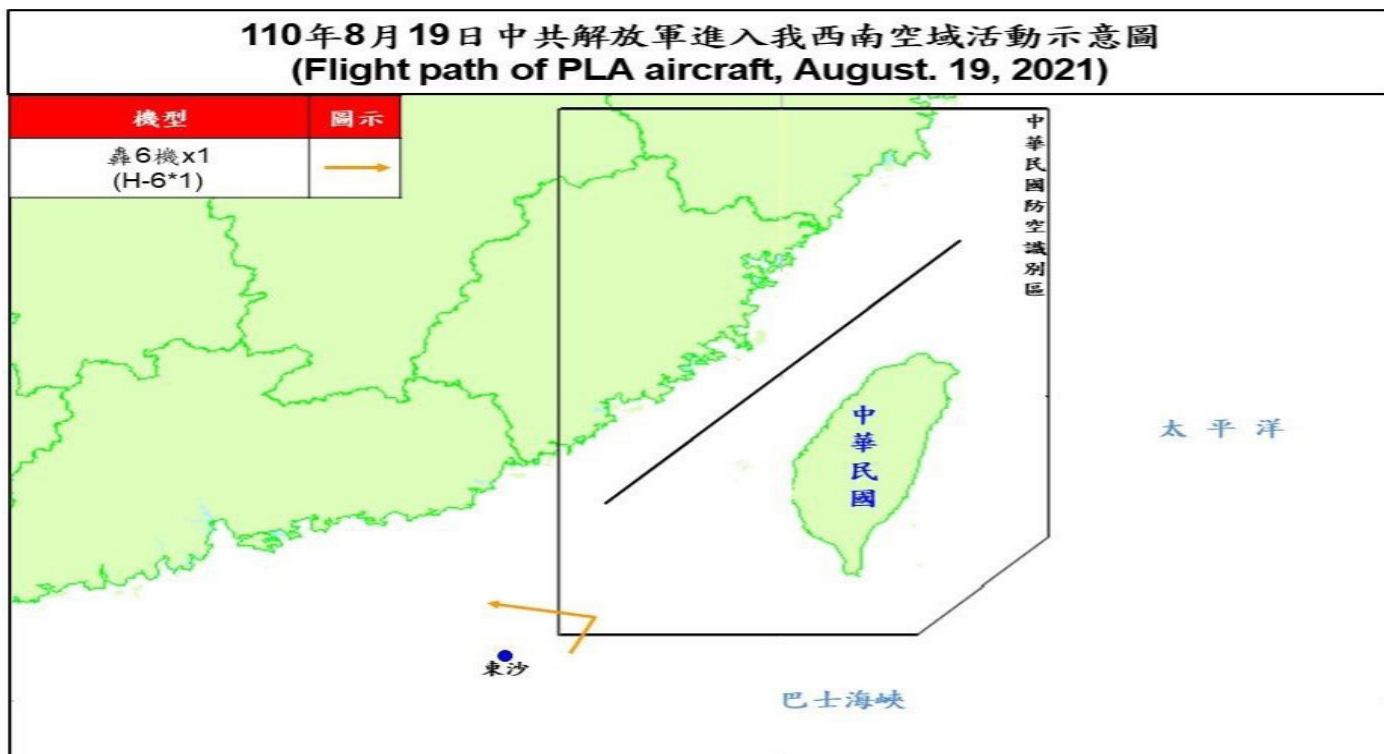
TAIPEI (Taiwan News) — A Chinese bomber entered Taiwan's air defense identification zone (ADIZ) on Thursday afternoon (Aug. 20), marking the seventh intrusion this month.

A People's Liberation Army Air Force (PLAAF)

Taiwan sent aircraft, issued radio warnings, deployed air defense missiles systems to track PLAAF bomber

Xian H-6 strategic bomber flew into the southwestern corner of Taiwan's ADIZ from the south, according to the Ministry of National Defense (MND). In response, Taiwan sent aircraft, broadcast radio warnings, and deployed air defense missile systems to track the PLAAF bomber.

Chinese planes have been spotted in Taiwan's identification zone so far this month on Aug. 8, 11, 12, 15, 16, 17, and 19. While last month all the planes sent into the zone were slow-flying Y-8 turboprops, this month has seen a mix of spotter planes and warplanes. On Aug. 12, three Y-8s consisting of different variants, along with four Shenyang J-16 fighter jets were tracked in Taiwan's ADIZ. Meanwhile, on Aug. 17, two Y-8s and a KJ-500 airborne early warning and control planes were seen in the zone along with six J-16 fighter planes and two H-6 bombers. Since September last year, Beijing has stepped



up gray zone tactics by routinely sending aircraft into Taiwan's ADIZ, with most occurrences taking place in the southwest corner of the zone. Compared to previous months, June and July saw fewer incursions into Taiwan's ADIZ.

An ADIZ is an area that extends beyond a country's air space where air traffic controllers ask incoming aircraft to identify themselves. Gray zone tactics are defined "as an effort or series of efforts beyond steady-state deterrence and assurance that attempts to achieve one's security objectives without resort to direct and sizable use of force."

According to MND data, Chinese aircraft were tracked in Taiwan's ADIZ 14 times in July, 10 times in June, 18 times in May, 22 times in April, 18 times in March, 17 times in February, and 27 times in January. Last year, they were observed 19 times in December, 22 times in November, and 22 times in October.

British Typhoons in Romania Intercept Russian Su-24 Fighter

Hercules Reues | 19 August 2021

Source: The Defence Post | <https://www.thedefensepost.com/2021/08/19/uk-intercept-russian-fighter-romania/>

The British Royal Air Force (RAF) intercepted a Russian Su-24 Fencer jet flying toward Romanian territorial airspace on Tuesday, the force reported.

The team of RAF Typhoons was stationed at the Romanian Mihail Kogalniceanu Air Base near Constanta on the Black Sea coast when the incident occurred. The Russian jet was detected as it entered the Bucharest Flight Information Region.

The jet did not have a flight plan on record, and no one responded to Romanian air traffic control when they hailed the aircraft for identification.

With that, the aircraft was treated as a flight safety hazard.

An RAF Typhoon pilot then sent out a Quick Reaction Alert concerning the unidentified aircraft. It “scrambled to carry out a visual identification.” When the jet did not respond to their requests, the Typhoons “were airborne within minutes and heading towards the track.”

“It wasn’t long before we intercepted the aircraft and identified it as a Russian SU-24 Fencer,” the RAF statement read. “It had flown no closer than 20 miles (32.19 km) from the Romanian coast before we intercepted it. We shadowed it until it left the Flight Information Region, heading North East. We then resumed our combat air patrol mission and returned to base.”

About The Quick Reaction Alert

The Quick Reaction Alert program is a readiness protocol of air defense maintained round the clock by NATO air forces, including the RAF Typhoon fleet from the UK.

This program connects a fleet of Typhoons ready to take to the air if the need arises. The National Air Defence Operations Centre (NADOC) at RAF Air Command, High Wycombe, is responsible for gathering information from radar sites across the UK and civilian air traffic and intelligence agencies.

India Notifies Drone Rules 2021, Eases License Regulations

26 August 2021

Source: Bharat Shakti | <https://bharatshakti.in/india-notifies-drone-rules-2021-eases-license-regulations/>

The Central government has notified the new Drone Rules 2021 which replaces the Unmanned Aircraft System (UAS) Rules passed in March this year. Under the new regime, no security clearance is required before any registration or license issuance for drones. The requisite fees for permissions have also been reduced to nominal levels. Rules make it easier for people and companies in the country to now own and operate drones.

The Ministry of Civil Aviation has eased the rules regarding drone operations in the country by reducing the number of forms that need to be filled to operate them from 25 to 5 and decreasing the types of fees charged from the operator from 72 to 4.

Hailing the new initiative, Prime Minister Narendra Modi said that the new drone rules usher in a landmark moment for the sector in India. He said on Twitter that “the rules are based on the premise of trust and self-certification. Approvals, compliance requirements and entry barriers have been significantly reduced,” and added the new rules will tremendously help start-ups and youth working in this sector.

“It will open up new possibilities for innovation and business. It will help leverage India’s strengths in innovation, technology and

engineering to make India a drone hub,” he mentioned.

The fee, according to the new rules, has been reduced to nominal levels and de-linked from the size of the drone. The rules have also abolished the requirement of various approvals, including certificate of conformance, certificate of maintenance, import clearance, acceptance of existing drones, operator permit, authorisation of R&D organisation and student remote pilot licence.

Other approvals such as unique authorisation number, unique prototype identification number and certificate of manufacturing and airworthiness have also been abolished, according to Drone Rules, 2021. No flight permission will be required for up to 400 feet in “green zones” and up to 200 feet in the area between 8 and 12 km from the airport perimeter, the new rules stated.

“Green zones” are the airspace up to a vertical distance of 400 feet that have not been designated as red zone or yellow zone in the airspace map.

An interactive airspace map with green, yellow and red zones shall be displayed on the digital sky platform within 30 days of publication of these new rules.

The Drone Rules, 2021, have also prescribed easier processes for the transfer and deregistration of drones.

No pilot licence will be required for micro drones (for non-commercial use) and nano drones, the rules mentioned, adding that the maximum penalty for violations has been reduced to Rs 1

lakh. According to the new rules, the type certificate and unique identification number will be required only when a drone is to be operated in India.

If a drone is being imported or manufactured only for export purposes, it will be exempted from type certification and the requirement of a unique identification number.

Drone corridors will be developed for cargo deliveries and a drone promotion council will be set up to facilitate a drone-friendly regulatory regime in the country, according to the draft rules.

The rules also stated that there would be no restriction on drone operations by foreign-owned companies registered in India.

Digital sky platform will be developed as a business-friendly single-window online system, the new rules mentioned.

Civil Aviation Minister Jyotiraditya Scindia said on Twitter that the new drone rules will trigger a revolution in the logistics and transportation sector and create change ripples across sectors such as agriculture, healthcare and mining.

Key takeaways from Drone Rules, 2021

1. Reduction in compliance burden

- a. Following approvals have been abolished: unique authorisation number, unique prototype identification number, certificate of conformance, certificate of maintenance, operator permit, authorisation of R&D organisation, student remote pilot licence, remote pilot instructor authorisation, drone

port authorisation, import permission for drone components.

b. Number of forms/permissions have been reduced from 25 to 5.

c. All permissions shall be through a single nodal point i.e. Digital Sky platform.

d. No security clearance required for conducting any activity in the drone sector.

e. Fees for permissions have been nominally reduced to a maximum of INR 1,000. f. Maximum penalty under Drone Rules, 2021 reduced to INR 1 lakh. This shall, however, not apply to penalties in respect of violation of any other laws.

g. Import of drones shall be regulated by DGFT while no permission shall be required for import of drone components.

2. Airspace Maps for Drones

a. Interactive airspace maps with green, yellow, and red zones will be launched on the digital sky platform and shall also be accessible using APIs.

b. Yellow zone for drones reduced from 45 km to 12 km from the perimeter of airports.

c. No permission required for operating a drone in green zones and upto 200 feet in the area between 8 and 12 km from the perimeter of airports.

3. Registration of drones:

a. Online registration of all drones required through the Digital Sky platform.

b. Easy process prescribed for sale, lease, gift,

transfer and deregistration of drones.

c. A limited window opportunity provided for regularisation of existing drones in the country. However a GST paid invoice shall be required for the same.

4. Drone Training & Drone Certification

a. Drone training and exams to be carried out by a DGCA authorised drone training school.

b. DGCA shall prescribe training requirements, oversee drone training schools and provide drone pilot licences online.

c. No drone pilot licence required for operating nano drones and micro drones for non-commercial use.

d. Type Certification of drones delegated to the certification bodies authorised by Quality Council of India.

5. Drone Deliveries and Drone Taxis

a. Drones upto 500 kg shall be covered under these rules which shall pave the way for heavy payload-carrying drones and drone taxis making India future ready.

b. Special drone corridors shall be developed for cargo deliveries.

6. Promotion of R&D and Indigenous Manufacturing

a. No type certification, drone registration, remote pilot licence or prior permission for flying drones required during research and development.

b. The Central Government shall issue certification standards which shall promote the use of made-in-India technologies, designs,

components and drones and India's NavIC regional positioning system.

c. An Unmanned Aircraft Systems Promotion Council which shall include industry experts and academic institutions and shall facilitate development of a business friendly regime, provide policy advice and promote the overall development of the drone ecosystem.

Complimenting on the landmark moment that may change the Indian drone ecosystem, the Drone Federation of India said "India aspires to become one of the most powerful countries of the world. To achieve this vision it needs to develop technological, cultural, military as well as economic strength. Drones shall play a major role in achieving this vision. The government's fearless decision to liberalise the drone policy even after multiple rogue drone incidents near our northern borders is a paramount move in this direction. The issuance of these rules marks a new era in the Indian drone ecosystem which has a market potential of more than INR 50,000 crores and can create 5,00,000 professional jobs in the next 5 years. The regulations which cover drones up to 500 kgs shall open up opportunities for indigenous manufacturing of delivery drones and drone taxis making India future-ready".

From Desert Storm to Inherent Resolve: The Evolution of Airpower

Becca Wasser and Stacie L. Pettyjohn | 18 August 2021

Source: War on The Rocks | <https://warontherocks.com/2021/08/from-desert-storm-to-inherent-resolve-the-evolution-of-airpower/>

On June 27, U.S. fighter jets struck weapons storage facilities used by Iranian proxy groups Kataib Hizballah and Kataib Sayyid al-Shuhada in retaliation for launching drone attacks on U.S. military facilities in the region. This was the second set of airstrikes ordered by the Biden administration in order to deter Iran and its proxies from attacking U.S. equities in the Middle East.

Just several weeks later, U.S. airpower was used once again, but this time in Afghanistan. "Over-the-horizon" airstrikes sought to bolster Afghan defenses, blunt the Taliban's momentum, protect key urban areas, and stave off the collapse of the Afghan state.

President Joe Biden's decision to use fighter jets to strike Iranian infrastructure in Syria and Iraq, and to defend key Afghan cities, follows a familiar pattern. Since the 1991 Gulf War, U.S. presidents have chosen time and time again to use airpower to protect U.S. interests abroad. Since the six-week air campaign that immobilized and demoralized Saddam Hussein's forces defending Kuwait, airpower has become the centerpiece of U.S. military interventions in Bosnia and Herzegovina, Kosovo, Afghanistan, Libya, and, once again, Iraq.

The U.S. airstrikes against Iranian-backed militia groups located along the Iraqi-Syrian border, and the uptick in American air support to Afghan forces, demonstrate how the model of airpower perfected against the Islamic State in Iraq and the Levant (ISIL) in Iraq and Syria has evolved. But the limited strikes on Iranian proxies and Taliban forces stand in stark contrast to the continued strikes on Islamic State leaders and targets in Iraq and Syria also authorized by the Biden administration. Previous military successes are just as likely to distort policymakers' thinking as prior failures. The Biden administration should not harbor unrealistic expectations about what airpower can achieve, nor should it succumb to the temptation to employ airpower because it is a low-risk form of taking action.

The Evolving Use of Airpower

The five-year fight against the Islamic State may appear like one of the “forever wars” the Biden administration seeks to end. Instead, it should be viewed as an evolution in how U.S. leaders have leveraged airpower to achieve military and political goals. Yet, it should also be a cautionary tale regarding the limits of airpower, as operational success has not translated into a strategic victory with enduring gains against a now-resurgent ISIL and the ideology it espouses.

The Obama administration leveraged the speed, agility, and precision of airpower when it intervened in Iraq in 2014 to stop the Islamic State's expansion in Iraq and Syria. While the U.S.-led coalition mainly fought from the air, Iraqi state and Syrian non-state forces trained

and equipped by the coalition led the fight on the ground.

Technological and tactical innovations since the Gulf War enabled a light American footprint more removed from the ground battle in contrast to the heavy boots-on-the-ground approach associated with the wars in Afghanistan and Iraq. Only 10,000 U.S. troops were engaged in Operation Inherent Resolve — not primarily to fight, but to support partner ground forces away from the frontlines. This stands in stark contrast to the large conventional force required to liberate Kuwait in 1991, which consisted of a massive ground attack involving hundreds of thousands of U.S. forces.

Inherent Resolve demonstrated a growing sophistication in using airpower. Even without American troops on the battlefield directing the airstrikes, U.S. aircraft could find, fix, and track ISIL targets, and accurately deliver weapons. This feat was enabled by drones, which filled the skies over Iraq and Syria, piping real-time full-motion video to U.S. command posts directing the airstrikes.

Leveraging “exquisite intelligence” that detailed ISIL's operations and expert planning and execution, U.S. aircraft dropped smart bombs that not only usually hit their intended targets, but also limited civilian casualties and unnecessary damage. One coalition airstrike, for example, blew the roof off a building in Mosul, destroying one floor and incinerating an ISIL cash stash inside, while leaving nearby buildings undamaged.

The capabilities of contemporary U.S. airpower have allowed American leaders to intervene in international conflicts while limiting risk to U.S. ground troops, thereby reducing opposition from those wary of putting U.S. boots on the ground. At times, American leaders have employed airstrikes because they wanted to “do something” and appear strong during a crisis, whether the attacks succeeded or not. But airpower is not without risks. Even with increased precision, modern technology, and stringent measures, airpower cannot avoid civilian casualties. It also is not a sure means for a swift and decisive victory, as the recent resurgence of ISIL fighters has shown.

The Siren Song of Airpower

There are important differences between full-blown air campaigns and bounded strikes, such as those on Iranian targets in Iraq and Syria or recently against the Taliban, in terms of the theory for how airpower will achieve the desired effect. Moreover, they differ in the longevity and intensity of air operations. In the Gulf War and during Inherent Resolve, U.S. leaders correctly applied airpower to achieve the operational aims of liberating illegally seized territory. In both cases, the United States sought to produce a durable outcome — the liberation of Kuwait, and the liberation of Iraqi and Syrian territory from ISIL rule.

In contrast, the goal of the recent strikes in Iraq and Syria is less clear. They were a proportional response to Iranian proxy attacks on U.S. facilities and forces in the Middle East, but the linkages of very discrete attacks on these particular targets

to broader outcomes is tenuous. Instead, these strikes appear to be another half-hearted attempt at punitive or coercive diplomacy through airstrikes, which have historically failed to have the intended effect due to the limited nature of the attacks and the unclear links to goals.

Already, the Biden administration may be finding this out the hard way. Despite the strikes being intended as a deterrent measure, they have failed to halt attacks on U.S. equities in the region. The recent airstrikes were promptly met by the very type of drone attacks on a U.S. facility in Baghdad the administration sought to halt.

During the withdrawal of American forces from Afghanistan, the Biden administration employed airstrikes to “do something” as Taliban forces have captured city after city. Initially, these strikes may have been to encourage the Afghans to “fight for themselves” as Biden has exhorted. This halfhearted support has failed to turn the tide in Afghanistan. Although a much more aggressive air campaign launched earlier could have blunted the Taliban’s offensive, alone it would not have defeated the Taliban. As the war against ISIL demonstrated, American airpower can halt an offensive, but it alone cannot liberate captured territory. A capable ground force is also needed. Yet, after 20 years of trying and billions of dollars invested, the Afghan military did not emerge as this partner and airpower alone will not liberate Afghanistan from the Taliban.

Airpower is an “unusually seductive” form of military power because of its immediate effects, distance from the battlefield, and relatively

low-risk application. But there are right and wrong ways to apply airpower. Using advanced airpower capabilities in an operation with clear tactical goals — as evidenced by the Gulf War and Inherent Resolve — may achieve battlefield victories and support foreign policy aims with limited risk to U.S. forces. Employing airpower as a form of coercion in one-off strikes without a precise operational objective, or merely as a way of demonstrating action, is less impressive.

Presidents and their advisers should be mindful that, although innovations in warfighting may achieve tactical and operational aims, they do not guarantee strategic success. Today, although the Islamic State's so-called caliphate has been destroyed, groups of well-financed fighters remain active, and the airstrikes against these targets continue. The combined effects of air and landpower can curb threats to regional stability, but they cannot defeat ideology.

At present, it appears as though the Biden administration has seized on airpower as the preferred tool to do something — even if it fails to achieve its purported goal — as opposed to doing nothing. But this approach has failed to deter further Iranian proxy attacks on U.S. forces in Iraq or to keep the Taliban from taking Kabul. Such actions appear mainly intended to appease domestic critics who accuse Biden of being weak on Iran or abandoning Afghanistan. Moreover, airpower not tied to broader objectives that align with national interests risks unintended consequences, which may undermine the administration's longstanding plans to reduce the

U.S. military presence in the Middle East and Afghanistan, and distract from the Pentagon's efforts to focus on China.

The Biden administration should be careful to not fall under the siren song of airpower as its preferred method of response. There are times in which military power is the best tool— as was the case of Inherent Resolve, where only the combination of ground and airpower could roll back ISIL's territorial advance. But there are times in which other instruments of power, particularly diplomacy, may do a better job of protecting U.S. interests, or it is simply best to do nothing. As such, the Biden administration should think twice before calling for airstrikes and should preserve military power for when it is truly needed.

Space Power

SpaceX adding capabilities to Starlink internet satellites, plans to launch them with Starship

Michael Sheetz | 19 August 2021

Source: CNBC | <https://www.cnbc.com/2021/08/19/spacex-starlink-satellite-internet-new-capabilities-starship-launch.html>

Elon Musk's SpaceX revealed new details about plans for the next-generation of satellites in its Starlink internet system in federal filings on Wednesday, including that the company intends to use its massive Starship rocket as the primary vehicle to deliver the spacecraft to orbit.

SpaceX filed an amendment with the Federal Communications Commission that included

descriptions of its plan, known as the Starlink **Starlink Gen2**

“Gen2 System.”

“This Gen2 System was designed to complement the first-generation constellation SpaceX is currently deploying,” SpaceX wrote in the filing. “While the original constellation provides unprecedented capacity for a satellite system, the demand for more broadband continues to grow unabated and the need for user connectivity has never been more important.”

Starlink is the company’s capital-intensive project to build an interconnected internet network with thousands of satellites, known in the space industry as a constellation, designed to deliver high-speed internet to consumers anywhere on the planet. SpaceX first rolled out the service with a beta program for select consumers for \$99 a month, and in the past year has begun looking to test the network for aviation service inflight and expand the service to large moving vehicles, like ships and trucks.

While Starlink service is still in beta, the company recently said that the network has about 90,000 users in 12 countries so far, with over half a million orders or refundable deposits placed by potential customers.

SpaceX has launched 1,740 Starlink satellites to date, with its first generation system beginning launches in November 2019. Gen2 is planned to have nearly 30,000 satellites in total.

SpaceX says the Gen2 Starlink satellites are heavier and “will be somewhat larger and generate more power than originally” designed. That will allow the satellites to “support expanded capabilities” for SpaceX’s network, as well as “accommodate additional payloads in the future” – the latter meaning Starlink satellites may be able to host sensors or antenna for other companies.

The “preferred configuration” for Gen2 would feature 29,988 Starlink satellites in orbit, deployed at nine altitudes, ranging from 340 kilometers to 614 kilometers. Previously SpaceX had proposed Starlink would have 30,000 satellites across eight altitudes, ranging from 328 kilometers to 614 kilometers.

“SpaceX would target multiple inclinations to more evenly spread capacity by latitude, ensuring better, more consistent global coverage,” the filing said.

Additionally, SpaceX’s amended plan would “nearly double the number of satellites deployed in a sun-synchronous orbit,” which would allow the company to provide better “service to polar regions like Alaska.”

The company also noted that “SpaceX has invested in advanced propulsion capabilities for its satellites,” so that the “collision risk with large objects is considered to be zero while the spacecraft are capable of maneuvering.” When a Starlink satellite malfunctions, SpaceX disposes

Elon Musk’s SpaceX revealed new details about plans for the next-generation of satellites in its Starlink internet system in federal filings on Wednesday.

of the satellite by reentering into the Earth's atmosphere so that it burns up and disintegrates.

SpaceX emphasized that, if a Starlink satellite is out of control, the low altitude of the satellites in orbit mean the spacecraft would be in orbit for "less than four years" before reentering.

Space debris is another threat both to and from Starlink satellites that SpaceX aims to further protect against with Gen2.

"SpaceX is also aware of the possibility that its system could become a source of debris in the unlikely case of a collision with small debris or meteoroids that could either create jetsam or cause loss of control of the spacecraft and prevent post-mission disposal," the company wrote. "SpaceX has continued to explore ways to make its spacecraft even more resistant to such strikes. Although the design of these protective features is still being finalized, SpaceX has improved redundancy in the power and propulsion systems."

Leveraging Starship

SpaceX has talked before about the additional capabilities that Starship would bring to deploying its Starlink network, but the filing on Wednesday outlined that it plans to use the massive rocket as the primary delivery system for Gen2.

The company's leadership has previously touted the increased capability Starship would bring. Its Falcon 9 rocket can launch 60 Starlink

satellites at a time, but Starship would be able to "take 400 satellites at a time," SpaceX president Gwynne Shotwell said in 2019.

The company intends to use its massive Starship rocket as the primary vehicle to deliver the spacecraft to orbit.

Amending Starlink's altitudes and constellation design would also allow SpaceX to launch the satellites directly into intended orbits with Starship, the company said.

"The revised orbital planes would enable single plane launch campaigns that capitalize on the ability of Starship to deliver satellites at a faster pace by not necessarily requiring a waiting period for orbital precession in a parking orbit. SpaceX could deploy satellites into their operational orbits within a matter of weeks after launch, rather than months," the company added.

SpaceX also included a deployment plan for Gen2 that continues to utilize its Falcon 9 rockets, in case Starship is not operational by the time the new Starlink system begins launching. The company has completed multiple test flights of Starship prototypes over the past year, and is moving closer to its first orbital flight attempt. SpaceX recently stacked prototype Starship 20 on a Super Heavy rocket booster for the first time. Musk said last weekend that it "should be ready for flight in a few weeks, pending only regulatory approval" to launch.

Starship and Starlink each represent multi-billion dollar projects that are key to SpaceX's growth, driving much of the company's \$74 billion valuation.

China launches twin satellites capable of creating 3D maps in space

25 August 2021

Source: India Today | <https://www.indiatoday.in/science/story/china-launches-twin-satellites-capable-of-creating-3d-maps-in-space-1845070-2021-08-25>

China has been busy in 2021 as it ramps up its space led activities in a bid to dominate the modern space race. Beijing conducted the 29th orbital launch of the year by blasting off twin satellites to boost its remote sensing and mapping capabilities.

The Long March 4B lifted off from the Taiyuan launch centre to deploy the twin satellites in the near-polar orbit around 500 kilometres above the planet. The deployment was confirmed by the US space tracking data that reported the two Tianhui-2 (02) satellites in orbit.

China's space missions have always been shrouded in secrecy and the launch was reported only by the state-run media in China stating that the satellites were developed by the Shanghai Academy of Spaceflight Technology (SAST) and will be "mainly used for scientific experiments and research, land and resources surveying, and geographic surveying and mapping."

This was the ninth mission of the Long March-4B carrier rocket series this year and the 384th flight mission of the Long March series.

Meanwhile, it's not the first launch of a pair of Tianhui-2 satellites, the country had launched

Tianhui-2 satellites in April 2019 for a similar approach to map the areas it surveyed.

According to a paper published in the Journal of Surveying and Mapping, the two satellites will work in tandem so that their data can be combined to form a 3D map with a resolution of around 9.8 feet. "The TH-2 satellite system is China's first microwave surveying satellite system. It is composed of two equal satellites that adopt a technical system of satellite formation in different orbits and a bistatic radar transceiver mode. It can measure the global digital surface models and acquire radar orthophotos in a short time," the paper said.

With 29 launches complete, China has a total of 40 planned missions this year which included its ambitious Tianhe space station module and the Shenzhou-12 crewed mission. The next launch is of

Tianzhou 3, a cargo resupply mission to its under-construction space station, which is likely to take place in September.

A report by the Asia-Pacific Leadership Network for Nuclear Non-proliferation and Disarmament had said that space is part of the grand strategy for China as it assessed the prospects of the proliferation of space warfare capabilities, the institutional and legal regimes and constraints on space weaponisation, worst-case militarisation scenarios, and pathways for demilitarising space.

With an \$8 billion budget, China has an

The Long March 4B lifted off from the Taiyuan launch centre to deploy the twin satellites in the near-polar orbit around 500 kilometres above the planet.

ambitious space programme and is on par to establish a permanent space station by 2022, a lunar research outpost by 2036, a Solar Power Satellite (SPS) transmission capacity from geostationary orbit (GEO) by 2050, and a world leader in space by 2050.

BRICS signs deal on cooperation in remote sensing satellite data sharing

20 August 2021

Source: The Hans India | <https://www.thehansindia.com/karnataka/brics-signs-deal-on-cooperation-in-remote-sensing-satellite-data-sharing-702511?infinitescroll=1>

Brazil, Russia, India, China and South Africa (BRICS) signed an agreement for cooperation in remote sensing satellite data sharing, according to Indian Space Research Organisation (ISRO). The pact inked on Wednesday enables building a virtual constellation of specified remote sensing satellites of BRICS space agencies and their respective ground stations will receive the data, ISRO said.

“This will contribute in strengthening multilateral cooperation among BRICS space agencies in meeting the challenges faced by mankind, such as global climate change, major disasters and environmental protection,” the Bengaluru-headquartered space agency said in a statement. The agreement was signed under India’s BRICS Chairship, it was stated. Secretary (Consular, Passport, Visa & Overseas Indian

Affairs) & India’s BRICS Sherpa, Ministry of External Affairs, Government of India, Sanjay Bhattacharyya, was present.

“#BRICS reached major landmark today with signing of Agr on BRICS Satellite Constellation by Heads of Space Agencies It will promote cooperation & use space data & applications for development & social objectives outlined in SDGs, providing benefit to citizens #BRICSIndia2021”, Bhattacharyya tweeted. Chairman of ISRO and Secretary in Department of Space, K Sivan, Administrator of China National Space Administration, Zhang Kejian, Chief Executive Officer of South African National Space Agency, Valanathan Munsami, President of Brazilian

Space Agency, Carlos Augusto Teixeira de Moura, and Director General of Russia’s State Space Corporation Roscosmos, Dmitry Rogozin, signed the agreement.

Space is the Limit

20 August 2021

Source: DT Next | <https://www.dtnext.in/News/National/2021/08/20070138/1313011/Editorial-Space-is-the-limit.vpf>

The satellite EOS-03 was meant to have had a 10-year mission life and was launched to provide real-time imaging about natural disasters, and episodic events apart from obtaining spectral signatures for cloudburst and thunderstorm monitoring. As far as the Indian Space Research

Organisation (ISRO) is concerned, a lot of hope was riding on this launch, which was cancelled twice due to technical glitches.

The launch was also the national space agency's second space mission in 2021 after it successfully blasted off the Brazilian satellite Amazonia-1 by the Polar Satellite Launch Vehicle (PSLV) earlier this year. These developments in India are taking place at an important juncture in the global space race. Over the past few months, billionaires took to the final frontier in privately funded space missions, opening up space tourism for those with the means. So now, the Indian government is also making plans to place the nation front and

centre in space research. For starters, the budget allocated to space research witnessed a significant jump this fiscal. Following a deep plunge last year, the Department of Space (DOS) was allocated Rs 13,949 cr in this year's

budget, out of which Rs 8,228 cr was earmarked for capital expenditure. The net budgetary allocation is Rs 900 cr over 2019-20's allocation and Rs 4,449 cr over the budget of 2020-21.

And Rs 700 cr has been set aside this year for the New Space India Ltd (NSIL), a public sector undertaking under the DOS, which helped execute the aforementioned PSLV-CS51 launch, which carried the Amazonia and a few other small Indian satellites. NSIL was incorporated to spearhead the privatisation of launch vehicles, technology transfer, and marketing of space products. There

are high hopes for India's manned space mission as well, the Gaganyaan, as four Indian astronauts are undergoing training on aspects of Generic Space Flight in Russia.

ISRO has lined up four launches over the next five months, while plans for the Gaganyaan's unmanned mission (set for Dec 2021) has been put on hold. The manned space mission was initially being planned to coincide with India's 75th anniversary of independence, in 2022. The success of these missions will elevate India's stature in the global space research arena. What has also perked up the ears of space enthusiasts in India is how ISRO is gradually opting for the

India's space programme experienced a setback last week when the GSLV F-10 rocket failed midway in its mission to place into orbit, the Earth Observation Satellite (EOS-03). The communication satellite carried by the rocket was lost as it faced a failure of the cryogenic upper stage ignition, the result of a technical anomaly.

role of a facilitator, as it paves the way for the private sector to play a much bigger role in India's second space age. This will be a sea change for ISRO which has until now served as an end-to-end provider of the nation's space programme.

The move towards privatisation is spurred by tailwinds in space programmes globally. India was once known for its cost-effective solutions to complicated problems. Now, thanks to Elon Musk and his enterprise SpaceX, the investment needed to launch satellites has become competitive. Under India's Aatma Nirbhar Bharat programme, the Indian National Space Promotion and Authorisation Centre (IN-SPACe) is also being set up. The Centre's objective is to unveil ISRO's satellite data to private players and start-ups in space research, and they in turn, can use ISRO's

facilities to incept in-house technologies and innovations. As per the Economic Survey 2020-21, just 40 Indian start-ups are working with ISRO, whereas there are 120 active start-ups in the space business.

The fact that the Centre has opened up to the idea of privatising space research, a highly regulated sector, bodes well for India in the long run. Armed with our knack for offering low-cost solutions, outer space might be the limit for India's brightest, who have the opportunity to reshape our space narrative in the years to come.

Global Aerospace Industry

India seeks clarity from US on price, technology transfer before finalising \$3-billion Predator drone deal

25 August 2021

Source: Money Control News | <https://www.moneycontrol.com/news/india/india-seeks-clarity-from-us-on-price-technology-transfer-before-finalising-3-billion-predator-drone-deal-7384191.html>

India has sought "more clarity" from the United States about the armed MQ-9B Predator drones before finalising the deal, media reports have said.

India plans to buy 30 armed drones, which are designed for long-range precision strikes against hostile targets on land and sea, from the US.

New Delhi has now sought to know more about the price fixation, maintenance and transfer

of technology in the proposed \$3 billion (around Rs 22,000 crore) deal to acquire these drones, The Times of India cited sources as saying.

According to the report, the procurement project would be moved for "acceptance of necessity (AoN)" by defence minister Rajnath Singh-led Defence Acquisitions Council (DAC) once it gets the information from the US government.

The Indian government finalised the plan to acquire these 30 drones, also known as SeaGuardian or SkyGuardian remotely-piloted aircraft systems (RPAS) to strengthen its long-range unmanned lethal capabilities. The army, navy and Indian Air Force (IAF) are to get 10 drones each, with different payloads to hunt and destroy targets over land and sea, the report said.

However, the high cost has delayed the signing of the final contract, the report said. It will be a government-to-government deal through the US foreign military sales (FMS).

Due to the high procurement cost of the 30 armed drones, the defence ministry has sought more details on costing, repair and maintenance facilities to be set up in India and the technology transfer.

"Due to the high procurement cost for the 30 armed drones, the defence ministry wants better insight into the deal under the FMS, which is slightly opaque," the

report quoting a source as saying.

That is why the defence ministry had asked for some more details on the exact costing, the repair and maintenance facilities that would be set up in India and the technology transfer it would entail, the source told the publication.

Once the project gets the AoN from the DAC, India will issue an actionable LoR (letter of request) to the US government, the report said. The final contract would be signed after the US responds with a letter of offer and acceptance and notifies US Congress, the report added.

Companies Are Preparing for Space Mining

Hugo Britt | 19 August 2021

Source: Thomasnet | <https://www.thomasnet.com/insights/companies-are-preparing-for-space-mining/>

When LA-based blues and rock band Canned Heat wrote “Poor Moon” in the same year Neil Armstrong took his famous giant leap, their lyrics reflected the Cold-War-era concern that spacefaring nations would one day scar the moon by testing a bomb on its surface.

While this, thankfully, hasn’t yet happened, the moon — along with all the other planets, moons, and asteroids in the solar system — could one day be mined for resources to meet Earth’s ever-growing needs.

Why Mine Off-Earth?

Space Exploration Is Expensive

While the price tag involved in establishing a human colony on the Moon or Mars is mind-boggling, the costs of sustaining off-Earth colonies and keeping them resupplied indefinitely are even more so — unless the settlements can somehow pay for themselves. Mining for much-needed metals and sending them back to Earth could change the

game for space exploration, transforming off-world ventures from prohibitively expensive to financially viable.

That being said, bringing a heavy payload of minerals down through Earth’s atmosphere is not currently feasible. Futurists believe that instead, minerals mined in space will be used in space as humanity spreads outwards.

Rare Earth Materials Are Abundant

There are around two million near-earth asteroids brimming with rare earth minerals, precious metals, iron, and nickel. The Moon contains helium-3, yttrium, samarium, and lanthanum, while Mars contains an abundance of magnesium, aluminum, titanium, iron, chromium, and trace amounts of lithium, cobalt, tungsten, and other metals. Importantly, many planetary bodies contain water, which through hydrolysis can be used as rocket fuel.

It Helps with Sustainability

Earth’s resources are finite. Non-renewable metal resources are inherently unsustainable, and mining causes environmental degradation all over the world. The answer is to source our minerals off-world. Off-world minerals are exhaustible as well, but the argument is that mining lifeless rocks such as the Moon or asteroids is infinitely preferable to continuing to damage Earth’s fragile biosphere.

Discoveries May Be Made

Opening space to commercial mining does not mean that science takes a back seat. Space-mining interests could drive scientific advancement by

discovering extremely rare or unknown minerals on other planetary bodies.

Robotics Would Do the Work

While countless lives have been lost on Earth over the centuries due to mining accidents and disasters, it is likely that humans will not have to risk their lives by traveling in-person to off-world mining sites. Regolith-sampling probes are already in use and provide an early glimpse of what a scaled-up robotic mining craft may one day look like.

Off-Earth Mining and Space Law

The 1967 Outer Space Treaty is unclear in terms of whether any country — or private company — can claim mineral rights in space. It states that “exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind.”

The 1979 Moon Treaty was an attempt to declare the Moon and its natural resources to be CHM (Common Heritage of Mankind). Significantly, it called for “an equitable sharing [by all countries] in the benefits derived from these resources.” Most nations, including the U.S., did not ratify this treaty.

Recently, the U.S. has accelerated its efforts to create a legal framework for the exploitation of resources in space.

- The Obama administration signed the U.S. Commercial Space Launch Competitiveness Act of 2015, allowing U.S. citizens to “engage in the commercial exploration and

exploitation of space resources.”

- In April 2020, the Trump administration issued an executive order supporting U.S. mining on the Moon and asteroids.
- In May 2020, NASA unveiled the Artemis Accords, which included the development of safety zones around lunar mining sites. Former NASA administrator Jim Bridenstine said: “It’s time to establish the regulatory certainty to extract and trade space resources,” and clarified in a separate statement that: “We do believe we can extract and utilize the resources of the moon, just as we can extract and utilize tuna from the ocean.”

NASA planned an Asteroid Redirect Mission which involved collecting a multi-ton boulder from an asteroid and redirecting it into a stable orbit around the moon, but the mission was canceled in 2017

What Companies Are Preparing for a Future of Space Mining?

One thing that is becoming clear is that off-earth mining is unlikely to be a state-run activity. Instead, several private companies are jockeying to be first in line to access minerals in space.

iSpace (Japan) has a mission to “help companies access new business opportunities on the moon,” including the extraction of water and mineral resources to spearhead a space-based economy.

Planetary Resources (defunct) was founded in 2009 with the goal of developing a robotic

asteroid mining industry. Despite having high-profile founding investors including Alphabet's Larry Page, Eric Schmidt, and Virgin Group founder Richard Branson, Planetary ran into financial trouble in 2018 and was gone by 2020.

Deep Space Industries (defunct) was another early mover that intended to explore, examine, sample, and harvest minerals from asteroids. DSI was acquired by Bradford Space in 2019.

Offworld is an AI company building "universal industrial robots to do the heavy lifting [including mining] on Earth, the Moon, asteroids, and Mars."

The Asteroid Mining Corporation (UK) is a venture currently crowdfunding for a 2023 satellite mission called "El Dorado," which will conduct a spectral survey of 5,000 asteroids to identify the most valuable for mining.

Alongside the U.S., the tiny European nation of Luxembourg has also developed a space mining framework and has subsequently emerged as a European hub for the fledgling industry.

Indian Air Force (IAF) chief, Air Chief Marshal RKS Bhadauria has reviewed the progress of the ongoing manned and unmanned air power projects and operational trials in Bengaluru during his two day visit to various defence establishments.

Indian Aerospace Industry

IAF chief reviews progress of Air Power projects

25 August 2021

Source: DT Next | <https://www.dtnext.in/News/National/2021/08/25084958/1314013/IAF-chief-reviews-progress-of-air-power-projects.vpf>

He visited Air Force units and flight test establishments and facilities of Defence Research and Development Organisation and Hindustan Aeronautical Limited at Bengaluru on August 23 and August 24, officials said.

During his visit to Aircraft and Systems Testing Establishment (ASTE), Air Chief Marshal RKS Bhadauria was given an overview of ongoing projects and briefed on progress of operational trials.

During his interaction with personnel, the IAF chief spoke of the unique and challenging role of ASTE, noted its laudable achievements and re-emphasised the need for staying ahead of the curve in order to leverage its expertise in delivering the requirements of IAF operational units.

He also visited Software Development Institute (SDI), the unit tasked for undertaking development of avionics software.

He noted that the sustained focus on critical projects by the Institute had contributed significantly in increasing the operational and

functional capability of IAF.

Air Chief Marshal Bhadauria outlined his vision for SDI to move towards software indigenisation for integration of various weapons on IAF aircraft and achieving self-reliance in enhancing combat potential, officials said.

As part of the visit, he met and interacted with the test crew and engineers of Aeronautical Development Agency (ADA), DRDO and Hindustan Aeronautics Limited (HAL).

Bhadauria also underscored the crucial role of both the establishments in furthering the shared goal of building an indigenous aviation industry capability of meeting our future requirements.

During his visit to Bengaluru, the IAF chief flew a sortie in a Tejas MK1 final operational clearance fighter.

Last year, the air force had inducted the first final operational clearance (FOC)-standard Tejas light combat aircraft into squadron service.

HAL to respond to Malaysia RfP for LCA Tejas in September

Aksheev Thakur | 19 August 2021

Source: India Express | <https://indianexpress.com/article/cities/bangalore/hal-to-respond-to-malaysia-rfp-for-lca-tejas-in-september-7460766/>

Hindustan Aeronautics Limited (HAL), a public sector aircraft company, will be bidding to sell 18 LCA Mk1 A fighter aircrafts to the Royal

Malaysian Air Force in the light of Malaysian authorities showing interest in the indigenous fighter planes, HAL chairman R Madhavan said Wednesday.

HAL will respond to a Request for Proposal (RfP) from the Royal Malaysian Air Force (RMAF) in the third week of September, the HAL chairman said. Malaysia has shown interest in the Light Combat Aircraft (LCA) Tejas Mk-1A and India stands a good chance in bagging the deal, Madhavan added.

Malaysia has shown interest in the Light Combat Aircraft (LCA) Tejas Mk-1A and India stands a good chance in bagging the deal, Madhavan said.

“There are many countries which are showing interest in LCA Mk-1A. Malaysia has issued the RfP and we are responding to it. It has to be sent in the third week of September. We stand a very good chance. There are eight more contenders including US, China and Russia,” Madhavan said. Malaysia is looking at procuring 18 aircrafts with the probability of a follow up order of 18 more, he said.

“Regions which have exhibited interest in the LCA Mk- 1A are East Europe, South Asia, West Asia and South America. We see whether there is a demand from those countries and if they are trying to upgrade their Air Forces. Malaysia was in the process of upgrading their capabilities. We have been in business with them for the last two years,” the HAL chairman said.

The LCA Mk-1A is a fourth-generation fighter aircraft with an Active Electronically-Scanned Array (AESA) radar, an Electronic Warfare (EW) suite, and is capable of air-to-air refuelling

(AAR).

The main customer for HAL's indigenous LCA Mk1A or Tejas fighter aircraft is at present the Indian Air Force. The IAF initially ordered 20 LCA Tejas jets in the Initial Operational Clearance (IOC) phase of the aircraft and 20 more in the Final Operational Clearance (FOC) phase and has raised two squadrons with the aircraft.

In January this year, the IAF signed a Rs 48,000 crore-deal with HAL to buy 83 LCA-Tejas Mk1A aircrafts to be delivered over a period of nine years.

On Tuesday, HAL placed an order worth Rs 5,375 crore for 99 F404-GE-IN20 engines and support services with GE Aviation, USA to power the LCA. Madhavan said on Wednesday that work on the Tejas Mark II is progressing and ground trials will begin by December 2022.

The chairman stated that restrictions imposed during the lockdown in the second wave affected the supply chain of the company. "It is going to improve. We faced issues earlier due to restrictions on the movement of transport and people. The materials which have to come from abroad are also delayed because of the restrictions. However, this was until July. August is good," Madhavan added.

The HAL chairman said the LCA stands a good chance of being bought by foreign air forces on account of fourth generation fighters still being relevant.

Raksha Mantri Sh. Rajnath Singh launches Defence India Startup Challenge 5.0

19 August 2021

Source: The Hindu | <https://www.thehindu.com/news/national/rajnath-launches-defence-india-startup-challenge-50/article35998979.ece>

Defence Minister Rajnath Singh on Thursday launched the 5th edition of the Defence India Start-up Challenge (DISC) under Innovations for Defence Excellence - Defence Innovation Organisation (iDEX-DIO) meant to achieve self-reliance and foster innovation and technology development in the defence and aerospace sectors.

"Thirty-five problem statements – 13 from the Services and 22 from Defence Public Sector Undertakings (DPSUs) – were unveiled under DISC 5.0. These are in areas such as situational awareness, augmented reality, artificial intelligence, aircraft-trainer, non-lethal devices, 5G network, underwater domain awareness, Drone SWARMS and data capturing," a Defence Ministry statement said.

Speaking at the virtual launch, Mr. Singh said the iDEX provided a strong foundation for innovation, Research and Development (R&D) to the industry. "Initiatives like iDEX form a link between our youth, academia, R&D, start-ups and the armed forces," he pointed out.

iDEX4fauji

On the earlier editions of DISC, Mr. Singh said that more than 80 start-ups, Micro, Small and Medium Enterprises (MSME) and individual

innovators had joined as winners in over 40 technological areas. He noted that iDEX4fauji was a similar initiative that gave an opportunity to the Service personnel to showcase their talent in these fields.

Mr. Singh listed out measures taken by the Ministry to promote innovation, such as including iDEX as a procurement avenue under the Defence Acquisition Procedure 2020, earmarking ₹1,000 crore for domestic procurement through iDEX for financial year 2021-2022 and approving a budget of ₹ 498.8 crore for the next five years to support over 300 start-ups and foster innovation in defence and aerospace sectors.

The launch of DISC 5.0 comes three years after the launch of DISC 1.0. iDEX initiative was launched by Prime Minister Narendra Modi in April 2018.

DRDO develops advanced chaff technology for IAF jets

Amit Chaturved | 19 August 2021

Source: Hindustan Times | <https://www.hindustantimes.com/india-news/drdo-develops-advanced-chaff-technology-for-iaf-jets-all-you-need-to-know-101629353449306.html>

The Defence Research and Development Organisation (DRDO) has developed an advanced chaff technology to safeguard Indian Air Force (IAF) fighter jets against hostile radar threats.

This come a few months after the DRDO

developed a similar technology for naval ships to protect them from missile attacks.

The technology was developed in three variants. The Indian Navy conducted trials of all three variants in the Arabian Sea on Indian Naval Ship and found the performance satisfactory.

Where has the technology been developed?

The advanced chaff technology has been developed by DRDO's defence laboratory situated in Rajasthan's Jodhpur.

It was developed in collaboration with high energy materials research laboratory in Pune to meet qualitative requirements of the IAF. The Air Force has started the process of induction of this technology after completion of successful user trials, according

The Air Force has started the process of induction of advanced chaff technology after completion of successful user trials, according to DRDO. It has been developed to protect the fighters jets against hostile radar threats.

to DRDO.

What is the advanced chaff technology?

It is an electronic countermeasure technology used by militaries worldwide to protect their assets, like naval vessels and aircraft. It protects the assets from radar and radio frequency.

In case of naval ships, chaff rockets are deployed in the air, which act as multiple targets for missile guidance system.

The importance of this development lies in the fact that very less quantity of chaff material deployed in the air acts as decoy to deflect enemy's missiles for safety of the ships, the defence ministry said in a release.

Difference between chaff and flares

Both are used to as defensive countermeasure to confuse the radar from detecting a vessel, or deflect the missiles from the target.

But there is a major difference between the two. While flares, when fired, generate a strong infrared source to attract heat-seeking missiles, chaff is used to misguide radar-tracking weapons.

Chaff is composed of many small aluminium or zinc coated fibres. It will be stored on-board the aircraft as cartridges.

What were the three variants of chaff technology developed by DRDO to Indian navy?

Defence Laboratory Jodhpur indigenously developed three variants of the critical technology, namely Short Range Chaff Rocket (SRCR), Medium Range Chaff Rocket (MRCR) and Long Range Chaff Rocket (LRCR) to meet the navy's qualitative requirements, according to the defence ministry.

The successful development of Advanced Chaff Technology by DLJ is another step towards Atmanirbhar Bharat, the ministry further said in a release.

Technology Development

China reveals plans to launch a fleet of mile-long solar panels into space to beam energy back to Earth

Ryan Morrison | 18 August 2021

Source: Daily Mail | <https://www.dailymail.co.uk/sciencetech/article-9904651/China-reveals-plans-launch-fleet-mile-long-solar-panels-space.html>

China plans to launch a fleet of mile-long solar panels into space by 2035 and beam the energy back to Earth in a bid to meet its 2060 carbon neutral target.

Reports suggest that once fully operational by 2050, the space-based solar array will send a similar amount of electricity into the grid as a nuclear power station.

The idea for a space power station was first suggested by science-fiction writer Isaac Asimov in 1941 and has been explored by several countries including the UK and US.

Above the Earth there are no clouds and no day or night that could obstruct the sun's ray – making a space solar station a constant zero carbon power source.

However, the Chinese government appear to be ready to go from exploring the science and technology behind the idea, to putting a system into practice.

In the city of Chongqing, the Chinese government has broken ground on the new Bishan space solar energy station where it will begin tests by the end of the year, with the hope

of having a functioning megawatt solar energy station by 2030.

It isn't clear how much the full space power station will cost to launch or operate, but it is expected to be operational by 2035 and at capacity by 2050.

A third of days in Chongqing city in southwestern China are marred with fog all year, making it an unlikely host for a research centre focused on solar power.

However, over the next decade a team based at the new centre will test and launch an array of solar panels into geostationary orbit.

It will start with just a megawatt of energy, but by 2049 this will be expended to a gigawatt of power, the same output as the largest nuclear power reactor in China.

Originally, ground was broken on the \$15.4 million testing facility for the national space solar-power programme, in Heping village near Chongqing three years ago, but was delayed to make time for debates on cost, feasibility and safety.

However, those issues resolved, the project started up again in June with construction due to be finished by the end of the year.

The plan, once the first satellites are sent into orbit, will be to use an intensive energy beamed tightly focused on the new facility.

This is needed to penetrate the cloud and hit the ground station directly, with the orbiting station operating day and night.

Having solar panel array orbiting 22,400 miles above the Earth in geostationary orbit would allow the power station to avoid Earth's shadow and gather sunlight full time.

The researchers will work on the best design for sending the power back to the Earth, including building on existing long-range power transfer experiments.

Early Beamed Microwave-Powered Rocket Launches and Drone Power

Brian Wang | 11 August 2021

Source: Next Big Future | <https://www.nextbigfuture.com/2021/08/early-beamed-microwave-powered-rocket-launches-and-drone-power.html>

Sending a rocket into space typically requires about 90% of the rocket's initial weight to be fuel. This limitation could be overcome by wirelessly transmitting the needed power to the rocket through a beam of microwave radiation. A research team from Japan has investigated the viability of using such microwave-powered propulsion for real-world applications.

In a study published this month in the Journal of Spacecraft and Rockets, researchers led by the University of Tsukuba have demonstrated wireless power transmission via microwaves for a free-flying drone and determined the efficiency of this process.

Previous analyses of this kind were carried out decades ago and mostly considered microwaves of a low frequency (a few gigahertz; GHz). Given that the power transmission efficiency increases

as the operating frequency is raised, the team behind this latest research used microwaves with a relatively high frequency (28 GHz). The team's drone weighed roughly 0.4 kilograms and hovered for 30 seconds at a height of 0.8 meters above the source of the microwave beam.

The researchers measured the efficiencies of the power transfer through the beam (4%), the capture of microwaves by the drone (30%), the conversion of microwaves to electricity for propulsion (40%), and other relevant processes. Based on this information and an analytical formula, they calculated the overall power transmission efficiency in their experiment to be 0.43%. For comparison, in a previous study, the team measured the total transmission efficiency

for a fixed-position (rather than free-flying) drone to be 0.1%.

"These results show that more work is needed to improve the transmission efficiency and thoroughly evaluate the feasibility of this propulsion approach for aircraft, spacecraft, and rockets," explains Shimamura. "Future studies should also aim to refine the beam-tracking system and increase the transmission distance beyond that demonstrated in our experiment."

Although microwave-powered rocket propulsion is still in its early stages, it could someday become a superior way to launch rockets into orbit given the high onboard-fuel demands of conventional propulsion techniques.



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