CENTRE FOR AIR POWER STUDIES (CAPS)
Forum for National Security Studies (FNSS)

AEROSPACE NEWSLETTER

VOL II NO 5 **01 May, 2022**

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> *Deterrence is the art of producing, in the mind of the enemy, the fear to attack.*
>
> *- Sterling Hayden*

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Opinions and Analysis

Band of Brothers: Three Service Chiefs' Jointmanship

Air Vice Marshal Anil Golani (Retd)

Additional Director General, Centre for Air Power Studies | 28 April 2022

Source: Bharat Shakti | https://bharatshakti.in/band-of-brothers-three-service-chiefs-jointmanship/

The credo of the National Defence Academy (NDA), the only institution of its kind in the world where cadets of all the three services train together, is 'Seva Parmo Dharma' -in Sanskrit, which means 'Service Before Self.' This unique institution grooms budding and impressionable cadets, the future armed forces officers of the country to always think of their service first and foremost at all times.

When these young cadets pass out of the Academy, the Army cadets go to the Indian Military Academy (IMA) as 'Gentleman Cadets' where they imbibe the Chetwode Motto which states that, "the safety, honour and welfare of your country come first, always and every time. The honour, welfare and the comfort of the men you command come next. Your own ease, comfort and safety come last, always and every time."

Similarly, the Air Force and Naval cadets go to their respective service academies before getting commissioned as officers. The National Defence Academy, over the years, has more than proven itself, giving the nation scores of gallantry award winners apart from the first Indian cosmonaut and individual Olympic medal winners. The bonhomie and camaraderie built through sweat, toil and tears during the three years of rigorous training at the Academy get segued into an unspoken, yet unbreakable bond amongst coursemates that invariably lasts a lifetime.

As officers continue to progress through their service careers, charting out their path through their own services, gaining professional acumen through their various appointments and deployments across the country and the world, coursemates often cross each other and bond like those indelible early days, reliving the times spent together at the Academy. During the course of their careers, the initial years are dedicated towards their Service specific training and the focus invariably is towards your own service and the soldiers under your command.

The loyalty towards individual service and men who form the rank and file gets cemented during these formative years. With subsequent growth in their careers, officers undergo joint services courses where they learn about the other services and joint warfighting. As some rise to become two- and three-star generals, air marshals and admirals, their horizons are further widened with knowledge, experience and exposure to the functioning of the higher defence organisation. Only one amongst the initial batch from across five to six courses makes it to the top, commanding the service.

It is a rare occasion when you have more than one Chief from the same NDA course. Having all the Three Chiefs from the same course is even more unique and since the inception of the Joint Services Wing in 1949 and the National Defence Academy in 1954, this has happened only thrice.

The very first course from NDA produced Three Chiefs General SF Rodrigues, Admiral LN Ramdas and Air Chief Marshal NC Suri who were at the helm of their respective services at the same time in the early nineties.

Incidentally, the first course also produced three Maha Vir Chakra recipients of the 1971 Indo – Pak war. With the announcement of Lt Gen Manoj Pande as the next Army Chief with effect from 1 May 2022, all the Chiefs are going to be from the 61st NDA course. It would also be the first time in history that this would have been in succession as the previous incumbents were also from the same NDA course.

"Uneasy lies the head that wears a crown," this famous quote is from Shakespeare's Henry IV Part II. Henry bemoans his position as a King wherein he cannot find a moment's peace or repose. This could not be truer for the Three Service Chiefs today, as they navigate their respective services in an uncertain and volatile environment. With the increasing clamour on integration and jointmanship, the thrust on self-reliance – Atmanirbharta on a nascent and underfunded indigenous defence industry, two hostile neighbours that are nuclear powers and in collusion with each other, unresolved border disputes and the challenges of a burgeoning revenue expenditure of a manpower-intensive armed forces, the Three Chiefs no doubt have an unenviable and humongous task on their hands.

Coupled with these challenges is the proposal to introduce a 'tour of duty' scheme for soldiers, sailors and airmen wherein they will just serve for a couple of years in the armed forces before they take up other opportunities. This scheme has been proposed with the aim of inculcating discipline and a sense of duty in the nation's youth, apart from reducing the pension bill. The true test of military leadership is no doubt on the battlefield, however, in the absence of a full-fledged conflict, the mettle of leadership would get tested in the present no war, no peace scenario coupled with the challenges described earlier.

'With great power comes great responsibility.' This adage reflects the predicament that the Three Service Chiefs from the same batch would find themselves in as they battle the demons in their own minds over loyalty to their respective Service or the Nation. The esprit de corps developed and nurtured through four decades of a sterling career that has given them the opportunity to be at the helm and choose the difficult path of the larger good for the nation would be tested as they wrestle with competing and conflicting demands of their own service.

Challenging situations present golden opportunities to leaders, as Brutus said to Cassius in Shakespeare's Julius Caesar, "There is a tide in the affairs of men. Which, 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." Will the 'Band of Brothers' from the 61st Course of NDA heed the call to arms and lead the armed forces of the nation to becoming a lean, mean, efficient and integrated fighting force capable of securing nation from all kinds of external threats?

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Air War in Russian Special Operations Across Ukraine

Air Cmdre SP Singh (Retd) | 23 April 2022

Source: Bharat Shakti | https://bharatshakti.in/air-war-in-russian-special-operations-across-ukraine/

On 24 February 2022, amidst global speculations and official Russian denial, Russia launched a full-scale special operation against Ukraine with coordinated artillery shelling, air, sea, and ground-based missile strikes targeting Ukrainian military targets. The roots of this invasion could be traced back to the certain key developments that occurred eight years earlier and the chain of events thereafter. The major development of the Russian occupation of Crimea in Southeast Ukraine and the subsequent seizure of territories of Donetsk and Luhansk in the Donbas region, followed by Volodymyr Zelenskyy approving Ukraine's new National Security Strategy towards the development of the distinctive partnership with NATO with the aim of membership in NATO, became the 'raison-d'etre' for the present military action in the region.

Military Power Asymmetry

All the three services of the Russian Armed forces are numerically and technologically far superior as compared to the Ukraine forces. This differential is overwhelming just in numbers itself; be it in terms of regular soldiers, artillery, tanks, armoured vehicles or, aircraft, drones, High-Value Air Assets (HVAA) like Airborne Warning And Control System (AWACS), Heavy Lift Aircrafts, Flight Refuelling Aircraft (FRA) of Air Force and naval assets like Carrier Battle Group (CBG), nuclear submarines and various kinds of warships. The differential gets even wider with the number of weapons of various types of precision and stand-off capability, Electronic Warfare (EW), Intelligence Surveillance and Recce (ISR), and Cyber and Space capabilities.

In any modern warfare, it has been observed that air campaign plays a pivotal role as a primary instrument of degrading the war potential of any adversary and Russian special operations in Ukraine are no exception.The Russian air Force is one of the largest air forces in the world with about 4000 aircraft including all types of fighters, bombers, special role aircrafts and helicopters along with about 500 plus drones Unmanned Aerial Vehicles/Unmanned Combat Aerial Vehicles (UAV/UCAVs). Russian Navy and Army also have a substantial number of aircraft; mainly helicopters, amounting to more than 800 aircrafts.

In comparison the Ukraine Air Force has just about 250 aircraft in all with just about 100 plus UAV/UCAV; most of which are from countries like the US, Turkey and Israel. It is very evident that there is a huge differential in the number of aerial platforms between the two opposing sides. It is not the quantity but also there exists a huge quality differential between the two. While on one side Russia has almost 70 per cent of its aircraft and weapons of fourth-generation and above with state of art technology and precision capability, the Ukrainian aircraft and other systems are mostly of much lower capabilities.

As far as the Russians are concerned, the fighter aircrafts like SU-35, MiG-31, SU-30, SU-27 and MiG-29 with A-50 AWACS, AN-22

heavy lift and a large number of IL-78 FRA along with a large helicopter fleet of attack helicopters like KA-52, Mi-35, armed helicopters Mi-17 as well as various UCAVs, provide the Russian air force a capability to dominate the skies over Ukraine which has very limited fighters, helicopters, UCAVs as well as limited air defence capability of merely two S-300 units and limited Surface to Air Missiles (SAMs) or Man-Portable Air Defence Systems (MANPADS) to oppose the Russian air campaign.

Limited Air Operations and Implications

The special operations by Russia in Ukraine commenced with a large number of airstrikes on 24 February itself. The notable airstrikes, mostly on military targets, included airstrikes on Chuhuive air base, Antonov airport, Avdivka, snake island, Kharkiv, Kherson, Kontop and Odessa. Simultaneously there were airstrikes on certain select military targets in areas of Mariupol, Sumy, Chernihiv and Okhtyrka. A large number of targets were military strongholds, ammunition dumps and a few air defence missile and radar sites.

The air campaign appeared to be in line with the principles of air war where Suppression/ Destruction of Enemy Air Defence (SEAD/ DEAD) precedes any other military offensive. The next day, along with repeated attacks on these targets, air attacks on other airbases were also launched. The intensity of air attacks, as the days passed, was observed to be gradually declining rather than increasing, as also the employment of fighters. The next few major attacks were not only separated in time but also lacked full potential exploitation. The notable airstrikes after 27 February were few and far and included Vinnytsia airstrike on 6 March, Yavoriv on 13 March, Kherson on 16 March and Berdiansk port attack on 24 March.

Despite having overwhelming air superiority, instead of dominating the skies of Ukraine in the first few days itself, the Russian Air Force, except for the first five days, seemed to be limiting its airpower employment both in terms of numbers and types of air operations. Since the major objective of Moscow appeared to be of forcing Ukraine to give up its quest to become a member nation of NATO, an unprecedented force application by air to destroy assets on the ground may not have been considered logical. Secondly, since Russian forces focussed on military targets only, extensive use of airpower could have led to an unacceptable level of collateral damage to civilian lives and assets.

However, while the reasons for such limited use of airpower could be justifiable, they have resulted in Russian Army facing counterattacks from Ukraine. Secondly, the absence of air interdiction of the entire arms and ammunition supply route from Poland to Ukraine also enhanced the capabilities of Ukraine fighters to target Russian tanks and army elements continuously. The Russian Air Force, by failing to exploit its full potential and create at least a Favourable Air Situation (FAS) to minimise attrition of land forces, has indirectly pushed its land offensive into a long drawn battle.

Conclusion

The Russian special military operations that were expected to achieve terminal goals in a swift and short duration conflict have turned out to be a long-drawn battle. One of the major contributing factors for this operation becoming a quagmire for Russian forces appears to be the non-exploitation of overwhelming air dominance that Russia enjoys

over Ukraine, as also of not employing the air power to either conduct SEAD/DEAD operations fully or interdict the enemy supply lines; the two important facets that allow freedom of operation to own land forces. It is highly possible that in the coming days of operations, the Russian Air Force may review its strategy and launch an effective air campaign to bring an early end to the conflict.

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Air Power

Roscosmos Plans to Soon Start Deliveries of ICBM Sarmat to Russian Forces

22 April 2022

Source: Space War | https://www.spacewar.com/reports/Roscosmos_plans_to_soon_start_deliveries_of_ICBM_Sarmat_to_Russian_forces_999.html

Loading Sarmat ballistic missile into the silo prior to its test launch. A screenshot from a video provided by the Russian Defense Ministry. The image is a handout courtesy of a third party. File image

Russian state-owned space agency Roscosmos is planning to start serial shipments of the intercontinental ballistic missile (ICBM) Sarmat to the Russian strategic missile forces this fall, Roscosmos chief Dmitry Rogozin said on Wednesday.

"This fall, once the Sarmat flight and development tests are completed, we plan to begin supplying serial heavy intercontinental ballistic missiles of this superweapon to the Strategic Missile Forces," Rogozin said on social media.

Earlier in the day, the Russian Defense Ministry announced that it had successfully conducted the first test launch of ICBM Sarmat as part of the state trials from a silo launcher at the Plesetsk Cosmodrome.

The launch tasks were fully completed, with design characteristics confirmed at all stages of the missile's flight, the ministry said. The training

warheads arrived in a planned area at the Kura training ground on the Kamchatka Peninsula, the ministry added.

Sarmat is a heavy missile system with an intercontinental liquid-propellant ballistic missile weighing over 200 tonnes. The system is intended to replace the Voevoda missiles (known as Satan) in Russia's strategic missile forces.

Sarmat is capable of hitting targets at long ranges and using various flight trajectories, which enables it to avoid all existing and prospective anti-missile defense systems, according to the ministry. Having the longest range of target engagement, Sarmat is also expected to reinforce the combat capabilities of the Russian strategic nuclear forces..

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Israel Successfully Tests New Laser Missile Defense System

Laurie Kellman | 15 April 2022

Source: Defence War | https://www.defensenews.com/training-sim/2022/04/15/israel-successfully-tests-new-laser-missile-defense-system/

An Israeli police officer demonstrates a laser defense system designed to intercept explosives-laden balloons launched from the Gaza Strip into Israel, on the Israeli Gaza border, Aug. 30, 2020. A new Israeli laser missile defense system has successfully intercepted mortars, rockets and anti-tank missiles in recent tests, Defense Minister Benny Gantz said on April 14, 2022. (Tsafrir Abayov/AP)

TEL AVIV, Israel — Israel's new laser missile-defense system has successfully intercepted mortars, rockets and anti-tank missiles in recent tests, Israeli leaders said Thursday.

The Israeli-made laser system, known as the "Iron Beam," is designed to complement a series of aerial defense systems, including the more costly rocket-intercepting Iron Dome.

"This may sound like science-fiction, but it's real," said Prime Minister Naftali Bennett. "The Iron Beam's interceptions are silent, they're invisible and they only cost around $3.50″ apiece, he added.

Little is known about the laser system's effectiveness, but it is expected to be deployed on land, in the air and at sea. The goal is to deploy the laser systems around Israel's borders over the next decade to protect the country against attacks.

Thursday's announcement also sent a message

to Israel's foes, including archenemy Iran. The tests took place last month in the Negev Desert.

The announcement came near the anniversary of the 11-day Israel-Gaza war, in which Gaza's ruling Hamas militant group fired more than 4,000 rockets toward Israel.

Israel said its Iron Dome defense system has been a great success, with a 90% interception rate against incoming rocket fire. But officials say the system is expensive to deploy. Bennett has said someone in Gaza can fire a rocket toward Israel for a few hundred dollars, but it costs tens of thousands of dollars for the Iron Dome to intercept it.

The Defense Ministry released a short video showing what it said were the new system's successful interceptions of rockets, mortars and an unmanned aerial vehicle. The video, which was highly edited and set to music, appeared to show a laser beam coming out of a ground station, hitting the targets and smashing them into small pieces.

Bennett said in February that Israel would begin using the system within a year.

Israel has already developed or deployed a series of systems meant to intercept everything from long-range missiles to rockets launched from just a few kilometers (miles) away. It has also outfitted its tanks with a missile-defense system.

Talks on restoring Iran's tattered nuclear deal with world powers have stalled. Israel opposes the deal, saying it does not do enough to curb Iran's nuclear program or its military activities across the region, and Israeli officials have said they will unilaterally do what's necessary to protect the country.

China Expanding UAV Usage Network Along Border

Dinakar Peri | 20 March 2022

Source: The Hindu | https://www.thehindu.com/news/national/china-expanding-uav-usage-network-along-border-say-officials/article65329175.ece

File photo released by Indian Army shows PLA and tanks during the disengagement along the Line of Actual Control at the India-China border in Ladakh. Photo used for representation purpose only. | Photo Credit: AFP

Intelligence, Surveillance and Target Acquisition and Reconnaissance Capabilities are Core Tasks

China continues to expand its unmanned aerial vehicles (UAV) network and usage in areas close to the Line of Actual Control (LAC).

There is a significant increase in their use for a variety of tasks from intelligence, surveillance and target acquisition and reconnaissance (ISTAR) capabilities and logistics support, official sources said citing intelligence inputs. This follows an increasing trend in UAV deployment by the People's Liberation Army (PLA) in Tibet and along the LAC since the standoff began in eastern Ladakh in May 2020.

"It is learnt that flight sorties are being coordinated from a unified command centre and are extensively monitored for further improvement. Efforts are being made to cover all important locations, places in the UAV net for better patrolling and other related activities,"

said an official source citing inputs. China is also increasingly deploying its advanced UAVs in Tibet close to the LAC, another official said.

In addition, drones have been used for supplying vaccines in the border areas for effective last mile coverage at several locations and especially opposite Arunachal Pradesh. As the armies of India and China prepared for winters in the high–altitude region, China had released videos of swarms of quadcopter drones being used to supply rations and other essential items to personnel deployed close on the border.

In line with this, the PLA UAV units have been regularly conducting exercises to finetune their employment. One such exercise was held in February according to inputs during which drones were packed with food, water and medicines for delivery to troops in remote areas.

Indigenous Satellite Communications

China is also trying to reduce its dependence on foreign origin satphone communications and is promoting use of indigenously built Tiantong satellite communication system, officials said. The testing and use of the Tiantong system has been noticed at several locations along the northern borders and the latest being areas opposite Arunachal, according to inputs..

As the standoff continues, satellite imagery from October last year showed the deployment of the UAVs and fighter jets by the Chinese Air Force at Ngari Gunsa airbase located in the Ngari prefecture and is around 200 km from the Pangong Lake. Satellite images posted on Twitter by open source intelligence handle @detrasfa_ showed what are likely the CH-4 armed UAVs.

This is part of the massive expansion of infrastructure and runways, construction of habitat and support facilities which has continued in the last two years, even while the two sides were engaged in senior military commander talks for disengagement and de–escalation in eastern Ladakh to end the standoff.

Acknowledging that there is certainly an increase in the Chinese UAV activity along the LAC, military sources said they are keeping a close tab on them.

To counter it, the Army and the Air Force too are ramping up their own UAV fleets and upgrading the existing ones in inventory. Additional procurements are also in the pipeline including a proposal for 30 Predator armed drones, 10 for each Service, from the U.S.

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Indo-Israeli Medium-Range Surface-to-Air Missile Tested Twice

28 March 2022

Source: IMR India | https://imrmedia.in/indo-israeli-medium-range-mediumontent=Indian+Military+Review+Newsletter+4+April+2022&utm_campaign=&gr_s=Bh1gzqm&gr_m=BSaXei&gr_x=a62b

DRO-IAI developed MR SAM missile test

India successfully conducted twin tests of Medium-Range Surface-to-Air Missile (MRSAM) from a defence facility off Odisha coast on 27 March 2022 demonstrating the system's high killing efficiency.

Both the rounds of the army variant of the missile were test-fired from the launching complex – III of the Integrated Test Range (ITR) at Chandipur as part of the live firing trials against high-speed aerial targets.

The network-centric and most advanced sleek missile has been developed by Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI) in collaboration with public and private sector enterprises.

Defence sources said the MRSAM-Army system intercepted unmanned aerial vehicles and destroyed them completely achieving direct hits at both long and short ranges. The missile intercepted the target in medium altitude at long range during the first trial and destroyed another target in low altitude at short range during second trial.

The flight tests were carried out by DRDO in the presence of senior officials of Indian Army. The performance of the weapon system was validated through the flight data captured by range instruments like radars, electro-optical tracking systems and telemetry deployed by the ITR.

"All mission parameters were successfully met and Indian missile components validated. The tests are major milestones in achieving the idea of Aatmanirbhar Bharat," said DRDO Chairman Dr G Satheesh Reddy.

With a strike range of nearly 100 km, the 4.5-meter long supersonic quick reaction missile weighs around 2.7 tonne and can carry a payload of 60 kg. Travelling at a speed of Mach 2, it can achieve high degrees of manoeuvrability at the terminal phase.

Each MRSAM unit comprises one command and control system, multi functional surveillance tracking radar, threat alert radar, mobile launcher, combat management system, mobile power and radar power systems apart from the missile.

The next generation weapon system has been developed with cutting-edge technology to neutralise airborne threats like jets, subsonic and supersonic cruise missiles, anti tank systems and rockets.

One of the variants of MRSAM system has already been handed over to Indian Air Force (IAF). The missile is designed to provide point and area air defence for ground assets against a wide range of threats.

Defence Minister Rajnath Singh congratulated DRDO, Indian Army and the Industry for the successful flight tests of MRSAM-Army. He said both the tests established the capability of the weapon system in intercepting targets at critical ranges.

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IAF to Prepare its Mi-17 Helicopters for Precision Stand-Off Strike with Israeli-Made Spike NLOS Missile

25 April 2022

Source: Swarajya | https://swarajyamag.com/defence/iaf-to-prepare-its-mi-17-helicopters-for-precision-stand-off-strike-with-israeli-made-spike-nlos-missile

Mi-17 helicopter of the Indian Air Force

The Indian Air Force (IAF) has decided to add firepower to its Russian-origin Mi-17 helicopters by equipping them with Israeli-made Spike 'Non-Line of Sight (NLOS)' missiles.

Context: Spike is a family of anti-tank missiles made by Rafael Advanced Defense Systems, an Israeli state-run company.

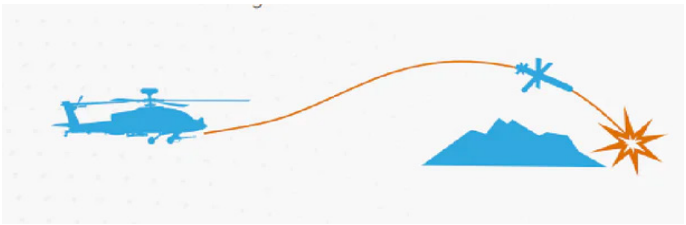
- The Indian Army has a variant of the Spike anti-tank missile in its arsenal.
- The US has validated the Spike NLOS missile from its Boeing AH-64 Apache attack helicopter. The IAF operates 22 Apache helicopters, and the Indian Army has placed an order for six of these helicopters.

Why It Matters: The missile can reach ranges up to 32 kilometres.

- Given the missile's long-range, it can be used as a precision stand-off strike system, meaning the user can fire the missile at a non-line-of-sight target while remaining at a safe distance or a relatively advantageous position.
- The missile comes with a real-time wireless data link for ranges up to 25 kilometres. The missile uses its seeker and wireless datalink to give the user real-time video imagery and man-in-the-loop control throughout its flight. When operated in mid-course navigation mode, this feature will allow the user to control the missile in flight to "alter or abort the mission" while it is en route to the target.
- It is a multi-purpose missile system with three warhead configurations—fragmentation warhead for vehicles with light armour, high explosive anti-tank warhead for armour penetration, and penetrating blast fragmentation warhead for fortified targets.

The Backdrop: The IAF started showing interest in the missile "almost two years ago when the Chinese Army deployed a large number of tanks and infantry combat vehicles close to the Line of Actual Control", the ANI said.

- A stand-off, non-line-of-sight missile could prove useful in mountainous Ladakh, as this simple image from Lockheed Martin's Spike NLOS fact sheet shows. (Lockheed has tied up with Rafael Advanced Defense Systems to provide the missile to the US forces.)



Representative Image

(Lockheed Martin's Spike NLOS fact sheet)

- The Chinese claim that their T-15 tank, which they have deployed on the Tibetan plateau and in eastern Ladakh, can hit enemy targets "beyond the line of sight" using the Red Arrow anti-tank missile.

'Make in India' is also in the picture.

- "Spike NLOS ATGMs have been ordered in limited numbers at the moment and the force would look for getting the missiles in larger numbers through 'Make in India' solutions," ANI has reported.

Space

US Commits to No ASAT Missile Testing in Space

20 April 2022

Source: Space Watch | https://spacewatch.global/2022/04/us-commits-to-no-asat-missile-testing-in-space/?mc_cid=1c0bacca15&mc_eid=5410314afa

Space debris in orbit around Earth. Credit: Adobe Stock

Edinburgh, 20 April 2022. – Vice President Kamala Harris announced that the United States commits not to conduct destructive, direct-ascent anti-satellite (ASAT) missile testing, to set a new international benchmark for responsible behavior in space. The Vice President called on other nations to follow in the US' footsteps as such efforts benefitted humankind.

The commitment is one of the National Security Council, the Department of Defense, the Department of State, and other national security agencies' proposals. These offices were tasked last December to find ways for nations to preserve the security and sustainability of space.

Russia conducted a destructive direct ascent ASAT missile test in November last year while the People's Republic of China performed a similar test in 2007. The long-lived space debris resulting from these tests threaten satellites, crewed space stations and space infrastructure. Keeping spacecraft safe is vital to all nations'

security, economic, and scientific interests.

The United States wishes to ensure that outer space remains conflict-free. The Biden-Harris Administration aims to lead the development of new measures and guidelines that contribute to space sustainability. The US is committed to carrying out space activities in a responsible, stable, safe, secure, peaceful, and sustainable manner.

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China Gears Up for New Space Station Missions, Record-Breaking Crew Set to Return Home

Andrew Jones | 14 April 2022

Source: Tiananmen's Tremendous Achievements | https://tiananmenstremendousachievements.wordpress.com/2022/04/15/china-gears-up-for-new-space-station-missions-record-breaking-crew-set-to-return-home/

Liftoff of the Long March 7 rockets carrying the Tianzhou-3 cargo spacecraft on Septembe 20, 2021

HELSINKI — A Long March rocket arrived at Wenchang spaceport Monday in preparation for a new round of space station missions starting May.

The Long March 7 rocket was delivered to Wenchang after a near week-long voyage from the northern port city of Tianjin, China's human spaceflight agency announced April 11.

The rocket is planned to launch the roughly 13.5-metric-ton Tianzhou-4 cargo vessel next month to China's Tianhe space station core module.

Tianzhou-4 will deliver supplies and propellant for the Shenzhou-14 crewed mission, expected to launch from Jiuquan spaceport in the Gobi Desert in June.

The three-person Shenzhou-14 crew will be aboard the Tianhe space module for the arrival of two new modules, named Wentian and Mengtian, which will complete the three-module, T-shaped Chinese space station, later in the year.

China deorbited the Tianzhou-2 spacecraft late last month after using the cargo vessel for space station module transposition tests, making way for the new mission.

The subsequent launch of the Tianzhou-5 and Shenzhou-15 late in 2022 will see a first crew handover, with six astronauts aboard the Tiangong space station, and completion of the project's 11-mission construction phase.

China plans to operate the Tiangong station for at least 10 years and has already announced plans to open the station to commercial activities and potentially tourist missions.

Tianhe is currently hosting the three Shenzhou-13 astronauts Zhai Zhigang, Wang Yaping and Ye Guangfu. The mission is China's longest human spaceflight endeavor so far which, at 181 days in orbit, is nearly double the previous national record of 92 days set by the 2021 Shenzhou-12 mission.

Airspace closure notices indicate that Shenzhou-13 will return to Earth between 9:35 and 10:05 p.m. Eastern April 15 (9:35-10:05 local time, April 16) following departure from Tianhe.

The Shenzhou return capsule is planned to set down in a designated landing zone near Dongfeng in the Gobi Desert, Inner Mongolia.

Previous landings occurred in the grasslands of Siziwang, Inner Mongolia. Factors for the change include increasing population density around Siziwang, and the need to optimize for astronaut recovery as the duration of China's spaceflight missions increases.

The Shenzhou-13 mission has included a pair of extravehicular activities, conducted a range of experiments and hosted live science lectures for students back on Earth.

The mission was involved in a number of outreach and messaging events for domestic audiences, including an appearance in the flagship Lunar New Year live television show.

However the astronauts also interacted with participants at an Embassy of the People's Republic of China in the United States of America event on space exploration held April 9.

Notably Elon Musk contributed pre-recorded remarks to the event, saying he was looking forward to "humanity working together" in space. Ambassador Qin Gang commented that space exploration is a "huge project of mankind, and it requires extensive international cooperation."

The messaging, apparently signaling Chinese interest in cooperation with the U.S. at one level, comes in the wake of China amplifying Russia space officials' comments on the possibility of Moscow working more closely with China in space.

However, while Chinese media have interviewed senior Russian officials and reported Russian comments, there have been no public announcements from China's space industry on potential further cooperation.

Russia has said it is looking at the possibility of sending Russian cosmonauts to China's space station, using either ESA's launch site in French Guiana or spaceports in Russia. The former is no longer a possibility following the Russian invasion of Ukraine, while the respective latitudes of Russian spaceports and inclination of the Tiangong station pose problems for the latter avenue.

Source: spacenews "China gears up for new space station missions, record-breaking crew set to return home"

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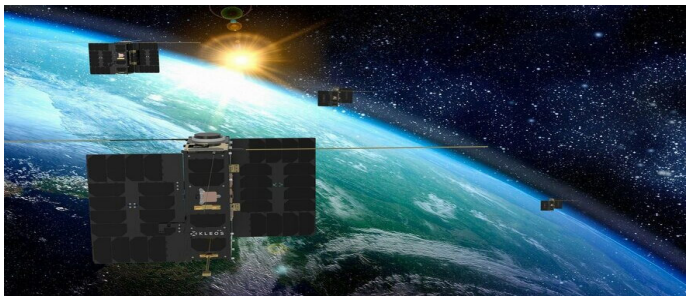
Kleos Unveils Dedicated, Taskable RF Monitoring Missions

Debra Werner | 25 April 2022

Source: Space News | https://spacenews.com/kleos-mission-as-a-service/



Kleos Space operates a constellation of RF reconnaissance satellites. Credit: Kleos Space

DENVER – Kleos Space announced plans April 25 to offer customers dedicated, taskable radio frequency monitoring capabilities.

It's a new business model for Kleos, a Luxembourg based company that operates three clusters of four satellites to detect RF signals and pinpoint their location. To date, Luxembourg-based Kleos has provided RF monitoring data to government and commercial customers.

"Our discussions with government departments, national security agencies and commercial entities have highlighted a growing need for a dedicated mission capability, including unrestricted access," Kleos CEO Andy Bowyer said in a statement.

With the new Mission-as-a-Service model, Kleos will offer customers "exclusive access to Kleos' dedicated, in-orbit radio frequency reconnaissance satellite clusters for fixed periods of time and capacity," according to the April 25 news release. "Each Mission-as-a-Service contract will be tailored to suit the customer requirements and needs including on the percent of satellite capacity needed, level of taskability required and corresponding data rights."

At the same time, Kleos will continue to sell data from its constellation, which eventually could include as many as 20 satellite clusters. Kleos sent its third cluster to orbit April 1 on a SpaceX Falcon 9 rideshare mission. Another cluster of four Kleos satellites is scheduled to launch in a couple of months.

Through Kleo's Data-as-a-Service business, multiple customers gain access to the same commercial dataset. In contrast, the Mission-as-a-Service model "is tailored to meet the need of specific intelligence, surveillance, reconnaissance requirements of an individual customer mission," Bowyer said.

The data service model relies on high volume to offset low contract values, while Mission-as-a-Service contracts are expected to have a higher price tag.

"This blend of offering reflects the balance of needs between the commercial and non-commercial customer we have witnessed developing over the last few years," Bowyer said.

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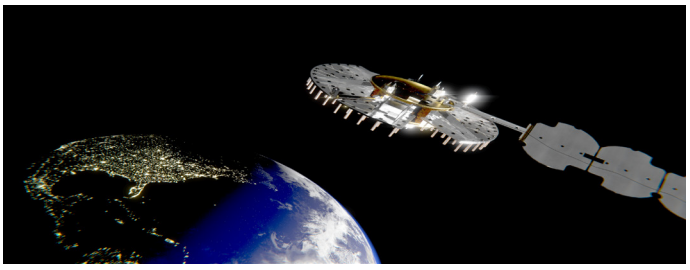
Fearing GPS Jamming by China, US Air Force Wants to Send Extra Layer Of Satellites to the Geostationary Orbit

Tanmay Kadam | 12 April 202

Source: Eurasian Time | https://eurasiantimes.com/fearing-gps-jamming-by-china-us-air-force-wants-to-send-extra-layer-of-satellites/

Artist's concept for NTS-3 in geostationary orbit. (AFRL)



The satellite will be used to enhance the positioning, navigation, and timing (PNT) services that are currently provided by Global Positioning System (GPS) satellites.

A medium Earth orbit (MEO) is an Earth-centred orbit with an altitude above a low Earth orbit (LEO) and below a high Earth orbit (HEO) — between 2,000 and 35,786 km above sea level.

The US Air Force Research Laboratory (AFRL) is working on a Navigation Technology Satellite-3 (NTS-3) to be sent to geostationary orbit as an add-on to the GPS satellites already present in Medium Earth Orbit (MEO).

"We wanted to look at how to use a constellation that has a hybrid architecture," Joanna Hinks, NTS-3 deputy program manager at AFRL, told reporters on April 7 at the Space Symposium in Colorado Springs.

In 2018, L3Harris won an $84 million contract from AFRL to build NTS-3. The 1,250-kilogram satellite is being assembled at an L3Harris facility in Palm Bay, Florida.

Initially, the AFRL was considering sending NTS-3 into the MEO, according to Hinks, but later it was decided that Geostationary Earth Orbit (GEO) would be a better location for NTS-3 for the researchers to assess the possible advantages of having a multi-orbit PNT architecture.

"The idea here is that we already understand how navigation works from MEO," Hinks said.

Pentagon Growing Weary

One of the objectives for NTS-3 is to test new software-defined radio technologies which can be used to reprogram the signals to confuse jammers. Parsons Corp is developing a ground system that will integrate the GPS and NTS-3 signals to assess the network's performance in a jamming environment.

In recent times, Pentagon is growing weary of the threat of electronic devices that can interfere with the signals from GPS satellites in MEO.

The US Space Force operates a constellation of 31 satellites orbiting Earth at an altitude of 20, 000 km for PNT services. These satellites in six orbital planes circle the Earth twice per day broadcasting PNT signals that are essential not only for military operations but also for the daily functioning of the civilian economy.

According to the National Institute of Standards and Technology, GPS technology has a $1 billion a day economic impact on the US. Such reliance on GPS makes it an attractive target for adversaries.

During the hearing of the House Appropriations Committee's defense subcommittee in May 2021, the chief of space operations of the US Space Force Gen. John Raymond pointed at China and Russia as the primary actors pursuing technologies aimed at "robust jamming of GPS and communications satellites."

In late 2019, Bjorn Bergman, an analyst with SkyTruth, a nonprofit environmental watchdog, analyzed a large data set of Automatic Identification System (AIS) associated with ships.

Bergman discovered at least 20 locations near the Chinese coast where GPS spoofing took place with GNSS [Global Navigation Satellite System] locations of ships operating in the area were replaced with fake coordinates.

These included the ports of Shanghai, Fuzhou (Huilutou), Qingdao, Quanzhou (Shiyucun), Dalian, and Tianjin.

The timing of the spoofing coincided with observations of Iranian oil being received by China in defiance of US sanctions on Iran suggesting that some of the spoofings may be designed to help conceal these transactions.

This phenomenon was first documented by the MIT Technology Review which described how the Captain of a US-flagged container ship noticed the apparent malfunctioning of the vessel's AIS — vessels on the navigation screen appeared and disappeared without explanation and appeared to move when they were in fact stationery.

Bergman identified GPS spoofing rings or circles that were about 200 meters in diameter indicating that the actual spoofing device may be located at the center of each of these rings

Alternative PNT Technologies

While the Defense Department uses several alternative PNT technologies to complement GPS or to serve as a backup if GPS is unavailable, such as an inertial navigation system that uses inertial sensors and clocks that allow a platform to identify its position and keep track of time without an external signal.

Other technologies rely on celestial and magnetic navigation to determine position. Also, there is a growing number of satellites in low Earth orbit (LEO) that transmit PNT information.

However, according to a report by the Government Accountability Office (GAO), none of these alternatives, have reduced the US military's heavy reliance on GPS.

"There are known vulnerabilities and military officials talk about the need for alternatives," said Jon Ludwigson, GAO's director of contracting and national security acquisitions. "But when it comes down to funding programs, by default they choose GPS."

Therefore, the concept of adding another layer of PNT could be a significant offset of the U.S.'s overreliance on GPS.

The NTS-3 is projected to launch on the USSF-106 mission planned by the U.S. Space Force to be launched in 2023 It will be the first national security mission to fly on United Launch Alliance's new Vulcan Centaur rocket.

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Global Aerospace Industry

ESA ends Cooperation with Russia on Lunar Missions

Jeff Foust | 13 April 2022

Source: Space News | https://spacenews.com/esa-ends-cooperation-with-russia-on-lunar-missions/

Russia's Luna-25 lander was to include a navigation camera provided by ESA to help it develop precision landing technologies. Credit: NPO Lavochkin

WASHINGTON — The European Space Agency announced April 13 it was further cutting ties with Russia by dropping plans to cooperate on a series of lunar missions, turning instead to NASA and other agencies.

At the conclusion of an ESA Council meeting, the agency said it was ending plans to cooperate with Roscosmos on that agency's Luna-25 and Luna-27 landers and the Luna-26 orbiter. The announcement came nearly a month after ESA formally suspended cooperation with Russia on the ExoMars mission, postponing a launch of an ESA-built rover that had been scheduled for September.

"As with ExoMars, the Russian aggression against Ukraine and the resulting sanctions put in place represent a fundamental change of circumstances and make it impossible for ESA to implement the planned lunar cooperation," ESA said in a statement.

The long-delayed Luna-25 lander, projected to launch later this year, was to carry an experimental navigation camera called PILOT-D that would collect images during the spacecraft's landing to support ESA's work developing a precision landing system for the European Large Logistic Lander (EL3), a proposed lander for delivering large cargoes to the lunar surface.

PILOT-D was already mounted on Luna-25, Josef Aschbacher, ESA director general, said at a press briefing after the meeting. "I have already communicated this decision to the head of Roscosmos and also to request this instrument be put into safe storage until it can be returned to ESA," he said.

Luna-27, slated for launch later this decade, was to carry Prospect, a payload consisting of a drill and an instrument to study lunar volatiles. Instead, Aschbacher said ESA reached an agreement with NASA to fly the payload on a commercial lander through NASA's Commercial Lunar Payload Services (CLPS) program.

David Parker, director of human and robotic exploration at ESA, said Prospect would likely fly on a CLPS lander in 2025, although it had not been assigned to a specific mission. NASA's seven CLPS awards announced to date cover missions scheduled for launch through 2024.

A version of the mass spectrometer instrument on Prospect will also fly on one of the first CLPS missions, Astrobotic Technology's Peregrine lander, scheduled for launch late this year on the inaugural flight of ULA's Vulcan Centaur. ESA will fly another version of the instrument on a joint Indian-Japanese lunar rover mission called LUPEX under an agreement between ESA and the Japanese space agency JAXA signed April 4 during the 37th Space Symposium. That mission is scheduled for no earlier than 2024.

Luna-27 was also going to carry PILOT, a full-fledged version of the precision landing technology. "We need to find a suitable flight opportunity for that," Parker said, which could be augmented with additional ground testing to mature the technology for use on EL3.

New Programs, and Hope for Sentinel-1B

In addition to the decision to end cooperation with Russia on the lunar missions, Aschbacher used the briefing to announce support for three new initiatives that will be part of the package ESA will present to member states for funding at the next ministerial meeting late this year.

One is Moonlight, a program to develop a satellite system to provide communications and navigation services around the moon. ESA awarded study contracts in May 2021 to teams led by Surrey Satellite Technology Ltd. and Telespazio to examine the technical feasibility of their concepts as well as the business case. Those studies were designed to conclude in time to support a decision on proceeding with Moonlight at the 2022 ministerial meeting.

A second, called Civil Security from Space, will examine how space can support civil security needs. "It focuses mostly on the Earth observation and telecommunications aspects of space, obviously in combination with navigation where appropriate," Aschabacher said. One example he gave was using space data to support agricultural studies and damage assessments in Ukraine.

The third is Scale-up, which he described as supporting ESA commercialization initiatives but about which he did not go into details. Commercialization is one of the priorities of Agenda 2025, Aschbacher's overall strategy for

ESA released a year ago.

The briefing also provided a glimmer of hope for Sentinel-1B, the radar imaging satellite that has been out of service since last December when the power supply for its radar payload malfunctioned. Engineers have spent months working to diagnose the problem in the hopes of being able to return it to service while ESA also makes plans to launch a replacement, Sentinel-1C, in the first half of 2023.

"There was quite an interesting reaction in one of the many tests we have conducted," he said. In that test, the antenna power supply turned on for 4.4 seconds before turning off again. "We're investigating what this means. We assume there's some degradation of a capacitor at the core of this problem, but we are not sure yet."

He said ESA will continue efforts to get the Sentinel-1B payload working again until it's "100% sure" it can't be returned to service. "Still, it's fair to assume that there's a likelihood that Sentinel-1B may not be recovered."

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Jeff Bezos and Amazon Just Hired Everybody but Spacex for Project Kuiper

Eric Berger | 05 April 2022

Soirce: ARS Tachnica | https://arstechnica.com/science/2022/04/amazon-signs-blockbuster-launch-deal-for-its-satellite-megaconstellation/

Enlarge / Amazon is counting on the Vulcan rocket, a pathfinder for which is shown here, to deliver a large number of satellites into space

Amazon on Tuesday announced the largest commercial launch deal ever. The company said it has finalized agreements with three different rocket companies for a total of 83 launches. The rockets will deploy a majority of Amazon's low-Earth-orbit constellation of broadband satellites.

With this deal, Amazon has acquired an extraordinary amount of medium- and heavy-lift launch capacity over the next five years, procuring launches from every major Western provider except for its direct satellite competitor, SpaceX. Aside from SpaceX, this purchase represents the vast majority of any "spare" launch capacity for larger rockets in the United States or Europe over the next half-decade.

Amazon announced launch agreements with the following companies as it seeks to build out its constellation of 3,236 satellites:

- Arianespace: 18 launches of Europe's new Ariane 6 rocket
- Blue Origin: 12 launches of the company's New Glenn rocket, with options for 15

additional launches

- United Launch Alliance: 38 launches of the company's Vulcan rocket

Additionally, Amazon previously announced that it has purchased the final nine Atlas V rocket launches from United Launch Alliance before that vehicle, which is powered by Russian engines, is retired.

Amazon's "Project Kuiper" seeks to bring fast and affordable broadband Internet access to tens of millions of customers in unserved and underserved communities around the world. The company plans to launch two prototype satellites in the fourth quarter of 2022. Amazon has not set a date for when deployment of its operational constellation will begin, but a spokesperson said that will be shared after the demonstration mission later this year.

"We still have lots of work ahead, but the team has continued to hit milestone after milestone across every aspect of our satellite system," Dave Limp, Amazon's senior vice president for Devices & Services, said in a news release. "These launch agreements reflect our incredible commitment and belief in Project Kuiper, and we're proud to be working with such an impressive lineup of partners to deliver on our mission."

This is a hugely consequential deal, with myriad implications for the space industry. While Amazon officials would not talk costs, Amazon is likely paying at least $10 billion for these launches. That is a giant pot of money for the commercial launch industry.

Game on, SpaceX!

In building out its Project Kuiper constellation, Amazon is going head-to-head with SpaceX and its Starlink constellation. Based on the timing of its first launches, Amazon is running about four years behind SpaceX.

Amazon is also behind SpaceX because it does not have its own rocket, and no one in the industry can compete with SpaceX's Falcon 9 on price or launch cadence. The Falcon 9 rocket could launch as many as 60 times this year, and because SpaceX can reuse the first stage and payload fairing, the internal cost per launch is probably substantially less than $30 million. Amazon is likely paying, on average, at least three times as much per launch.

Whether Amazon simply chose to avoid SpaceX or SpaceX said, "Thanks, but no thanks" is unclear. The former seems more likely, as SpaceX is working with another satellite competitor, OneWeb. Either way, by using other providers, Amazon is assuming some risk.

None of the three rockets that Amazon has chosen has proven itself in flight. Both the Ariane 6 and Vulcan rockets are probably about 12 months, plus or minus, from making their debut flights. New Glenn is probably at least two years from its first flight.

Amazon is asking a lot of these rockets. The company wants them to reach a high flight cadence during the mid-2020s in order to complete both their existing manifests as well as the additional Project Kuiper missions. For example, the Ariane 6 rocket was planned for six to nine launches a year, but with the Soyuz vehicle off the market for European satellites, it will now carry additional demand. How quickly will the Ariane 6 be able to accommodate three or more annual missions from Amazon?

At the same time, this is a huge shot in the arm to SpaceX's primary Western launch competitors. The Falcon 9 rocket had already peeled away a substantial number of commercial launches from

Arianespace and dozens of military and NASA launches from United Launch Alliance. Now, Jeff Bezos has showered these launch providers with cash as they scramble to compete with Elon Musk.

It will be fun to see which of these companies can execute on their new rockets in the coming years and quickly reach a high flight cadence. The safe bet is that not all three will make it.

Huge Bet on BE-4

Bezos is also betting big on his own rocket company. Not only does Bezos own Blue Origin and the New Glenn rocket—Blue Origin is also building the BE-4 engine that will power the Vulcan rocket. That means that 78 percent of the launches Amazon is buying will fly on Blue Origin engines. That is not a small number of engines to build.

Seven BE-4 engines will power New Glenn, but Blue Origin plans to reuse the first stage, so production should not be a huge issue. United Launch Alliance, however, does not plan to initially reuse its BE-4 engines, two of which will power each Vulcan launch. Since this contract effectively doubles the Vulcan launch manifest during its first five years, the company's plans to reuse BE-4 engines may accelerate.

Blue Origin has yet to produce a flight-ready BE-4 rocket engine, although the company will probably deliver the first two to United Launch Alliance later this summer. Bezos clearly believes his rocket engine has the right stuff.

Bad for Small Launch

Previously, Amazon announced a "multilaunch" deal with ABL Space, which is developing the small RS1 rocket, for its Project Kuiper satellites. However, any additional deals with small launch companies were noticeably absent from Tuesday's blockbuster announcement.

The problem is that, as small launch companies have gone public through special purpose acquisition companies, they have sold investors on playing a role in megaconstellations. However, all Starlink satellites are launching on the Falcon 9 rocket. OneWeb, so far, has flown the vast majority of its satellites on Soyuz rockets and will soon switch to the Falcon 9. And the last major Western megaconstellation, Project Kuiper, seems to have indicated a clear preference for larger rockets.

So what does that mean for the small launch companies? Well, Tuesday's announcement was not good news. Beyond that, who knows?

Finally, this launch deal also means that Amazon's satellite constellation is definitely coming. Amazon will compete with Starlink, OneWeb, and potentially others for broadband customers. And the deal means thousands more satellites in the sky, more cluttered orbits, and more potential for debris. The time for sensible regulation of space debris and better space situational awareness is long past due for both US and international policymakers.

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Combat Aircraft Tejas Being Armed with American JDAM Bombing Kits

29 March 2022

Soirce: IMR India | https://imrmedia.in/combat-aircraft-tejas-being-armed-with-american-jdam-bombing-kits/?utm_ilitary+Review+Newsletter+4+April+2022&utm_campaign=&gr_s=Bh1gzqm&gr_m=BSaXei&gr_x=a62b

030323-N-1328C-507

Amid an ongoing conflict with China along the northern borders, the Light Combat Aircraft (LCA) Tejas are now being equipped with American Joint Direct Attack Munition (JDAM) precision-guided bombing kits to enhance the capabilities of the Indian Air Force (IAF), according to government sources.

The LCA Tejas would be the first fleet to be equipped with American JDAMs, which is going to be one of the mainstays of the force in the future, ANI quoted the sources as saying. The IAF had recently signed a contract for the JDAM kits.

Tejas is a single-engined, lightweight, highly agile, multi-role supersonic fighter. It has been designed by the Aeronautical Development Agency (ADA) in collaboration with the Aircraft Research and Design Centre (ARDC) of Hindustan Aeronautics Limited (HAL) for the Indian Air Force and Indian Navy.

Not very long back, the IAF had equipped Tejas with Hammer, the French-origin air-to-ground stand-off missiles, and also with the indigenous Astra air-to-air missiles. By adding more and more capabilities to the Tejas aircraft, the IAF is showing its support in developing the indigenous fighter aircraft programme.

How will JDAM boost IAF capabilities?

The Joint Direct Attack Munition (JDAM) is a guidance kit that converts unguided bombs, or "dumb bombs", into all-weather precision-guided munitions. JDAM kits will enable Tejas fighter jets to take out enemy bunkers and runways at distances of 80 km and beyond.

This will give the homegrown aircraft a further edge over the adversary fighter jets as they would be able to destroy targets from standoff distances.

How does joint direct attack munition (JDAM) work?

The JDAM "tail kit" includes adjustable tail fins, a control computer, an inertial guidance system, and a GPS receiver. This system works well even in bad weather because it gets all its information from satellite signals, which aren't blocked by clouds or other obstacles.

In the air, the JDAM's GPS receiver processes signals from the GPS satellites to keep track of its own position. As with other smart bombs, the control system adjusts the flight fins to "steer" the bomb in the right direction.

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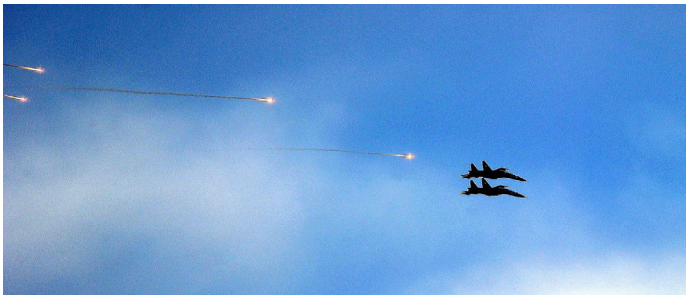
Army Inducts Russian MANPADS

29 March 2022

Source: The Hindu | https://www.thehindu.com/news/national/army-inducts-igla-s-shoulder-fired-air-defence-systems-from-russia/article65284695.ece



Air Defence functions in three levels – gun/missile system, medium range, and high range. File image for representation. | Photo Credit: VIJAY SONEJI

Igla-S Is A Short-Range Weapon

The Army, which has for long been looking for new man portable air defence systems, has inducted a small number of Igla-S systems recently bought from Russia under emergency procurement, according to defence sources. However, a much larger contract for Igla-S systems under the Very Short Range Air Defence System (VSHORAD) deal is still pending and under review by the Defence Ministry.

"The contract was signed in December 2020 and the equipment was delivered by December 2021. This includes 24 launchers, 216 missiles and testing equipment," one of the sources said.

The procurement was done through the Vice Chiefs emergency financial powers given to the Services for the first time after the Balakot air strike in February 2019 and further extended after the standoff with China in Eastern Ladakh in May 2020. Under this, Services can procure weapons systems upto ₹300 crores on an urgent basis without any further clearances.

In the backdrop of the Russian special military operation in Ukraine and the Western sanctions, India and Russia are working out modalities to utilise the Rupee-Rouble route in a large way for trade and payments. The Ministry is also assessing the impact it would have on the timely execution of deals as well as steady supplies of spares and support.

The larger VSHORAD deal which began in 2010 and saw several rounds of trials and re-trials is still pending.

This deal which was close to conclusion is now under review as part of the overall relook at all direct import deals by the Defence Ministry. Deliberations are still continuing on the larger VSHORAD deal, another defence source said.

The Request for Proposal (RFP) for VSHORAD was issued in October 2010 for over 5,000 missiles, 258 single launchers and 258 multi-launchers. Five contenders responded and eventually three made it to the trials - MBDA of France, Rosoboronexport of Russia and SAAB of Sweden. Eventually all three companies were declared technically compliant in 2017 and Igla-S was declared the lowest bidder in November 2018.

While the benchmark price arrived at by the Army was just over $2 bn, Rosoboronexport's bid was much lower at around $1.47 bn, SAAB at about $2.6 bn, and MBDA at about $3.68 bn. This led to much deliberation within the Ministry as the Russian bid was much lower compared to the benchmark price. The deal also saw several allegations of deviations in procedures with some of the vendors sending protest letters.

As per requirements, the VSHORAD should have a maximum range of 6 km, altitude of 3 km

along with all-weather capability and will replace the existing Igla in service which is in urgent need of replacement. VSHORAD is the soldier's last line of defence against enemy combat aircraft and helicopters in the multilayered air defence network.

In addition to the Igla-S, the Army variant of the Medium Range Surface to Air Missile (MRSAM) being jointly developed by the Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI) completed trials earlier this month and is now ready for induction. The maiden launch of MRSAM Army Version was conducted in December 2020.

Air Defence functions in three levels – gun/missile system, medium range, and high range. Within this the Air Defence guns are of two types, AD Gun Missile system, AD self propelled guns. The Army is looking for AD guns in both the categories. In the medium segment, it has the indigenous Akash SAM while MRSAM fits in the high range.

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Lockheed Martin Signs Deal to Use Spideroak Cybersecurity to Protect Satellite Networks

Sandra Erwin | 29 March 2022

Source: Space News | https://spacenews.com/lockheed-martin-signs-deal-to-use-spideroak-cybersecurity-to-protect-satellite-networks/

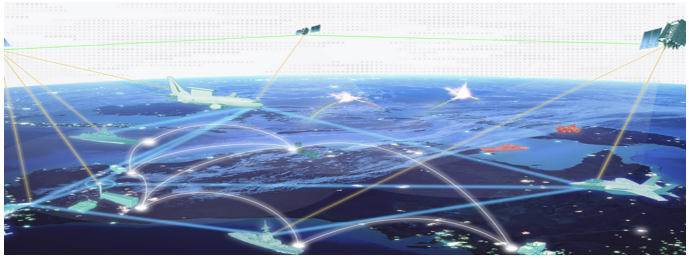

Illustration of a network that connects platforms across air, land, sea, cyber and space. Credit: Lockheed Martin

WASHINGTON — SpiderOak Mission Systems announced March 29 it won a contract from Lockheed Martin Space for its cybersecurity software.

The contract allows Lockheed Martin to use SpiderOak's OrbitSecure software. "This is commercial technology that was developed for terrestrial applications and has been repurposed for the space business, specifically for low Earth orbit," SpiderOak chairman Charles Beames told SpaceNews.

Beames said he could not disclose the value of the contract with Lockheed Martin. "The goal is to make OrbitSecure available to Lockheed Martin customers as part of an offering to provide an extra level of cybersecurity," he said.

Lockheed Martin builds large satellites for the U.S. government but is now also moving into the small satellite market.

The cybersecurity technology from SpiderOak uses what is known as a "zero-trust architecture" where network users by default are not trusted

and special keys are required to access encrypted data. OrbitSecure also uses blockchain for data transactions so every modification made to the ledger is time stamped and signed, ensuring traceability.

The distributed ledger platform is offered as a blockchain and encryption software development kit. Satellite network developers can embed the software at the application layer. Beames said the system was designed to operate with minimum power to make it practical for use on small satellites.

"We're in discussions with all the satellite builders, including the small ones," said Beames, who is also chairman of the SmallSat Alliance. "One of the criticisms from small sat companies is that they need all this hardware to add cybersecurity. With OrbitSecure, with a software layer they will be able to have the same security that the very large, very expensive satellites do."

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China Cements tts Place as Pakistan's Largest Supplier of Major Arms

Sutirtho Patranobis | 26 April 2022

Source: Hindustan Times | https://www.hindustantimes.com/world-news/china-cements-its-place-as-pakistan-s-largest-supplier-of-major-arms-report-101650973184494.html

A Pakistan Air Force official briefs former prime minister Imran Khan (centre in cockpit) about Chinese-built J-10C fighter jet during a ceremony in Minhas Base near Islamabad, Pakistan, on March 11, 2022. (AP)

The China, between 2017 and 2021, has cemented its place as Pakistan's largest supplier of major arms, including fighter aircraft, warships, submarines and missiles, data compiled by an independent institute focusing on arms transfers and conflict said.

Between 2017 and 2021, Beijing met 72% of Islamabad's demand for major arms, data from Sweden's Stockholm International Peace Research Institute (SIPRI) published in March showed.

Conversely, 47% of all the major arms exported by China went to Pakistan during that period, SIPRI said.

Though several of the deals are labelled "co-production" or "joint programme" - implying significant Pakistani research and design (R&D) input - in reality, in most cases, the R&D is mainly or all Chinese even for specific Pakistani requirements, according to SIPRI's analysis.

Top arms deals between the two countries include the continued supply (as licensed production in Pakistan) of the JF-17 combat aircraft - with the delivery of the "much improved" Block-3 version to start this year - SIPRI's report Trends in International Arms Transfers, 2021, said.

"Delivery of the first batch of J-10 combat aircraft started earlier this year, which was the first export of this aircraft by China. It is more advanced than the JF-17," Siemon Wezeman, a senior researcher with SIPRI's arms transfers programme, said.

China isn't supplying only combat aircraft, said Wezeman.

"With the combat aircraft come various types of guided bombs and air-to-ground missiles, as well as advanced long-range air-to-air missiles; the latter one reason for India's acquisition of the Rafale from France which comes with the Meteor long-range air-to-air missile – (triggering) a sort of air-to-air arms race," Wezeman said.

China is also supplying (again as licensed production in Pakistan) the Type-90-2M tank, known in Pakistan as Al-Khalid and Al-Khalid-I.

"At the same time Pakistan also imports the more advanced VT-4 tank directly from China," said Wezeman.

Warships are high on the agenda for both China and Pakistan as Beijing tries to counter India's influence in the Indian Ocean and Arabian Sea by arming the Pakistani navy.

"The supply of 4 Type-054A/P frigates: The first delivered in 2021 and the other 3 planned in 2022," Wezeman said.

Cooperation between the Chinese and Pakistani navies is a critical component in their defence ties.

The ongoing programme for eight Type-041 submarines, planned for delivery in 2022-2028, includes four to be produced under license in Pakistan.

"These are large advanced conventional submarines and there have been reports/rumours they may also be fitted by Pakistan as carriers of nuclear weapons."

Many other programmes for artillery, drones and air-defence systems have been ongoing or started in the last few years, the SIPRI analysis said.

Pakistan also has a wish list it expects China to look into: the 5th generation combat aircraft, long-range air-defence missile systems and major warships, like the "Type-054s or something else from the quite large Chinese catalogue of warships".

The trend in the last two decades of Pakistan's increasing reliance on China for major weapons is now fully established.

"Our assessment that this picture is not going to change, mainly since the US has 'given up' on Pakistan and turned more to India as it primary partner in region, aside from the end of US operations in Afghanistan in 2021 which ended the need to keep Pakistan as some kind of ally," Wezeman said.

After China, Pakistan buys most of its major arms from Sweden and Russia while for Beijing, after Islamabad, the next top buyers of its arms are Bangladesh and Thailand.

A Chinese expert said it is Pakistan's right to buy weapons from any country.

"As a sovereign country, Pakistan can buy from any other country including China or the US. Similarly, India can buy weapons from anyone, say, Russia, or the US, or France," Long Xingchun, head of the Chengdu Institute of World Affairs said.

Long added that India should not worry as it is a powerful and confident country. "I don't think China selling weapons to Pakistan is a threat to India."

"Does China complain when India buys weapons from Russia? Neither should India," Long said.

On March 31, Senior Colonel Wu Qian, a spokesperson for China's defence ministry said military-to-military relations, serving as the mainstay of the China-Pakistan friendship, have played an important role in the development of bilateral relations for a long time. It's evident why.

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Indian Aerospace Industry

UK, India Promise Partnership on New Fighter Jet Technology

Andrew Chuter | 22 April 2022

Source: Defence News | https://www.defensenews.com/global/2022/04/22/uk-india-promise-partnership-on-new-fighter-jet-technology/

Prime Minister Narendra Modi shakes hand with Boris Johnson, Prime Minister of UK after delegation level talks, in New Delhi on 22 April

Britain and India will strengthen their defense and security ties, including partnering on development of combat jet technology, UK Prime Minister Boris Johnson announced during a trip to New Delhi 14 April.

Johnson said the defense cooperation pact would boost procurement across several areas, but offered few details during a press conference wrapping up the two-day visit to India. The trip was aimed principally at progressing talks about a free trade deal between the nations.

But Johnson said the two countries would seek closer defense procurement "to meet threats across land, sea and air, space and cyber, including partnering on new fighter jet technology [and] maritime technologies to detect and respond to threats in the oceans."

The reference to a fighter technology partnership likely relates to British efforts to bring India onboard its sixth-generation Tempest Future Combat Air System program.

The program, launched by the British in 2018, has been the subject of talks with India for some time as part of a broader push to attract international partners into development of a combat jet with an in-service date of around the middle of the next decade.

Britain is already partnering with Italy and Sweden in the technology development effort and recently agreed to cooperate with Japan on sensor and propulsion systems.

BAE Systems, Leonardo, MBDA, Rolls-Royce and Saab are leading the early phases of the technology development program.

A statement issued by the British High Commission in India said both leaders "noted cooperation in key areas of strategic collaboration including modern fighter aircraft and jet engine advanced core technology."

India Prime Minister Narendra Modi said in the statement he "welcomed the UK announcement of an 'open general export license' [in defense] to facilitate technology engagement with India, and the open opportunity for India to participate in the UK's aviation and naval shipbuilding programs."

On the maritime front, the two sides have agreed to partner on electric propulsion capability.

Johnson said the arrangement would boost Indian efforts to increase the percentage of defense procurement manufactured locally.

"We have agreed to a new and expanded defense and security partnership, a decades-long commitment that will not only forge tighter bonds between us, but support your goal of Make in India," he said, referring to India's drive for greater domestic manufacturing in the defense sector.

India is one of the world's largest importers of defense technology, but it's a market dominated by Russia, which accounts for more than 50% of inward sales.

India has come under criticism from the UK and US over the refusal by Modi to condemn the Russian invasion of the Ukraine, but the issue appeared to be sidelined during the talks between the two sides.

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India Shares Document Outlining Military Tech Cooperation with US

Manu Pubby | 20 April 2022

Source: The Economic Times | https://economictimes.indiatimes.com/news/defence/india-shares-document-outlining-military-tech-cooperation-with-us/articleshow/90965405.cms

Orbit Fab developed a refueling port for satellites called RAFTI, short for Rapidly Attachable Fluid Transfer Interface. Credit: Orbit Fab

New Delhi: India has shared a document with the US outlining emerging areas where military technology cooperation can be undertaken by the two nations and specialised teams are likely to conduct visits in the coming weeks to take the proposals forward, highly-placed defence ministry officials have told ET.

The document, which specified the emerging technology areas where joint development and production would be beneficial, was shared during the recent two plus two dialogue in the US, with

officials saying that it was greeted positively and with enthusiasm.

Describing the dialogue as "very warm, receptive and cordial", officials said several areas of mutual cooperation have been identified that are set to be taken ahead in the coming months. US defence companies, including those which met Defence Minister Rajnath Singh, are also likely to invest in India, officials said, adding that India's commitment to self-dependence has been received well.

Major US arms manufacturer Raytheon is likely to invest $100 million in setting up production and research facilities in India, while Boeing is exploring the possibility of creating a Maintenance, Repair and Overhaul hub for systems like the P8I maritime reconnaissance aircraft that are used by both nations. Plans by Raytheon could result in the creation of over 2,000 jobs in India.

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Co-production of military systems was a key component of the talks, with emerging technology areas including artificial intelligence, cyber defence and space cooperation on the table. "There is now a clear understanding by both sides that jointly working on futuristic technologies is the way forward. It's a major step above a simple buyer-seller relationship," officials said.

The Indian side also pitched its shipyards for upcoming purchases planned by the US Coast Guard, showcasing their capability to deliver low cost, high quality products as well as a proven track record on delivery.

US teams are also expected to visit India soon to take forward a proposal to utilise Indian shipyards for repair and overhaul of American warships in the region. Such an arrangement, where US warships can be quickly turned around at Indian facilities, would be a key signal on the level of strategic partnership achieved.

"Closer military-military cooperation, increased engagement, information sharing and possible joint patrolling were discussed, with a focus on high end technology sharing," officials added.

On the strategic front, the security scenario in the Indo-Pacific was discussed, with both sides sharing their commitment to peace and open access to all. The importance of the Quad initiative was appreciated during the talks and enhanced cooperation discussed. Defence Minister Rajnath Singh is likely to visit the remaining quad nations -- Japan and Australia -- in the coming months.

On the Russia front, officials said that India's position on the matter was explained in detail and has been understood by the US. All official statements regarding the talks remained positive and constructive.

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IAF in Favour of 'Buy Global Make in India' for $20 Billion 114 Fighter Jet Deal

21 April 2022

Source: IMR News | https://imrmedia.in/iaf-in-favour-of-buy-global-make-in-india-for-20-billion-114-fighter-jet-deal/

Multi-role Fighter Aircraft

For over USD 20 billion tender for manufacturing 114 multi-role fighter aircraft (MRFA) the Indian Air Force (IAF) would prefer to take the 'Buy Global Make in India' route over the strategic partnership policy model to produce the planes within the country.

'Buy Global Make in India' is a category of procurement process provided in the Defence Acquisition Procedure 2020 under Defence Minister Rajnath Singh to smoothen the acquisition of foreign weapon systems and their production within the country under the 'Make in India' in the defence programme.

Along with the indigenous LCA Tejas and the 5th Generation Advanced Medium Combat Aircraft project, the 114 MRFA project would also be required by the IAF to maintain an edge over both the Northern and Western adversaries.

Three American aircraft including the F-18, F-15 and F-21 (modified version of the F-16), Russian Mig-35 and Su-35 along with the French Rafale, Swedish Saab Gripen and the Eurofighter Typhoon aircraft are expected to participate in the programme.

The Indian Air Force had also sought the views of these companies on the acquisition procedure that they would like to opt for in the programme and most of them have shown a preference for the Buy Global Make in India route only, they said.

The sources said that the force has also sought directions from the government on the project and when it can move the project for clearance from the Defence Ministry for further action.

Sources said the two squadrons of the Rafale combat aircraft were fully functional with 35 aircraft which have already arrived from France and only one plane is left for delivery.

Sources said the IAF would certainly require a capability that is being provided by Rafale and more planes would be required as the two squadrons had only met the emergency requirements of the force.

The sources said that the two Rafale squadrons played a major role in containing the situation after the Chinese started aggression in the Northern sector in Ladakh and were operationalised within few weeks of their arrival and induction into the IAF.

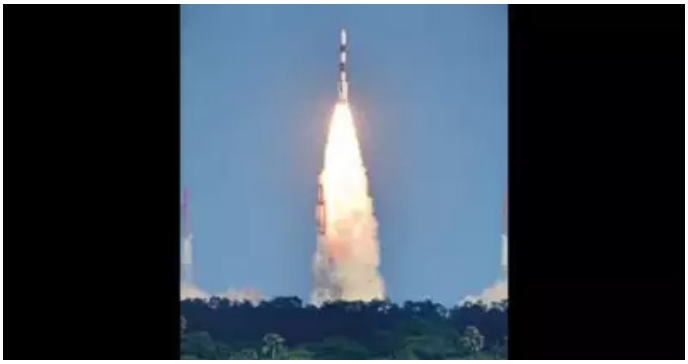
The sources said the 83 LCA Mark 1A would help the IAF replace the MiG-series planes as the MiG-23 and the miG-27 have already been phased out and the MiG-21s are also on the verge of being phased out.

The 5th generation AMCA is expected to be rolled out soon by the Defence Research and Development Organisation but its induction and trials are expected to take at least five to seven years from now.

HAL-L&T Wins Over Rs 824-Crore Contract for Making 5 Polar Space Launch Vehicles

Chethan Kumar | 09 April 2022

Source: Times of India | http://timesofindia.indiatimes.com/articleshow/90736339.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst



Although Isro had been talking about commercialising PSLV, the expression of interest was floated in August 2019

Chennai: BENGALURU: The much-awaited contract to let Indian industry manufacture five Polar Satellite Launch Vehicles (PSLVs) has gone to the consortium of defence PSU HAL and L&T. This will be the first time that the industry will build a launch vehicle (LV) and will pave the way for commercialisation of other LVs, including the small satellite launch vehicle and the GSLV family in the future.

The commercial bids of the three shortlisted entities — the HAL-L&T consortium, BHEL as a single firm and a consortium comprising BEL, Adani-led Alpha Design and BEML — were opened by space PSU NewSpace India Limited (NSIL) on April 6.

The winning bid had quoted around Rs 824 crore, BHEL's bidof around Rs 1,128.87 crore bid was L2 while the BEL-AdaniAlpha-BEML consortium had quoted around Rs 1,217.68crore, a source said, adding that the figures are exclusive oftax.

The TOI was the first to report that NSIL, which has beenauthorised to commercialise PSLV production by thedepartment of space (DoS), had completed the techno-commercial evaluation of the bids in its March 22 edition.

HAL chairman-and-managing director (CMD) R Madhavan told TOI on Friday: "The bids were opened a couple of daysago and we've been informed that we have won thecontract for five sets. The formal paperwork will now follow.While HAL is the lead partner, the work will be sharedequally between us and L&T. We will, of course, use all ourvendors. We feel we were best equipped to handle acontract of this magnitude. While some help will come from Isro on the mission side, we will be carrying out all the otherwork. Slowly, PSLV will become an out-sourced item for Isro."

Although Isro had been talking about commercialising PSLVproduction, the expression of interest (EoI) was floated onlyin August 2019 and multiple firms and consortia hadsubmitted their interests in September 2019. Following this,NSIL floated the RFP in December 2020, shortlisted thethree entities in early 2021 and these entities submitted thebids in July 2021. It then took NSIL eight months to open thebid.

Col (retd) HS Shankar, CMD, Adani-Alpha Design said theirconsortium had to consider fresh investments neededexclusively for PSLV whereas HAL-L&T already had quite a bitof infrastructure, which was one of the reasons for thedifference in the quoted price.

However, Shankar said: "Alpha Design is already animportant player in Isro's LV

programmes through our fullyowned subsidiaries Tokol at Peenya (Bengaluru) and Kortasat Thiruvananthapuram. Almost 15% of PSLV is being madeat these factories. Also, given that the winning consortiumwill have to procure Isro-qualified items from the samevendors, our subsidiaries will continue to work on theprogramme."

As reported earlier, given the complexity involved, Isro isexpected to still carry out some part of the work for these missions even as a majority of the work will be done by the industry that bags the contract.

As senior NSIL official said that while the industry is expected to realise each of the four stages, some strategic items like separation systems, pyro systems, inertial systems etc will lie with Isro which will also handle processes relating to mission operations, such as mission trajectory design, launch campaign etc.

"But Isro's workshare will only be about 20%," the official said, adding that NSIL was even looking at asking the industry to do the first-stage stacking on the launchpad with Isro guidance, while the remaining stages will be done by Isro for the first couple of missions.

The PSLV had its first flight in September 1993 and has completed over 50 missions since. It has put in space key science missions — Chandrayaan-1, Mars Orbiter Mission, Astrosat — all foreign satellites launched by Isro and a host of other payloads in the last 29 years.

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Brahmos Deal with Philippines Will Move Ahead on Bilateral Basis: Envoy

Dinakar Peri | 05 April 2022

Source: The Hindu | https://www.thehindu.com/news/national/brahmos-deal-with-philippines-will-move-ahead-on-bilateral-basis-envoy/article65293604.ece

A view of BrahMos supersonic cruise missile. Photo used for representation purpose only. | Photo Credit: R.V. Moorthy

Hindustan While the BrahMos supersonic cruise missile is a joint development between India and Russia, the sale of the systems to Philippines is a transaction between the two countries and we will be able to move ahead on a "bilateral basis", said Indian Ambassador in the Philippines Shambhu Kumaran, amid the global developments following the Russian war in Ukraine. Philippines was also given clarification on the accidental BrahMos missile launch recently.

"I did have an opportunity to speak to Philippines Defence Secretary Delfin Lorenzana and our Ministry of defence has clarified... There was a query and we responded with the fact there was no technical issue as far as we could understand it. There is an inquiry underway, we will have that cleared once the information is available," Mr. Kumaran said in a webinar on 'The Philippines: India's new Indo-Pacific partner' organised by the Ananta centre. There is definitely a degree of confidence in the system

because of the fact that India uses the system widely, he stated.

Stating that the decision to purchase it by Philippines was a high political decision, the Envoy said it was enabled by a combination of factors, but driven by the political understanding between the two countries.

Elaborating he said that the first agreement was signed only in March last year, a second agreement in November and the deal was signed this January. This is a frontline system in the Indian defence forces and the fact that we are will to sharing was appreciated by the Philippines, Mr. Kumaran noted adding, "There is definitely, in terms of the Philippines self defence national security requirements, a clear requirement on the part of their armed force of this capability."

To a question if China may have an issue with the sale, the Envoy referred to Philippines statement that it sees it as a self defence platform and so he doesn't see "how this can be a concern in other capitals."

A Court of Inquiry headed by a two star officer of the Indian Air Force is probing the incident in which the supersonic missile flying at three times the speed of sound was "accidentally released" on March 09 which ended up 124 kms inside Pakistan. Based on initial findings, defence officials had said it doesn't look like a technical issue but possibly human error which the Inquiry would throw light on it.

Referring to interest from Philippines in acquiring other defence equipment from India, Mr. Kumaran said discussions are underway for systems related to aerospace and Navy. He confirmed that Hindustan Aeronautics Limited (HAL) has offered to do a technical briefing on the indigenous Light Combat Aircraft (LCA) Tejas and there is a "degree of interest" from Manila. In addition to Tejas, discussions are also on for rotary platforms.

"There is a considerable degree of interest in Indian equipment in South East Asia and Middle East," he said in this regard while noting that converting that expression of interest into a contract is a challenge. The recent momentum in relations with Philippines has brought them to the centre of our Act East policy, he remarked.

In the broader trade, Mr. Kumaran highlighted Information Technology and pharma as the major areas. Indian IT companies have set up offices in the South East Asian country and employ large number of locals. Stating that Philippines Government would like to "see some local manufacturing capacity" in pharmaceuticals, he said Indian companies have set up base but there is need for enabling conditions locally before it can be taken up.

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Procurement of 15 Light Combat Helicopters Approved

31 March 2022

Source: IMR India | https://imrmedia.in/procurement-of-15-light-combat-helicopters-approved/

HAL Light Combat Helicopter

The cabinet committee on security, headed by Prime Minister Narendra Modi, on 30 March 2022 cleared the purchase of 15 light combat helicopters (LCH) for the Indian air force (IAF) and the army from Hindustan Aeronautics Limited (HAL) at a cost of ?3,887 crore, the defence ministry said.

The approval for the 15 limited series production (LSP) helicopters comes along with infrastructure sanctions worth ?377 crore. While the defence ministry is now set to award the contract to HAL, the state-run plane maker has already delivered some helicopters to the two services in anticipation of the order.

LCH has indigenous content of 45% by value, which will progressively increase to more than 55% for the series production version, the ministry said.

HAL expects follow-up orders as the IAF and army have a combined projected requirement of 160 LCHs, officials familiar with the matter said. Of the initial 15 LSP helicopters approved for purchase, 10 are for the IAF and five for the army.

LCH figures on the government's negative import list that seeks to ban the import of different types of weapons, systems and ammunition over the next five years to boost self-reliance in defence. In the last two years, the government has imposed a ban on the import of 209 defence items.

"LCH is specifically designed for operating in mountainous and high-altitude areas. Its capability to deliver armament at altitudes in excess of 15,000 feet makes it unique in the world. HAL should prioritise production to meet the demands of the services," said air vice marshal Manmohan Bahadur (retd), former additional director general, Centre for Air Power Studies.

Production of LCH will reduce India's dependence on imported combat helicopters, the ministry said in a statement. With its versatile features, the helicopter has export potential, the ministry said.

LCH can perform a raft of missions such as destruction of enemy air defences, targeting slow moving aircraft and remotely piloted aircraft, destroying high-altitude bunkers, carrying out counter-insurgency operations in jungle and urban environments aside from providing support to ground forces, the ministry said, adding that it would be a potent platform for the two services.

"State-of-the-art technologies and systems compatible with stealth features…and crashworthiness features for better survivability have been integrated in LCH catering to emerging needs for the next three to four decades," the ministry said.

The government has taken several steps in recent years to boost self-reliance including raising foreign direct investment (FDI) in defence manufacturing, creating a separate budget for buying locally-made military hardware and

notifying two lists of weapons and equipment that cannot be imported.

These lists include artillery guns, missile destroyers, ship-borne cruise missiles, light combat aircraft, light transport aircraft, long-range land-attack cruise missiles, basic trainer aircraft, multi-barrel rocket launchers, assault rifles, sniper rifles, mini-UAVs, specified types of helicopters, next-generation corvettes, airborne early warning and Control (AEW&C) systems, and medium-range surface to air missile systems..

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IAF Eyes 'Buy Global, Make in India' Model for Multirole Fighter Jet Procurement, to Enable Rapid Delivery

26 April 2022

Source: Swarajya | https://swarajyamag.com/insta/iaf-eyes-buy-global-make-in-india-model-for-multirole-fighter-jet-procurement-to-enable-rapid-delivery-report

Indian Su-30 MKI flies with an Australian F-18 Hornet (Representative Image) (Livefist)

The After the success of the Tata-Airbus collaboration to manufacture transport aircraft in India, the Indian Air Force (IAF) is said to be looking into a similar model for upcoming procurement of fighter aircraft, reports Economic Times.

The Air Force plans to procure 110 multi role fighter aircraft (MRFA) at an estimated cost of $20 billion.

The IAF reportedly evaluated at least four evaluated at least four different procurement options on moving ahead with its MRFA requirement and concluded that 'Buy Global, Make in India' would be the ideal model for project's smooth proceedings and time-bound execution, senior government officials told ET.

According to the report, the model will likely enable quick delivery of combat aircraft that are required urgently to retain a combat edge in the region.

The 'Buy Global, Make in India' process is

reportedly simpler and has a rather straightforward shortlisting procedure.

The developments comes after the apparent failure of the Strategic Partnership (SP) model, in which an Indian company ties up with a foreign supplier to manufacture major platforms in India.

The first project of Indian Navy under the SP model for the procurement of the Naval Utility Helicopters is on the verge of collapse.

Similarly, the plan to procure conventional submarines under Project 75I is also heading nowhere, with foreign technology providers expressing their inability to meet what they describe as unreasonable "joint and severe liabilities" for a product that will be manufactured by the Indian partner, ET reported.

On the other hand, the 'Buy Global, Make in India' has proved itself to be successful with the signing of a deal to manufacture C 295 transport aircraft by a Tata-Airbus combine.

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Technology Development

Tiny Probes Could Sail to Outer Planets with the Help of Low-Power Lasers

Aakansha Tandon | 25 Marhch 2022

Source: Science Daily| https://www.sciencedaily.com/releases/2022/02/220223085447.htm

Space travel can be agonizingly slow: For example, the New Horizons probe took almost 10 years to reach Pluto. Traveling to Proxima Centauri b, the closest habitable planet to Earth, would require thousands of years with even the biggest rockets. Now, researchers calculate in ACS' Nano Letters that low-power lasers on Earth could launch and maneuver small probes equipped with silicon or boron nitride sails, propelling them to much faster speeds than rocket engines.

Instead of catching wind, like the sails on boats, "laser sails" would catch laser beams and could, in principle, push spacecraft to nearly the speed of light. Scientists have been working on this concept for a while. For example, one privately funded project called the Breakthrough Starshot initiative aims to send a small, sailed probe weighing about a gram to Proxima Centauri b with a flight taking only 20 years. It would be propelled to 20% of light speed by a 100 GW, kilometer-square laser array. Ho-Ting Tung and Artur Davoyan wondered if much lower-power, smaller laser arrays could find use in applications where conventional electric and chemical rockets are now used. The lasers might someday be able to adjust the orbit of satellites after launch or propel tiny sailed probes on interplanetary or interstellar missions, without requiring large amounts of fuel.

The researchers performed calculations to show that even lasers with powers of about 100 kW and array sizes of about a meter could power a 1-gram probe at velocities far exceeding the current record, with only minutes to hours of laser illumination. According to their calculations, the lasers could maneuver small probes between different Earth orbits in only a day, which is not possible with current electrical and chemical rockets. The team determined that the best materials for the laser sails, which allowed high reflectivity and rapid cooling, were silicon nitride and boron nitride structured at the nanoscale.

Finally, the researchers calculated that these tiny laser-propelled probes could travel fast enough to escape the solar system, reaching 5 times higher velocities than the New Horizons probe. These prototype sailed spacecraft, driven by low-power lasers, could pave the wave for fast space exploration and future interstellar flight, the researchers say.

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Hoverfly Brains Mapped to Detect the Sound of Distant Drones

15 March 2022

Source: Science Daily | https://www.sciencedaily.com/releases/2022/03/220315094954.htm

For the first time, Australian researchers have reverse engineered the visual systems of hoverflies to detect drones' acoustic signatures from almost four kilometres away.

Autonomous systems experts from the University of South Australia, Flinders University and defence company Midspar Systems say that trials using bio-inspired signal processing techniques show up to a 50 per cent better detection rate than existing methods.

The findings, which could help combat the growing global threat posed by IED-carrying drones, including in Ukraine, have been reported in The Journal of the Acoustical Society of America.

UniSA Professor of Autonomous Systems, Anthony Finn, says that insect vision systems have been mapped for some time now to improve camera-based detections, but this is the first time that bio-vision has been applied to acoustic data.

"Bio-vision processing has been shown to greatly increase the detection range of drones in both visual and infrared data. However, we have now shown we can pick up clear and crisp acoustic signatures of drones, including very small and quiet ones, using an algorithm based on the hoverfly's visual system," Prof Finn says.

The hoverfly's superior visual and tracking skills have been successfully modelled to detect drones in busy, complex and obscure landscapes,

both for civilian and military purposes.

"Unauthorised drones pose distinctive threats to airports, individuals and military bases. It is therefore becoming ever-more critical for us to be able to detect specific locations of drones at long distances, using techniques that can pick up even the weakest signals. Our trials using the hoverfly-based algorithms show we can now do this," Prof Finn says.

Associate Professor in Autonomous Systems at Flinders University, Dr Russell Brinkworth, says the ability to both see and hear small drones at greater distances could be hugely beneficial for aviation regulators, safety authorities and the wider public seeking to monitor ever increasing numbers of autonomous aircraft in sensitive airspace.

"We've witnessed drones entering airspace where commercial airlines are landing and taking off in recent years, so developing the capacity to actually monitor small drones when they're active near our airports or in our skies could be extremely beneficial towards improving safety.

"The impact of UAVs in modern warfare is also becoming evident during the war in Ukraine, so keeping on top of their location is actually in the national interest. Our research aims to extend the detection range considerably as the use of drones increases in the civilian and military space."

Compared with traditional techniques, bio-inspired processing improved detection ranges by between 30 and 49 per cent, depending on the type of drone and the conditions.

Researchers look for specific patterns (narrowband) and/or general signals (broadband) to pick up drone acoustics at short to medium distances, but at longer distance the signal is weaker and both techniques struggle to achieve reliable results.

Similar conditions exist in the natural world. Dark lit regions are very noisy but insects such as the hoverfly have a very powerful visual system that can capture visual signals, researchers say.

"We worked under the assumption that the same processes which allow small visual targets to be seen amongst visual clutter could be redeployed to extract low volume acoustic signatures from drones buried in noise," Dr Brinkworth says.

By converting acoustic signals into two-dimensional 'images' (called spectrograms), researchers used the neural pathway of the hoverfly brain to improve and suppress unrelated signals and noise, increasing the detection range for the sounds they wanted to detect.

Using their image-processing skills and sensing expertise, the researchers made this bio-inspired acoustic data breakthrough thanks to Federal Government funding through the Department of Defence's Next Generation Technologies Fund

The funding partly supports technological solutions to address the weaponisation of drones which are now among the deadliest weapons in modern warfare, killing or injuring more than 3000 enemy combatants in Afghanistan and being deployed in the current war in Ukraine..

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Commentary

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3. Chinese Pla Fighters Led By J-11 Warplanes Hold 'Marathon' Drills; Expert Says Beijing's 'Asymmetrical Warfare' Alarming - https://eurasiantimes.com/pla-fighter-jets-hold-cross-regional-drills-over-5000km/
4. U.S. Intel Helped Ukraine Protect Air Defenses, Shoot Down Russian Plane Carrying Hundreds Of Troops - https://www.cnbc.com/2022/04/26/us-intel-helped-ukraine-protect-air-defenses-shoot-down-russian-plane-carrying-hundreds-of-troops.html
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8. Lockheed's HAWC Hypersonic Missile Makes Successful Test Flight - https://newatlas.com/military/lockheeds-hawc-hypersonic-missile-successful-test-flight/

9. The United States' 6th-Generation Fighter Is Here - https://nationalinterest.org/blog/buzz/united-states'-6th-generation-fighter-here-195727

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

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

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